

M.O.S.T.-AN ADVANCED TECHNIQUE TO IMPROVE PRODUCTIVITY

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ABSTRACT

The paper is with the intention to provide awareness of particular work measurement technique called 'Maynard Operation Sequence Technique' essential for planning and controlling operation. The objective of any work measurement technique is to reduce the work content and thereby improve the productivity of the process. The disadvantages of the other work measurement methods over M.O.S.T is that in each technique like MTM, PMTS the recording of the data is classified into a number of intangible ranges, which are not user-friendly. M.O.S.T has the data manipulation during operation. They has almost eliminated the online worker uncomfortability.

1) INTRODUCTION

H.B.Maynard and Company had introduced M.O.S.T. system after they found the application of PMTS.MTM detailed in data collection. This new system was brought into practice in the u.s. 1975. There are many reasons for wanting to know the amount of time a particular task should take to accomplish. It may simply be for reasons of curiosity. But, realistically, it is for any of three reasons: to accomplish planning, determine performance, and establish costs.

The advantages of M.O.S.T, over other work measurement technique are:-

- It is faster than other work measurement techniques.
- It has controlled accuracy
- It reduces paper work.
- The time can be calculated in advance.
- Easy to learn and understand, it is workman-friendly.
- It is universal application.
- Rating factor is not required.
- In can establish work- measurement independently.
- The staff required is less than other methods and hence economical.
- It is consistent, therefore, more acceptable of management, engineers, supervisors and workmen.

A M.O.S.T analysis is a complete study of an operation or a suboperation consisting of one or several methods steps and corresponding sequence models, as well as appropriate parameter time and total normal time for the operation or suboperation (excluding allowances).

2) THE CONCEPT OF MOST WORK MEASUREMENT TECHNIQUE:

Because Industrial engineers are taught with sufficient study any method can be improved, many efforts have been made to simplify the work measurement analyst's task. This has, for instance, led to a variety of higher level MTM data system now in use. This attitude also led us to examine the whole concept of work measurement to find a better way for analysts to accomplish their mission. The result was the formation of the concept later to be known as MOST, 'Maynard Operation Sequence Technique'.

MOST is a system to measure work, therefore it concentrates on the movement of objects. Efficient, smooth, productive work is performed when the basic motion patterns are tactically arranged and smoothly choreographed (method engineering). It was noticed that the movements of the objects follow certain consistently repeating pattern: such as reach, grasp, move, position, the object, etc. To move an object a universe sequence model instead of random, detailed basic motions describes movement.

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In general, objects can be moved in only two ways, either they are picked and moved freely through space, or they are moved while maintaining contact with another surface. For example, a box can be picked up and carried from one end of a workbench to another or it can be pushed across the top of the workbench. For each type of move, a different sequence of events occurs, therefore, a separate MOST activity model applies. The use of tools analyzed through a separate activity sequence model.

Consequently, only three basic MOST activity sequences are needed for describing manual work, plus a fourth for measuring the movements of objects with manual cranes:

The General Move Sequence (for the movements of an objects freely through air)

The controlled Move Sequence (for the movements of an objects when it remain in contact with a surface or is attached to another object during the movement)

The Tool Use Sequence (for the use of common hand tools) . Refer Table 1.

2.1) The Basic Sequence Model –

General Move is defined as moving objects manually from one location to another freely through the air. To account for the various ways in which a General Move can occur, the activity sequence is made up of four subactivities :

- A Action distance (mainly horizontal)
- B Body motions (mainly vertical)
- G Gain control
- P Placement

These subactivities are arranged in a sequence model (Fig.1), consisting of a series of parameters organized in a logical sequence. The sequence model defines the events or actions that always take place in a prescribed order when an object is being moved from one location to another. The General Move Sequence Model, which is the most commonly used sequence model, is defined as follows:

These subactivities, or sequence model parameters, are then assigned time related index numbers based on the motion content of the subactivity. This approach provides complete analysis flexibility within the overall control of the sequence model. For each object moved, any combination of motions might occur, and using MOST, any combination may be analyzed. For the General Move Sequence, these index values are easily memorized from a brief data card. A fully indexed General Move Sequence, for example, might appear as follows:

Get			Put			Return
A6	B6	G1	A1	B0	P3	A0

Where: A6 = Walk three to four steps to object location

B6 = Bend and arise

G1 = Gain control of one light object

A1 = Move object a distance within reach

B0 = No body motion

P3 = Place and adjust object

A0 = No return

$$(6 + 6 + 1 + 1 + 3) \times 10 = 170 \text{ TMU}$$

This example could, for instance, represent the following activity: walk three steps to pick up a bolt from floor level, arise, and place the bolt in a hole.

