

**EMGT 835 FIELD PROJECT:**  
***A Labor Measurement Structure for Retail Operations***

**By**

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## **Table of Contents**

<b>Executive Summary.....</b>	<b>3</b>
<b>1. Introduction.....</b>	<b>4</b>
<b>2. Literature Review.....</b>	<b>7</b>
<b>3. Current Standards in Retail.....</b>	<b>12</b>
<b>4. Developing the ELS Structure.....</b>	<b>15</b>
4.1 Structures from Literature.....	15
4.2 Structures from Paid Programs.....	17
4.3 Available Time Study Tools.....	18
<b>5. The Karls ELS Structure.....</b>	<b>21</b>
5.1 Time Study Pre-work.....	21
5.2 Time Study Components.....	23
5.2.1 Element Development.....	23
5.2.2 Avoidable/Unavoidable Delay.....	25
5.2.3 Customer Service.....	25
5.2.4 Personal, Fatigue & Delay.....	26
5.2.5 Occurrences.....	26
5.3 Pace Rating.....	27
5.4 Time Study Tools.....	30
Quetech's Workstudy+.....	30
Personal Digital Assistants.....	31
Standard Data & MOST.....	31
5.5 Quality Analysis.....	32
Samples Needed Calculation.....	32
Confidence Level.....	33
Weighted Confidence Interval.....	33
5.6 Standard Completion Formats.....	35
Elemental Descriptions.....	35
Standard Summation Sheet.....	35
Standard Raw Data.....	36
Standard Signoff Sheet.....	36
<b>6. The Benefits of the New Karls ELS Structure.....</b>	<b>37</b>
6.1 Increasing Engineering Efficiency.....	37
6.2 Setting New Company Benchmarks.....	38
6.3 Using Results to Guide Process Improvements and Cost-Benefits.....	38
<b>References.....</b>	<b>40</b>
<b>Glossary.....</b>	<b>42</b>
<b>Appendix A: Time Study Summary Sheet.....</b>	<b>45</b>
<b>Appendix B: Time Study Final Report Mock-up.....</b>	<b>46</b>
<b>Appendix C: Study Detail.....</b>	<b>48</b>

## **Executive Summary**

To compete effectively with the competition, retail companies like Karls need to adopt work measurement techniques to understand and plan for the correct amount of payroll. Proper allocation of payroll equates to a better sales margin and healthy bottom line. In order to improve the current work measurement process implemented at Karls, the following describes an industry and academic process to improve the quality and efficiency of their Engineered Labor Standards. Included is a summation of what other companies are doing with ELS, what tools and techniques are available to develop them, and an evaluation of each as they can be used at Karls. The result is a time study structure that gives statistical quality analysis, improved data collection methods, and formalized reports. The structure also includes new tools and software to use, which will speed up the rate at which standards are developed as well as make them more accurate. These tools include personal digital assistants and the time study software, Workstudy+. The structure also describes how to use the StandardsPro software to create standards for hypothetical jobs as well as a database of job elements to reference for re-evaluations of old processes. The final product is a new work measurement program with improved accuracy and data collection efficiency versus Karls current program. This program will allow engineers to produce more accurate standards quickly. The improved measurements will also allow managers to make better decisions. The program also supports process improvements, company benchmarking and an ability to create detailed cost benefit analysis. This program will be the base for the future of the store operations engineering department.

## **1. Introduction**

Karls Department Stores is a major department store chain that has experienced tremendous growth and notoriety throughout the United States. A cornerstone of Karls popularity is its merchandise selection and value pricing. Karls maintains value pricing through close scrutiny of the bottom line, particularly the multi-million dollar store payroll budget, the largest line item in the company. They maintain control of labor through labor measurement, budgeting and scheduling. Karls is only eight states away from becoming a nationwide retail company. Already Karls is mentioned in the same breath as J.C. Penney, Wal-Mart, Sears, and Target as a main barometer of the retail sector, specifically for national department stores. Karls has doubled its size in the last four years to almost 900 stores as well as its number of value priced private brands (like Apt. 9, Tony Hawk, and Candies). Karls long term goal is to grow to 1200 stores by the year 2010. Shareholders believe their goals are achievable by increasing their stock price by 53% over the last year.

One tool used to maintain this explosive growth and keep costs down is through centralization of budgets and schedules. Karls develops budgets and work schedules for all 900 stores through a central accounting system and a Kronos™ timekeeping and scheduling software called ASSETS. The budget and schedule are built from the previous year's sales activity and the previous month's current trend for each store. To plan the needed labor hours for each season, both the finance team and the ASSETS team use labor standards developed by Industrial Engineers to determine the expected workload.

An engineering group on the store operations side of a retail company is rare; one that analyzes labor is even rarer. Engineers are typically present on the logistic side of a retail company, but once the trailer backs up to the store's dock, their influence generally stops. Karls

### *A Labor Measurement Structure for Retail Operations*

originally developed their Engineered Labor Standards (ELS) through the help of a consulting firm, Arthur Anderson, six years ago. The consultants only provided the standards, not the methods to obtain them. As job descriptions changed, the standards did too. Karls made the decision early on to hire a group to maintain its standards, rather than continue to hire Arthur Anderson.

The group hired, however, was not well versed in creating a formalized ELS structure. The requests for standards came quickly with short deadlines, as is the nature of a retail environment. Consequently, standards became quick, one-day snapshot in one of the many stores and passed on as “the standard” for all Karls stores. The standards were not broken down into detailed elements, which and left little room for analyzing potential improvements. The data was not well documented either; at times, just a holistic number represented the work taken to get it. The standard had no elements, occurrences, statistical analysis, or supporting documentation. When the individuals that developed those numbers left, the history behind the standard was lost. These unorganized standards were a dangerous proposition for a fast growing company that was quickly reaching a \$1 billion payroll budget.

Because no official documentation or statistical analysis was presented, store managers, district managers, and vice presidents did not believe in the validity of the labor rates developed. Engineers could not relate the quality of the numbers they were gathering to upper management. Consequently, upper management would choose rates that coincided with their projected budgetary goals rather than giving appropriate times for the work. The result is an unrealistic labor budget for specific tasks. Since labor budget management is tied to store manager compensation, problems and arguments would arise between upper management and store management. Store managers would then reallocate labor in order to meet goals and rob from

other departments. Karls is in dire need of structured methods and documentation on developing ELS.

The purpose of this document is to design a work measurement structure that will account for current measurement practices from different companies and measure which solution is feasible for both the time and resources available. This document will also define common work measurement components such as elements, allowances and occurrences. Methods and qualitative analysis tools for developing acceptable standards with limited time and resources will also be introduced. Documentation and data storage will be defined in this document to maintain historical references. The final result will be a structure that measures, analyzes, and stores time study data for process improvement, payroll verification, and company benchmarking for the department.

## **2. Literature Review**

**Department of Defense**

*Online Article- 12 February 2006*

**Defense Procurement and Acquisition Policy: Contract Pricing Reference Guides- Work Measurement**

This document gives a comprehensive view of the work measurement process, and was written for contractors in terms understandable for both engineers and non-engineers alike.

Topics that were supportive for this paper were:

- identifying situations for use
- identifying elements of a labor standard
- identifying issues and concerns.

The literature aided in the definition of ELS, non-ELS, work measurement systems, labor standards, and the effects of variance on standards. The third chapter covers the methods of work measurement, including the differences between a time study, pre-determined time systems, standard time data, and work sampling. Each topic defines which work measurement method to use for each situation at Karls. This section also goes into great detail on how to develop personal, fatigue and delay (PF&D) and special allowance percentages to include in an ELS. Some interesting topics that would require additional study but are not a part of the scope of this paper would be:

- measuring and projecting operational efficiency-how to compare ELS with actual work data and creating the efficiency factor
- identifying and eliminating the possible cause of the variance.

Overall, the document is a good reference for anyone wanting to know more about or needing a refresher on work measurement.

**Gaynard, Phil**  
**Productivity through Data Organization**

*Work Study*—March 1997

Phil Gaynard covers the advantages of data systems in applying standards in an economical fashion. The article describes the use of a computer database as a means of storing previous work on ELS, specifically elements and their time values. A system used by the Sirg A Brin company is used as the example of how to define the elements in the proposed data system. A software package, called allCLEAR, is proposed as a means of creating new standards through the use of flow-charting. The article identified the distinct advantages of such a system to produce standards quickly through historical data rather than through current time study methods. The proposed system is part of how Karls can develop standards with a limited amount of engineering resources.

The article also advocates using Methods-Time-Measurement (MTM) in this data storage process, stating pace rating can be too subjective without proper training and can be “politically incorrect.” While the article gives some convincing evidence on why MTM could be considered superior to time and motion study, the arguments were only enough to make it a supplement to the Karls proposed program when determining new standards. The processes at Karls contain too many variables to allow for something as rigid as MTM, and time to create an MTM standard would be too great for existing processes.

**Naqvi, Syed A.**  
**Engineering Standards Development and Ergonomics**

*Proceedings of the SELF-ACE 2001 Conference*

Syed Naqvi writes of how improper pace rating causes job-related injuries due to fatigue and poor job design. Naqvi, an ergonomist, presented his argument at the 2001 SELF-ACE Conference (subtitled “Ergonomics for changing work”), the result of which is this paper that supports the proper training of Karls’ engineers in pace rating. The article makes important



statements about the consequences of rating a subject too high or eliminating steps seen in the study, but not included in the actual ELS. The main result is an unattainable standard. When employees try to meet this standard, they may be able to attain it for a few hours, but are unlikely to maintain it for a full 8 or 10 hour workday. The resulting fatigue causes injuries, lost work time, and possible lawsuits.

**Gregson, Ken**

*Work Study—May 1993*

**“Do We Still Need Work Measurement?”**

This article argues the relevancy of work measurement. Since the movement away from pay for performance and piecework, the argument can be made that time studies are no longer needed. This article ties the value of work measurement to modern day situations. The author looks at work measurement as the cornerstone of the management process. Work measurement allows the modern manager to manage controllable expenses through accurate cost accounting and improve the process by analyzing the job breakdown provided through work measurement. Work Measurement is also stated as a great tool to promote direct comparisons of the same operation in different locations. This article supports the arguments made in the introduction of using work measurement to reduce labor costs in a retail environment and to produce larger sales margins for Karls.

**Gagnon, Eugene J.**

*Material Handling Management February 2000*

**“How to Measure Work”**

Eugene Gagnon writes about the different ways to conduct work measurement. He first writes about the different techniques involved with work measurement. From guessing and historical data to pre-determined time systems, Gagnon covers the advantages and disadvantages of each in depth. Each technique is covered in terms of accuracy and then the associated are compared through time and cost constraints. This article aided in choosing a method to fit Karls

unique characteristics to create quality standards with the available data and resources. The various systems used to house and calculate the data generated from work measurement was also covered in detail. The article lists some of the components to a successful work measurement program:

- the definition of the preferred method of the job (Using Karls' best practice methods)
- a selection of a standard time value to apply to the job (minutes for Karls)
- the use of Labor Management Systems for verification (comparing to historical labor data)

**Tolo, Bill**  
**"21<sup>st</sup> Century Stopwatch"**

*Industrial Engineer-July 2005*

Bill Tolo, an Industrial Engineer for Marshall Field's Store Support, describes the new tools developed to help the Industrial Engineer conduct time studies. Specifically, he covers three techniques—work sampling, time studies, and "engineered data collection"—which he uses in a retail environment. The article supports the use of a personal digital assistant (PDA) in conducting a time study in a retail environment. It also supports the fact that a PDA can support an economical means to gather data for the highly variable jobs that exist in retail. The article covers the advantages and disadvantages to using a PDA and how it has a potential to revolutionize data collection.

**Aft, Larry and Neal Schmeidler**  
**"Work Measurement Practices"**

*Industrial Engineer—November 2003*

This brief article, from the same author that wrote the current *Work Measurement and Methods Improvement*, discusses an unscientific study conducted on the Institute of Industrial Engineering website asking participants how they conduct work measurement in their respective companies. The results are interesting and showed percentages on different methods:

### *A Labor Measurement Structure for Retail Operations*

- time study 36%
- work sampling 18%
- predetermined time systems 18%
- standard data 11%
- non-scientific guess 9%
- historical data 8%

The article also covers why their companies use work measurement, some percentages of what time study methods used, and cost-to-benefit ratios of using work measurement as a management tool. Although unscientific, the article gives great insight into modern day work measurement and is used to show how other companies conduct studies as a comparison to the development of Karls' system.

**Aft, Larry**

*Jon Wiley & Sons, Inc.--2000*

#### **Work Measurement and Methods Improvement**

The most comprehensive book on the subject today, this piece covers work measurement through different methods of analysis:

- Time Study
- Standard Data Systems
- Pre-Determined Time Systems
- Work Sampling
- Physiological Measurement
- Historical Data

This is the only literature found that gives a comprehensive view of how to conduct a time and motion study. This book helped in the development of the statistical quality analysis tools described for use in Karls' system. The book also helped in developing tips for pace rating and applying standard data.

### **3. Current Standards in Retail**

ELS have had a long history in manufacturing. Pioneered by Frederick Taylor's development of Scientific Management and improved upon by Frank and Lillian Gilbreth, ELS remain today's basic and most accurate form of measuring productivity (International Work Simplification Institute News, 1968). Manufacturing has used ELS from its inception to understand manufacturing capacity, set proper wages, and planning production. The logistics group closely resembles the manufacturing environment in the retail industry. Logistics focuses on throughput, highly repetitive jobs and getting products from shipyard to store front with the least amount of touches. As such, the logistics group and its engineering department use work measurement in everyday management practices. Until recently, work measurement has not crossed over to retail operations from logistics. Certain retail sectors, however, can benefit from work measurement.

Retail can be characterized into four categories: grocery, specialty stores, large discounters, and department stores. Grocery, who deals with low margin and perishable goods, has quickly adapted work measurement and process improvement. The grocery environment is geared towards customer self-service and quick throughput at the checkout counter. Speed and efficiency of product movement, coupled with a low sales margin on grocery goods, have used work measurement the most out of any retail sector. Specialty stores do not adapt well to work measurement. Specialty stores are typically too small and do not generate high traffic, relying on a higher sales margin and personal service rather than productivity to ensure profitability (Bjornsen, 2006). They also use multi-tasking sales associates whereas labors standards lend themselves more to repetitive, specialized tasks.

### *A Labor Measurement Structure for Retail Operations*

Large discounters and department stores, also called big box stores, present an opportunity for work measurement. Big box stores tend to rely on volume and varying levels of customer service to generate sales. They typically operate on a lower profit margin than specialty shops, but a higher margin than grocery stores (Bjornsen, 2006). This grey area has allowed big box stores to hide operational inefficiencies within their sales margin. No work measurement was needed as long as the amount of sales had justified the work hours. Tougher competition from national retailers, like Wal-Mart and Target, has lowered the prices through cheaper comparable goods. Retailers create slimmer margins on the same goods, relying on sales volume, rather than margin to ensure profitability.

The focus on sales margin is also why retailers calculate payroll needs in sales per labor hour. For each dollar of merchandise sold, a specific amount of payroll, or labor hours, are allocated to that store. This method keeps the labor cost as a direct part of the margin. While labor cost is a part of sales margin, using sales to allocate labor is an indirect method of applying the proper amount of time for the amount of work. Labor required for a sale, special display, and weekend or holiday traffic is needed in preparation of the event, and not necessarily the day of each event. The labor is then allocated to the day of the sale rather than the day needed to do the work. Allocating labor payroll to units and work versus sales dollars allows stores to have a product ready to buy, improving customer service and overall sales.

This new understanding in retail operations begins to usher work measurement and Industrial Engineers into the store operations environment to reduce payroll and keep retailers profitable with their smaller sales margins. ELS help reduce labor costs through exact measurement (Gagnon, 71). Companies that do use Industrial Engineers on the store operations side of retail include:

### *A Labor Measurement Structure for Retail Operations*

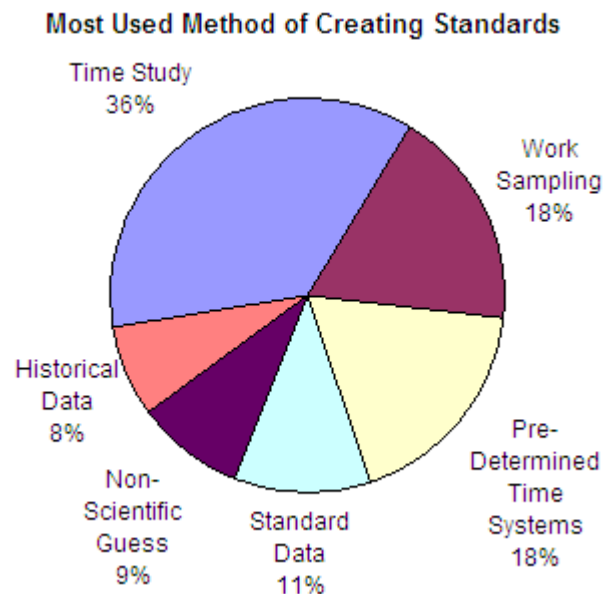
- Federated Department Stores
- Karls Department Stores
- Wal-Mart
- Crate and Barrel
- Home Depot.

Retailers can take the first step to pull away from competitors adopting work measurement to gain profit on low sales margin. The second, customer service, becomes the real obstacle for work measurement in a big box retail operations environment. Customer interaction can cause variables in these standards, making them difficult to fully quantify. Balance must also be achieved between a completely efficient process and one that allows for customer interaction.

## 4. Developing the ELS Structure

### 4.1 Structures from Literature

Over the years, work measurement analysts have developed many different techniques to create an ELS. The different types of measurement include time study, work sampling, predetermined time systems, standard data, non-scientific guess, and historical data. A study in July of 2003 of 282 people suggested companies use a vast array of data gathering methods (Aft-Schmeidler, 44).



Source: *Industrial Engineer*, November 2005

While the study was not statistically valid, the information shows the variety of methods different companies use to create standards. The most popular is time study, followed by work sampling and pre-determined time systems.

Time studies have been part of the Karls' culture since the inception of ASSETs. A time study consists of taking a stopwatch or time motion device to record each element of a job and the time it takes to do each cycle of the job. Each job and the elements that make it up are

recorded repeatedly in order to gather enough data to signify a complete study. The subjects studied must be pace rated in order to create a normalized or standard time. When all the data is collected, each element is summarized according to how often it happens during a job, or occurrence. The values of each element are then summarized to a base unit to create the standard.

Work sampling is choosing random intervals throughout a time frame to record what is being done in a job (Aft, 300). This type of work measurement is helpful in understanding a job with diverse elements that are not necessarily connected. Work sampling allows the engineer to gain a comprehensive look at the total time spent doing specific jobs. The random intervals give the study validity by eliminating the effect of watching a job at the wrong time, or the only time that a specific job was done throughout the day. Work Sampling can be used to get an overall sense of a job, but not for specific detail of that job (Aft, 324).

Pre-determined time standards are based on a set of values that are studied to be the accepted values of average human performance. A time is associated with each movement based on distance, accuracy, and difficulty. MTM-1 (Methods-Time Measurement), developed by H. B. Maynard is the most widely known pre-determined time system (Maynard, 17). The benefit of a pre-determined time system is that it eliminates the variability caused by different subjects with different abilities. It also eliminates the subjectivity of person applying the standard to his or her own perceptions (Gaynard, 92). There is also no need to do a qualitative analysis on the times for each element since they are built into the time value. The process to use MTM-1 to develop a standard is labor intensive. The process is also difficult to apply effectively, since every single motion taken by the subject must be measured and recorded. The occurrence of each motion can also be subjective or difficult to develop. An occurrence is the most critical piece of a pre-determined time study since the job is not watched repeatedly compared to a typical time study.



Standard data is the process of taking a database of elements and their respective times and applying them to new situations by way of changing occurrences (Aft, 210). The data can be derived from either formal time studies or pre-determined time standard development. The idea is that the whole job does not need to be studied, just the portions of the job that are distinctly different. For example, a job may be very similar to a job already studied. The elements of the previous job can be incorporated into the new standard directly if they are a direct match. The time study can then focus only on the motions, or elements, that are new. The results are developing ELS with limited resources more efficiently.

Two less effective means of generating standards are non-scientific guessing and historical data. The two measures have little or no value in describing a job in the detail needed for process improvement through the scientific method. The methods do, however, allow a base measurement when none existed before and allow for a broad measurement for improvement. The level of work needed to create a standard should be dependant on the use of the standard (Gregson, 19). A number needed for general planning may do fine with some scientific guessing or collection of historical data. If creating standards for individuals that are tied to performance, a more in depth standard must be created either through time study or a pre-determined time standard.

#### **4.2 Structures from Paid Programs**

A paid program is a work measurement structure derived and sold by a professional within the field for others to use. The most common paid program is H.B. Maynard's MOST systems and courses. The MOST system is a derivative of H.B. Maynard's MTM-1 pre-determined time system (Zandin, 9). The MOST system and StandardsPro are a combination of MTM-1 with a standard data table combining like movements into more common movements.

MOST takes the tedious task of combining small movements defined by MTM-1 and places them into more common, generalized moves. The times associated with these moves are defined in averages and applied to common movements. The overall result is an easily applicable pre-determined time study program. While pre-determined time studies are helpful in developing quick and accurate times, they are still operator dependant. The person applying the standards must accurately define the frequency (or occurrence) of each element within the standard. For example, using MOST, it may take a person 27 TMUs, or one second, to pull a lever after filling a bin. The challenge is finding out how often the lever is pulled. How often does the bin fill? 27 units per pulled lever? 20? This frequency ( $1/27$  or  $1/20 * 1 \text{ second}$ ) can swing the standard in either direction. So even if the process is accurately depicted, it must still be accurately applied.

Clemson Consulting Clearinghouse Corporation (C-FOUR) also has a paid program. C-FOUR uses the combination of a proven system and training along with their standard capturing device. The capture device was the pioneer of current palm-based time study software. C-FOUR is a time and motion system. The focus is on training and proper pace rating. C-FOUR also uses a short hand technique to identify and categorize elements within a standard.

#### **4.3 Available Time Study Tools**

Many tools exist to conduct time studies over the last 70 years. The most common is the stopwatch and clipboard. The clipboard contains a spreadsheet with the elements listed and boxes to fill in the times. The elements are then timed with the stopwatch and written into the columns of the spreadsheet. The spreadsheet is then entered into an Excel spreadsheet to analyze. The spreadsheets are then grouped together to get a comprehensive look at each element and a number for the overall standard.

A few more modern tools began to emerge in the 1980s like video capture and random interval generators. Both devices improve the “intrusion factor” a time study may cause. “Intrusion factor” is the altered behavior of the person being studied that skews the results because someone is watching them. While this is overcome generally from pace rating, some motions may not be seen in person because they are not considered part of the process, and the person being studied may be afraid of judgment of those actions. Random Interval Generators are the size of a pager and beep or buzz at random interval times to alert the time study official to go and take a reading. The time study official does not have to watch person all the time and can watch many people at the same time through this method (Aft, 319).

Video Cameras have a time clock as part of the screen. The time study analyst then watches the video and records the time stamps for each element. The video allows an accurate collection of time by affording the person studying to go back and watch the task again. They also prevent missing steps from fatigue by allowing the person studying to take breaks while watching the video. One disadvantage is that the camera does not have the ability to maneuver to capture tasks that cannot be directly seen by one vantage point.

New technology has been developed to aid in the collection and summarization of time study data. Most noticeably is the development of Palm and PocketWindows based software to collect data through a PDA. PDAs offer the portability and computer power needed to conduct time studies in various conditions on the fly. The data also imports into a PC quickly and efficiently to save time. The software can shave hours off of data input and analysis time, leaving more time to conduct studies (Tolo, 35). They also eliminate the data error caused by inputting information by hand. Two well-known software packages are Workstudy+ by Quetech and UMTplus by Laubrass. Both are similar in function with advantages and disadvantages. Karls,

*A Labor Measurement Structure for Retail Operations*

J.C. Penney, Sears, Home Depot, and Crate and Barrel use Workstudy+, while Marshall Fields uses UMTplus.

## **5. The Karls ELS Structure**

Karls will continue to utilize the time study primary method of work measurement to develop ELS. Work sampling will also be used to gain more knowledge of previously unknown tasks. Karls will use the best pieces from other process to create its time study structure. Such pieces include PDAs as capture devices, Workstudy+ as the capture program, Excel summation tools, its own standard data database, and incorporation of Maynard's BasicMOST and StandardsPro software. Karls will also develop a standardized reporting system to include forms, databases, and a filing system. The combination will allow Karls to dynamically create ELS with limited resources as well as document processes for future study.

### **5.1 Time Study Pre-work**

A few steps that must be completed before a time study is conducted are (Tolo, 36):

- proper definition of what is to be studied
- location selection
- job experience
- associate interviews
- process watching

The job must be properly defined in order for the study's result to be effective. For example, the job does include this set of actions and does not include those set of actions. The job cycle starts with this action and ends with that action. These objectives must be completed for the job analysis to be complete. All the motions must be accurately documented. Failure to account for all the steps within a job creates an inaccurate study. Failure to include all the work elements can also speed up the rate of the job. Faster than normal standards cause ergonomic issues by making workers perform beyond their physical limitations (Naqvi, 287). This overexertion will lead to serious physical injury. Proper documentation of all the steps involved will create an accurate and safer standard.

Location selection is also important, particularly in a retail operation environment. Retail operations can involve hundreds, even thousands of stores (Tolo, 36). This can create a unique situation, since every store could differ physically and have varying tools available. The idea is to find stores that are executing properly, best resemble the prototype design of a large portion of stores, and are staffed appropriately. The store must enforce the best practice according to the company's job definition for a considerable amount of time to eliminate any learning curve mistakes. The stores must also be staffed and executing properly, so observations are not laden with the associate having to do work that is supposed to be done by someone else. These criteria lead to the formation of best practice stores to allow the appropriate conditions for each standard. These stores will be held to higher standards compared to the company norms. Training budgets will be increased in these stores to insure proper execution.

Finally, job experience, associate interviews, and process watching allow the time study analyst to experience the job and form elements. Actually performing the job forces the time study analyst to think through each process and execute according to the best practice. The process allows for a full summation of all steps involved as well as an opportunity to improve specific aspects of the job. Associate interviews allow the observer to understand all that is not observed through other means. Associates experience difficulties with the current job process and are able to provide more thorough understanding and frequencies of problems that can prevent them from doing their job. Finally, observing the job will allow the analyst to place all experiences together to get a feel for the job, its element descriptions, start and stop points, and interactions between associates.

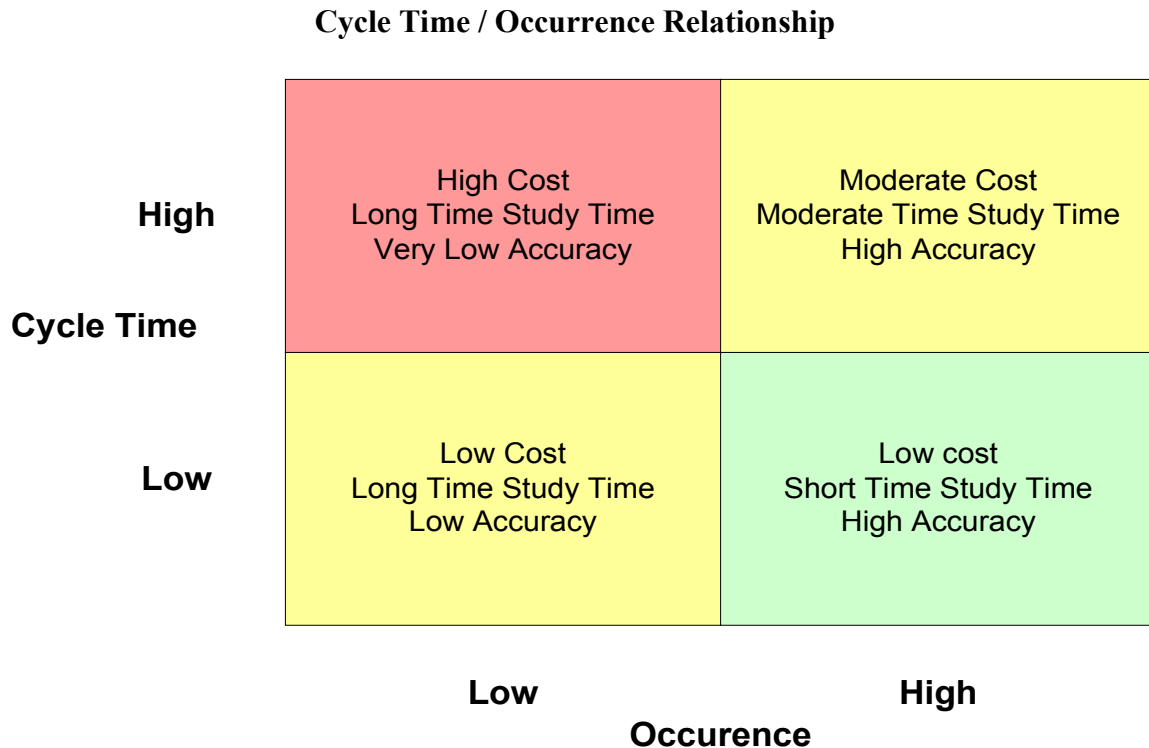
## **5.2 Time Study Components**

A time study consists of elements, avoidable and unavoidable delay, personal, fatigue and delay, and occurrences. Customer service is a new and special attribute to a retail standard and is a derivative of unavoidable delay. These components make up all that encompasses a retail ELS. The standard is not complete until all the components have been defined and measured.

### **5.2.1 Element Development**

Elements are the backbone of time studies. As such, elements must be defined precisely. Starting and stopping points, as well as the specific steps should all be part of the element. Typically, the description will become part for that name of the particular element. The element should have a cycle time and occurrence significant enough to be measurable during the study and small enough to be separated from other elements in the study. For example, the process of washing a car could be the study; it could also be an element. Washing the wheels could also be an element. Washing the car has an occurrence of one, and a large cycle time (start to finish). Several car washings would be needed to get an average time to wash a car. In contrast, washing each car wheel happens four times for each car wash, more occurrences and a shorter cycle time. A couple of car washings and a person would know how long it would take to wash just the wheels as part of washing the entire car. They would also know how long the car wash would take by not washing the wheels; having only a car wash element does not allow a person to determine the time to wash a wheel.

The rule for choosing the right amount of cycle time and occurrences to define an element is vague and is dependant on the resources that can be applied to the standard. The following shows an example of the relationship between cycle time, accuracy, cost, and occurrence.



A good rule of thumb is anything under a second is too small to measure accurately. Items taking over 2 minutes should be broken down into steps, unless it is purely one step (like waiting for a machine to finish processing).

The element descriptions should be accurate but not overly comprehensive. In the case of washing a wheel at the car wash, the description may read as follows:

**Wash Wheel:** Time taken to move to the wheel, kneel down, place sponge in soap water and scrub the wheel. Ends when the wheel is rinsed. Does not include time taken to get supplies (get soap, water, bucket and sponge).



Some steps may involve more or less description depending on how much action is involved. If the study needs to be broken down more, the description of one element can be used to create more detailed elements.

### **5.2.2 Avoidable and Unavoidable Delay**

Unavoidable and avoidable delay must be recorded to understand interruptions within a task. Avoidable delay covers time taken to do work that is not related to the completion of the task. In the example of the car wash, avoidable delay may be the time to get a beer while the car soaks. Although getting a beer may be a task, it is not crucial to the cleaning of the car, and should be recorded as avoidable delay, since it occurred during the car cleaning process.

Unavoidable delay covers operations that inhibit or are part of the process, but cannot be easily defined. An example using the car wash scenario is that someone has parked on the hose a person is using to wash the car. While getting someone to move the car has to be done to complete washing the car, it is not an everyday occurrence and should be considered unavoidable delay. Unavoidable delay must be recorded for two reasons: see if a specific occurrence happens more frequently to warrant becoming an element or the amount of unavoidable delay is large enough that it should be applied to the Personal, Fatigue and Delay (PF&D) percentage.

### **5.2.3 Customer Service**

As a side note to unavoidable delay, the retail environment lends itself to large variances due to customer interaction while the associate is trying to accomplish a task. This information is included in a new element type specific to the retail sales floor. Preliminary studies at Karls have shown a large portion of unavoidable delay can be attributed to customer service related tasks. These tasks include running a Point-Of-Sale (POS) register, looking in the back room for a size or color for a customer, or answering a customer's phone call. During studies conducted with

sales floor associates, Karls has found these tasks can take up as much as 10% of the overall time to do the job. This customer service element should be part of the normal set of elements with any job involving the sales floor during working hours.

#### **5.2.4 Personal, Fatigue & Delay**

Personal, Fatigue, and Delay (PF&D) must be incorporated to round out all the time required to do a job. PF&D covers any personal allowances needed during the job. Personal allowances include restroom breaks, drink breaks, state and federal mandate breaks and any time needed to recover or continue the job at hand (Aft, 152). PF&D can vary based on the nature of the job, for example, breaks are hard coded as part of PF&D. Taking the time given for breaks and dividing it by the remaining time work time creates the PF&D percentage. See the equation below:

$$\text{2-15 minute breaks in an 8 hour shift} = 30 \text{ min} / 480 \text{ minutes} = 6.67\% \text{ PF\&D}$$

More is added to the PF&D percentage according to the difficulty of the job and what is involved. Not allocating all the appropriate delays can skew the standard higher, causing ergonomic concerns (Naqvi, 289). Karls currently uses an overall PF&D of 15%, but should quantify that according to the nature of the job. The following table should be used when deciding a PF&D for a job.

Allowance	Time in Minutes					
	Sales Floor		POS	Detail Work	Heavy Lifting	
	Open	Closed	Open	Open	Open	Closed
Breaks	30	30	30	30	30	30
Restroom	10	10	10	10	10	10
Drink of Water	5	5	5	5	5	5
Customer Interaction	10	-	-	10	10	-
POS Coverage	15	-	-	15	-	-
Rest After Intense Work	-	-	-	12	24	48
Time for work	410	435	435	398	401	387
PFD Percentage	17%	10%	10%	21%	20%	24%

### **5.2.5 Occurrences**

Occurrences round out the basic components of a time study. An occurrence counts for the number of instances an element happens in relation to a base element or unit. In the example of the car wash, the base element is a single washed car. The standard rate will then be represented as washed cars per hour. If the job studied included only washing the wheels, the base element would be the wheel itself, and the rate would be represented as washed wheels per hour. Occurrences are a very important component to the time study in that it makes the result comparable to units rather than linear time. For example, filling a bucket of soapy water has to be done to wash the wheels, but it doesn't have to be done for every wheel you wash. The linear time to fill the bucket may be two minutes. If there was a one to one ratio for filling a bucket to washing a wheel, two minutes would be added to the time to wash each wheel. In reality, filling the bucket only happens once for four wheels, so the time per wheel is only 30 seconds, or two minutes per four wheels.

In short cycle, single contributor studies, the occurrences can be developed straight from the study. Every element observed can be equated to the base element to give a clear picture of each element's effect on the base element. In team environments, special attention must be paid to occurrences the study is not recording, because someone else is doing them. In these cases, an assumption will have to be made based on capacities. For example, the time study analyst may be able to time the subject taking a cart holding 75 items from the stockroom to the floor, and it may take 2.5 minutes. The cart's capacity, however, was 200 items. The occurrence should be adjusted to represent the average number of items on a cart at any given time. The average number of items would properly allocate the needed time per movement of the rack to the floor.

### **5.3 Pace Rating**

“Pace rating is the process of comparing the actual work being performed with the analyst’s concept of normal pace and evaluating the observed performance quantitatively (Aft, 151).” Workers work at varying paces. Some shift their pace throughout the day and others are consistently slower or faster throughout the day. Pace rating brings all of the different speeds and efficiencies and level sets them to 100%. The percentage can be as high as 120% or as low as 70%. These ratings are then applied to the time observed. For example, someone working at 120% completed a task in 1 minute. The equation then adjusts the observed time into a level set 100% time.

**1 minute X 120% = 1.2 minutes (the time for an average associate)**

The purpose is to ensure the times taken can be equated to a normal expectation, and not representative of the varying results of the individuals observed.

There is an inherent obstacle to pace rating and is the part of the time study that is most susceptible to non-scientific interpretation (Gaynard, 91). One person may rate a single performance a high rating, while the other may not. Someone may look like they are moving fast, but are doing many more steps to get the process done. Others may appear to be moving slow, but, in fact, have the most efficient movements to complete the job. Improper application of a pace rating could result in a skewed standard. A standard skewed on the faster side, could result in greater fatigue, and ergonomic injury (Naqvi, 290). Time study analysts should be within 5% of each other’s rating (Aft, 151). The H. B. Maynard Company has developed a chart to equate pace rating within a grid.

## *A Labor Measurement Structure for Retail Operations*

### SPEED PACE RATING TABLE

Rating	Classification	Definition
13 12	Excessive	Extends pace to unreasonable limit; best effort but risks health; could not be maintained throughout the day.
10 8	Excellent	Obviously works fast; thinks as well as acts; accepts and offers suggestions; takes a keen interest in the work.
5 2	Good	Works with rhythm and at a good pace; is interested in the work; readily accepts advice and suggestions and will give suggestions if asked; maintains good order.
0	Average	Works steadily and appears to take an interest in the work; accepts suggestions but makes none; appears to be holding back; maintains a good set-up; plans ahead; follows methods prescribed by process.
-4 -8	Fair	Attention wanders from work, but puts some energy into work; obviously trying, but motivation is lacking.
-12 -17	Poor	Lackadaisical, dispirited attitude; obviously slowed-down working pace; many false motions and unnecessary activities; kills time; poor housekeeping; lack of interest in work.

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### EFFORT PACE RATING TABLE

Rating	Classification	Definition
15 13	Super	Near perfection; machine-like motions - smooth and difficult to follow; precise; uncommon.
11 8	Excellent	Fast, smooth and coordinated; seemingly effortless and without errors
6 3	Good	No hesitation; steady pace; motions coordinated; good knowledge of tools and materials; works to specifications.
0	Average	Very little hesitation; reasonable accuracy; follows set procedure with few mistakes; plans ahead; passed the learning stage; slow in performing some high control motions.
-5 -10	Fair	Partially trained in operation sequence; somewhat clumsy; uncertain of motions; loses time due to blunders; familiar with workplace and surroundings; not easily distracted; does not waste time looking for things.
-16 -22	Poor	Hesitates - stops to think about next move; new to the work or not capable of performing the work; uncertain, clumsy and awkward movements; poor coordination of the hands and mind; even though careful and considerate produces poor quality work, and makes many mistakes.

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## *A Labor Measurement Structure for Retail Operations*

These two tables give a good example of the two aspects to pace rating (speed and effort) with descriptions. When pace rating, however, a combination of the two would be easier to apply.

Below is the table Karls should use when evaluating pace.

Rating	Classification	Definition
120% 115%	Excessive Pace Superior Work Ethic	Associate moves effectively and thinks in advance of all movements to complete a job. Associate moves at a pace that is not sustainable over a 4 hour period.
110% 105%	Efficient/Experienced Excellent Work Ethic	Associate moves efficiently enough to complete the immediate task, but does not tie together with the other tasks within the job. Moves at a pace that is quick and sustainable and in line with a strong work ethic.
100%	Normal, Sustainable Pace/ Average Work Ethic	Associate moves in a manner with little mistakes and does not interrupt other process around them. Moves at a pace that is sustainable and in line with a normal work ethic of an average person.
95% 90%	Restrained Pace/ Mild Inefficiencies	Associate moves are restrained or reduced due to inappropriate rest before work began or other post work needs. Moves at a pace with bursts of speed, but overall slow when looking at overall movement. Movements are inefficient causing double work for themselves or others.
85% 70%	New to the Job/ Poor Work Ethic	Associate moves are noticeably slow. Associate has difficulty knowing the next steps to take and makes movements that must be double backed to complete the job. Associate is unaware steps to complete a task or does not feel the need to complete the task.

Any time study analyst that does not have experienced in pace rating should work with an experienced person before doing his or her own studies. If an experience person is not available, they should watch pace rating videos, like the ones available from C-Four, to hone their pace rating abilities.

### **5.4 Time Study Tools**

The tools that Karls will use for its time studies will be Microsoft Excel, a PDA, Quetech's Workstudy+, a standard data database, and Maynard's MOST program. Microsoft Excel is a common program used by almost all analysts to form time study analysis and

summaries. There are better statistical analysis tools, but Excel is very flexible and has a commonality that can be used by virtually anyone.

PDAs have been chosen as the tool to use to conduct time studies. As discussed earlier, they are portable, dynamic, improve accuracy, and speed up input into Excel for analysis. The software used in combination with the PDAs will be Workstudy+. This software package has been proven to be a very customizable and flexible program to conduct time studies. Its analysis structure is tied directly into Excel, unlike Labrauss' UMTplus. The speed and flexibility allow the time study analysis to go from study, to data dump, to a custom analysis sheet in a matter of minutes, with no cutting or pasting necessary. The Excel summary sheet contains the statistical quality analysis, which will be discussed later in this chapter.

Once the data has been gathered, Karls will begin to develop an elemental database. The elemental database will allow limited engineering resources create a standard quickly and economically (Gaynard, 94). Like standard data, this database will house all elements involved in store operations and include a time value for each. StandardsPro, software developed by the H.B. Maynard Company, uses a SQL database for development of standards using MOST. It can also be used to house time and motion elements in the form of process times. The database can then be used to evaluate similar future, unstudied jobs with common elements. The guesswork can then be limited to tasks that have not been studied.

For new tasks that have not been implemented in the field, Karls will use H.B. Maynard's MOST. The pre-determined time values will give the analyst the "best guess" on jobs that need evaluation for payroll. MOST will also be used as an evaluative tool to compare with the time and motion study to ensure accuracy. Development of new studies or hybrids of pre-determined

and time and motion times will be easier to create, since all these times will be housed in the same database.

### **5.5 Quality Analysis**

Simply collecting data on what was observed only gives an average time; it does not relate that time to accuracy. Statistical analysis gives a quality control to the data collected. It also gives a stopping point for collecting data, reducing the time and cost of time studies by evaluating when the study can be considered complete.

The first tool, widely used by consultants and contract time analysts, is the sample needed calculation. The samples needed calculation takes a low number of observations, 10-30, derives a mean and sample standard deviation, and estimates the number of observations that are needed to complete the study. The calculation is based on a given Confidence Interval and Accuracy desired for the study. Typically, studies are acceptable when they fall within a 90% percent Confidence Interval (or range). According to Hildebrand's *Statistical Thinking for Managers*, the statistical equation for sample of a population mean is

$$n = \frac{z_{\alpha/2}^2 \sigma^2}{E^2}$$

where  $Z_{\alpha/2}$  is the value established from the z-table at  $\alpha$  (0.10 when C.I. (100 \* (1- $\alpha$ )) divided by two or  $Z_{0.05} = 1.645$ .  $\sigma$  is the standard deviation, in this case your sample standard deviation or s. E represents half of the acceptable width (2E). The width must be predetermined through experience. Common practice is to set  $E = \text{Accuracy} * \bar{x}$  to simplify the selection of an acceptable width (Aft, 172). Karls will use this quality measurement simply as a reference, and not the sole calculation of a quality study.



The most common form of quality for a time study is the confidence level. The confidence level is the probability an observed number falls between a desired pre-determined range (or accuracy) (Aft, 170). Confidence level is not perfect; it is subject to bias of what was watched in the time study (Hildebrand, 271). For example, if a time study analyst watches just one person for their time study, the study will be biased to that one person. A 90% confidence level will be reached, but it represents 90% confidence level in the one person observed, and may not represent the entire population that does the job. ELS are representative of the entire population doing the job, and every measure should be taken to watch a complete representative sample to ensure the confidence level is correct.

Confidence level was derived from the more common confidence interval. Confidence interval is taking a fixed probability (90%) and sample standard deviation and mean to determine a range (interval) that meets the fixed probability. Confidence level, on the other hand, is taking a fixed range and determining the appropriate probability. While statistically, the equations are the same with the same results, Confidence level is an easier number to relate to management. A 90% confidence level is easier to understand than being within 5% range of the population mean.

The equation for the confidence level is following:

$$Z = \frac{E * \sqrt{n}}{s}$$

E is the value representative of the pre-selected width. Karls will use 5% of the observed mean as the width for the confidence level ( $E = 5\% * \bar{x}$ ) and a 90% confidence level as an acceptable level. n is the number of observations and s is the sample standard deviation. The resulting z-value of the equation is placed against the z table to find the corresponding confidence level.

Not every element will need to reach a full 90% confidence level. Some elements, while important to make a distinction within the study, happen too infrequently to be able to bring to a 90% confidence without expending a great deal of time and energy. Obtaining an acceptable confidence level is easier to obtain as the sample size increases; however, the costs involved in gaining confidence in infrequent elements can tie up too much time and resources (Bischak, 1002). These elements still affect the study and the overall validity, however. There are essentially four ways to address multiple confidence levels of each element to the overall standard. The first is a straight average of the entire set of elements. This method equally distributes each element contribution to the standard. In the example below, this method would result in an overall confidence level of 86%. Aft proposes taking the confidence level of the smallest element (Aft, 179). The example below would then be 72%. While this is the most conservative approach to achieve the confidence level, it is not the most economical. A third approach would be to eliminate the effect of the element by placing it in the PF&D percentage. This could only be used for elements that occur in low enough frequencies to be part of the miscellaneous percentage within the PF&D. The fourth method, a weighted confidence level, is a relatively easy and accepted method of determining confidence intervals for small observations (Bischak, 1003). The weights assigned in this example are the effect of one element's time versus the entire time of the standard. For example, if an element's time contributes 20% to the overall standard, its Confidence Level contributes 20% of its individual confidence level to the composite Confidence Level. Here's a table form of a weighted confidence level for washing wheels:

### *A Labor Measurement Structure for Retail Operations*

	Time	Occurrence	Element Time	Confidence Level	Weight	Weighted Confidence Level
Washing Wheels						
Filling Bucket	35	1/4	9	80%	0.20	16%
Scrub tires	15	1	15	100%	0.34	34%
Rinse Tires	15	1	15	92%	0.34	32%
Empty Bucket	20	1/4	5	72%	0.11	8%
44 Seconds Per Tire						90%
82 Tires per Hour						

The weighted confidence level is 90%. Since scrubbing and rinsing tires accounts for 68% of the standard, their respective confidence levels are given stronger weights than a less contributing factor of emptying a bucket. Weighted confidence levels will be used to establish the quality levels for Karls' program.

#### **5.6 Standard Completion Formats**

Once the appropriate confidence level has been reached, the time study must be formalized into an ELS. This formalization should reside as an official record that has been recognized by upper management for the generation of payroll as well as a historical record for review, creation of best practices, and base measurement for future improvements. These records should include elemental descriptions, a standard summation sheet, the standard's raw data, and a management signoff sheet. This information should also be stored digitally into a standard file structure to allow quick and easy access for future reference.

Elemental descriptions define the general tasks in the element, starting with first motion and ending with the last. Elemental descriptions will also state any motions that are not included (or timed) as part of that specific element. Element descriptions will also include occurrence information if necessary. While element descriptions should be developed before the study begins, the formal listing of the elements will allow additional study in the future.

### *A Labor Measurement Structure for Retail Operations*

The standard summation sheet brings all the technical data from the study into a single readable form. The summation will be in spreadsheet format and will have all the information for each element including (see appendix A):

- name
- total time studied
- pace rating
- number of times taken
- element time
- the amount of avoidable and unavoidable delay
- occurrence percentage
- confidence level
- the PF&D percentage
- number of samples needed to make a 90% confidence

The summation sheet will also show the time needed per unit processed as well as the number of units completed in an hour. The standard's raw data, which is simply every time taken during the study, will be grouped together with the summation sheet (see appendix C).

Finally, the signoff sheet will be the cover sheet to the ELS package. The sheet will contain the basic description of the job on which the ELS has been developed (see appendix B). It will also contain the units per hour of the standard, the time frame in which it was studied and the weighted confidence level of the study. The signoff will also include any specific information needed to describe any unique situations in which the study is or is not intended for. Finally, the sheet will contain the name of the study analyst and the management person authorized to sign off on the study for payroll purposes.

As the standard is signed off, a physical copy will be stored on file. A digital copy will also be placed in the Office of Store Administration folder under a folder named Time Study Central File. The Time Study Central File will contain folders for each job or department that uses standards for payroll purposes. Each job/department folder will then contain the completed study for future reference.

## **6. The Benefits of the New Karls ELS Structure**

The new structure outlined above will no doubt take time and financial investment to bring to fruition. The benefits, however, will far out way the initial work to update Karls' ELS structure. The following chapter will explain the potential benefits of a strong ELS structure including a more efficient engineering group, stronger benchmarking, and a basis for process improvements and a use for cost-benefit analysis.

### **6.1 Increasing Engineering Efficiency**

Increased efficiency in the Engineering department means more value for your engineering dollar. Tools included in the new ELS structure are not only designed to allow a more accurate standard to guide the business, but to also get to that number quicker. Three tools in particular have the potential to increase productivity: the PDA, Workstudy+ software, and standard data.

The PDA allows you to use one tool to gather all the important data during time study. The tool captures the time, task, pace, and count. More importantly, in combination with the software Workstudy+, the data can be dumped directly to an Excel worksheet from the PDA via a personal computer. The Workstudy+ software also automatically summarizes the data. The end result is a summation of a standard that used to take more then a day, now takes a few minutes. The dramatic increase in standard summation will allow the engineers to conduct more standards or spend time on other projects.

After the standards are created, they are stored in a standard data structure. This standard data structure serves not only as a reference for previous standards, but a set of building blocks for a new standard. The elements that have not changed for the new standard can be obtained through the standard data database. Only the new elements would then have to be studied. The

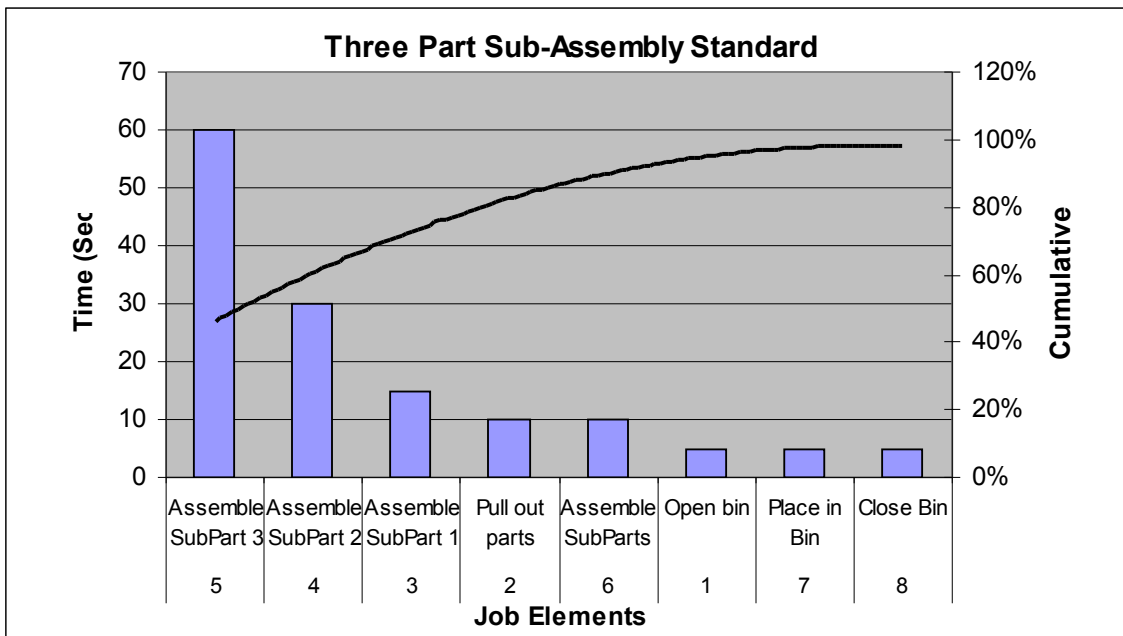
reduction in the amount of elements studied will result in a quicker and more efficient creation of new standards.

## 6.2 Setting New Company Benchmarks

Not only will the new structure help engineers in efficiency, it will help in the engineer's credibility. The use of statistical analysis will create standards that will most likely be accepted by everyone throughout the company. The new benchmarks can then be used effectively in managing company performance. The new structure creates standards that allow management to identify the top performers as well as underperformers with little or no subjectivity.

## 6.3 Using Results to Guide Process Improvements and Cost-Benefits

If the new benchmark is unacceptable to the company plan, the new ELS structure aids in identifying possible process improvement opportunities. The standard's elements can be placed in a Pareto analysis chart like the one below:



### *A Labor Measurement Structure for Retail Operations*

As you can see through the graph, assembling Subpart 3 consumes the most amount of time of any part of the standard. This element proves to have the greatest impact to the standard and the most potential for savings through process improvement. This new structure breaks out these elements to allow such an in-depth analysis. Directing the process improvements to impact the largest elements will bring the most savings to the process improvement efforts.

Improved cost-benefit analysis is also a by-product of this new structure. Since the elements are broken out, the impact of a new change to the process can be targeted to specific elements. In the case of the Subpart 3, a part redesign that reduces that specific element time by 50% can raise the standard by 21%. Depending on the volume and production cost of the product, a part redesign could be accepted or rejected through the analysis of labor standard. This ELS structure is the basis for identifying the highest impact changes that can be made to improve the bottom line.

In conclusion, this formal strategy for conducting time studies will provide a strong structure to maintain, revise, and predict time and payroll needed for each job in store operations. Secondly, the collection of time studies provides the basis for process improvement, by analyzing tasks that can be improved or eliminated through tools and strategies. Finally, the basic structure will provide consistent and quality information that can be used as a reference for all jobs within a store.

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## **Glossary**

ASSETS <sup>TM</sup> --A labor projection software package piloted by Karls and owned by Kronos <sup>TM</sup>. The software uses previous years history as well as recent sales trends and special events to predict needed labor for a store on specific days.

Avoidable delay—time a worker chooses to delay a task for, excluded from the time study standard.

Best Practice—The company approved method to complete a task. Not always the most efficient, the best practice encompasses both the most necessary and efficient ways to complete a task with the amount of quality needed for maximum effectiveness.

Big Box Retailer—Retailer who usually houses a large number of items including household items, electronics, furniture, clothing, and grocery items. Big box are named for their large size buildings which stand alone. Wal-mart and Target are examples of big box stores.

Confidence Interval—Statistical technique designed to show a range in which a value will likely exist based on a population, mean, standard deviation and desired accuracy.

Cycle time—Time from when a task starts to when the task begins again.

Engineered Labor Standards (ELS)—The scientific measurement in labor and work components in order to accurately create a base rate of production, usually in the form of units per hour.

Element—Basic task measured in work measurement. An element can describe a small motion or series of motions. Elements will have occurrences and times associated with them that usually define how many tasks are included in them.

Historical data—Using accounting of past work to predict the measurement of future work.

Kronos <sup>TM</sup> -- A well known timekeeping company. Their focus is time clocks and labor accounting.

Labor Measurement—The process of measuring a job and its components. The measurements can be, but are not limited to, time taken to complete, distance traveled, and times a process occurred.

Logistics—In a retail company, the department which is tasked with the delivery of a product from the shipyard to the store. Logistics usually controls distribution centers and trucks, but has no control of store operations.

MOST (Maynard Operation Sequence Technique)—Process developed by Kjell B. Zandin of the H. B. Maynard Company which takes MTM-1 Standards and generalizes movements for faster development of pre-determined time systems (Zandin, 4).

MTM-1 (Methods Time Measurement)—Original pre-determined time system took measurements of many individuals to develop the normal time to complete small defined movements. The culmination of movements would then create the normal time to complete a task (Zandin, 4).

Name Brand—Brand of merchandise made by a specific manufacturer for many retailers.

Non-scientific guess—process of imagining a measurement with no actual numbers attached to it.

Occurrence—Amount of times a movement or operation happens compared the base operation or unit; can be shown as a percentage or a fraction.

Operations—In a retail company, the department which is tasked with the operations of a retail store. The group is tasked with providing the right amount training, technology and labor to keep a store operating efficiently and customer friendly.

Personal, Fatigue and Delay (PF&D)—Time taken to complete normal bodily functions to maintain optimal efficiency. Usually described as a percentage of time, PF&D encompasses breaks, restroom and water breaks, company approved exercises and any expected delays to work.

Point-of-Sale (POS)—In a retail environment, the point at which a customer initiates a sale. Generally described with a counter and a cash register.

Pre-determined time systems—Work measurement systems where each body motion is assigned a normal time to perform. The work measurer only has to tally the number of each motion needed to complete a task and apply the pre-determined time to create a standard (Aft, 253).

Private Brand—Brand of merchandise made for and sold exclusively for that retailer.

Standard Data—A database of elements or motions with approved times associated with them. Standard data is generally associated with a pre-determined time system.

StandardsPro <sup>TM</sup>--Program developed by H.B. Maynard and Company which houses a standard data database and standard developer to create MOST standards.

Scientific Measurement—The process of using facts and figures rather than feelings and intuition to make management decisions. Frederick Taylor pioneered this process.

SQL Database—Microsoft developed database language that allows for efficient data analysis of a large number of data points.

Time and motion study (time study)—Form of work measurement where an observer times a person doing a task and records the time needed to complete the task.

TMU (Time Measured Unit)—Standard time unit used for both MTM and MOST. 1 TMU =  $1/27^{\text{th}}$  of a second. The standard was created through the video recording of each task to assign the time. Video recording is typically 30 frames per second; however, the equipment at the time was not reliable (Zandin, 14).

Unavoidable delay—time a worker is delayed from doing normal tasks, but must wait because it is part of their normal job.

Value Pricing—A merchandise pricing strategy where a retail company maintains a smaller margin on high value name brand clothing and a large margin on comparable private brands with less quality. The result is a perceived value for the price. The strategy is also complemented by a full price sticker that is almost always on sale.

Weighted Confidence Level—Technique used to approximate the validity of many confidence levels combined for a single number value. The process weights each confidence level according to its weight on the entire standard.

Work Sampling—A process of randomly checking on a job in short intervals. The percentage of each task is then created and applied to the time the person spends on a job. This process gives a rough estimate of how long each task takes (Aft, 299).

Work Measurement—(See Labor Measurement)

Workstudy+—Quetech Ltd. Software developed for personal digital assistants to create time standards. The software allows the user to create a time and motion standard with a PDA instead of a stopwatch and clipboard and download the information into an Excel spreadsheet.

**Studies included:**

- Softlines\_Markdown\_Subject 1
- Softlines\_Markdown\_Subject 2
- Softlines\_Markdown\_Subject 3
- Softlines\_Markdown\_Subject 4
- Softlines\_Markdown\_Subject 5
- Softlines\_Markdown\_Subject 6
- Softlines\_Markdown\_Subject 7
- Markdown-Scanner\_Subject 1
- Markdown-Softlines\_Sonr\_Tekir 2

Date generated: 3/14/2006  
Cycles: 1 to 999  
No. Studies included: 9  
Accuracy Interval: +/- 5%

45

## **Appendix B: Time Study Final Report Mock-up**

### **Price Optimization: First Markdown**

**UPH:132.33**

**C.I.: 62%**

This study was conducted at Green Bay West (Store #99) on 2/5-2/6/06 and Altamonte Springs (Store #798) on 2/14/06. Green Bay West conducted a First Markdown Process. Florida conducted a Second Markdown Process. Green Bay was on Process A (Multiple Markdowns) and Florida was on Process B (Single Markdown). The study consists of the following elements:

**UD**—Unavoidable Delay-Time spent to complete the process, but not discernable enough to callout as a separate element.

**AD**—Avoidable Delay-Time spent that does not facilitate the completion of the process.

**Scan**—Time taken to locate price ticket, grab ticket, and scan the barcode. Occurrence does include time taken to scan a non-clearance item, currently a 2-1 ratio.

**Ticket**—Time taken to take printed ticket of self peeling printer and adhere to a location on the ticket that does not cover the barcode.

**Reticket**—Time taken to find a garment not ticketed, find a matching garment or lookup, reprint the ticket, and place on the garment with the clearance ticket attached. Occurs 33 out of 3781 times according to a NCR February POS study.

**Move Item From Rack 2 Z-Rail**—Time taken to move cleared item from the sales floor fixture to the appropriate clearance z-rail.

**Move Item From Z-Rail 2 Rack**—Time taken to move cleared item from clearance z-rail to sales floor clearance rack.

**Put Hanger on Folded Item**—Time taken to place hanger on folded item that is cleared. Assumed 10% of all cleared items including hardlines.

**Remerchandise Active**—Time taken to move around active items to replaced cleared items that have completely cleared a fixture facing. Assumed 13 active items for every 100 cleared items needed remerchandising.

**Remerchandise Clearance**---Time taken to move item for one % off rack to another % off rack to make room for new clearance. Assumed to be occurring one of every three items cleared.

**Get Rail**—Time taken to go to the stockroom and collect clearance rack rails to create new clearance racks for the day.

**Fixture Setup**—Time taken to setup a new fixture once the rails have been provided. Includes time to adjust arms backward and up or down to meet clearance standards.

**Sign Fixture**—Time taken to change sign to a newly developed fixture, includes finding the appropriate sign and applying to the sign holder. Also included is the time to put up a large sign. Time to get the supplies is included in the Get Supplies standard.

**Login**—Time taken to login or relogin to scanner once logged out at beginning of shift, breaks, and lunch. All four occurrences are included in standard.

**Get Supplies**—Time taken to move to supply cart and get appropriate supply (signs, ticket roll).

**Refeed Printer**—Time taken to refeed printer more tickets. Occurrence is directly related to the number of tickets in a roll.

**Move 2 Next Fixture**—Time taken to move to the next fixture once the previous fixture has been fully scanned.

**Get Hangers**—Time taken to move to the stockroom and collect hangers to hang folded merchandise.

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