General Move is by far the most frequently used of the three sequence models. Roughly 50 % of all manual work occurs as a General Move, with the percentage running higher for assembly and material handling and lower for machine shop operations.

2.2) The Controlled Move Sequence

(Fig. 1). This sequence is used to cover such activities as operating a lever or crank, activating a button or switch, or simply sliding an object over a surface. In addition to the A, B, and G parameters from the General Move Sequence, the sequence model for a controlled move contains the following subactivities:

M	X	I	
Move controlled	Process time	Align	

As many as one-third of the activities occurring in machine shop operations may involve controlled moves. In assembly work, however, the fraction is usually much smaller. A Typical activity covered by the controlled move sequence is the engaging of the feed lever on the milling machine. The sequence model for this activity might be indexed as follows:

Get	Move or Actuate	Return
A1-B0 G1	M1 X10 I0	A0

Where: A1 = Reach to the lever a distance within reach
 B0 = No body motion
 G1 = Get hold of the lever
 M1 = Move lever up to 12 inches to engage feed
 X10 = Process time of Approximately 3.5 sec.
 I0 = No alignment
 A0 = No return.

Example- From a position in front of the lathe, the operator takes two steps to the side, turns the handwheel two revolutions, and sets the cutting tool by aligning the handwheel dial to a scale mark

A3 B0 G1 M6 X0 I6 A0

$$(3 + 1 + 6 + 6) \times 10 = 160 \text{ TMU}$$

2.3) Tool Use Sequence model :

This sequence model covers the use of hand tools for such activities as fastening or loosening, cutting, cleaning, gauging, and recording. Also, certain activities requiring the use of the brain for mental processes can be classified as tool use, e.g., reading and thinking. As indicated above, this model is a combination of General move and controlled move activities. It was developed as a part of the basic MOST systems, merely to simplify the analysis of the activities related to the use of the hand tools.

The use of a wrench, for example, might be described by the following sequence:

Get tool	Put tool or	Use tool	Put tool or	Return	or Object	object	in	place
object aside	operator							
A1 B0 G1	A1 B0 P3	F10	A1 B0 P1	A0				

Where: A1 = Reach to wrench
 B0 = No body motion
 G1 = Get hold of wrench
 B0 = No body motion
 P3 = Place wrench on fastener
 F10 = Tighten fastener with wrench
 A1 = Move wrench a distance within reach
 B0 = No body motion
 P1 = Lay wrench aside
 A0 = No return

$$(1 + 1 + 1 + 3 + 10 + 1 + 1) \times 10 = 180 \text{ TMU}$$

3) THE MOST SYSTEM FAMILY

MOST is divided into various systems as furnished below depending on the level of accuracy.

repetitiveness of the operations, cycle time of the operation being performed, type of operation etc. There are three types of MOST systems which are-

- Mini MOST (used for repetitive operations)
- Basic MOST (used for general operations)
- Maxi MOST (used for Non-repetitive operations)
- Clerical MOST (used for clerical operation)

Mini MOST

At the lowest level, Mini MOST provides the most detailed and precise methods analysis. In general, this level of detail and precision is required to analyze any operation likely to be repeated more than 1500 times per work. An operation in this category may range from 2 to 10 seconds. There are only two sequence models i.e. the General and the Controlled Move. In contrast to Basic MOST, the index value total for a sequence model is multiplied by 1 and converted to minutes or seconds.

Area of applications: Light press operations, Manufacturing of PCB etc.

Basic MOST

At the intermediate level, operations that are likely to be performed more than 150 but fewer than 1500 times per work should be analyzed with Basic MOST. An operation in this category may range from a few seconds to 10 minutes in length. (Operations longer than 10 minutes may be analyzed with Basic MOST, with 0.5-3 minutes being typical time for Basic MOST). The majority of operations in most industries fall into this category. Basic MOST index values readily accommodate the cycle-to-cycle variations typical at this level. The method descriptions that result from Basic MOST analyses are sufficiently detailed for use as operator instructions.

Areas of application: General manual Work.

MAXI MOST

At the highest level, Maxi MOST is used to analyze operations that are likely to be performed fewer than 150 times per work. An operation in this category may be less than 2 minutes to more than several hours in length. Maxi MOST index values readily accommodate the wide cycle-to-cycle variations that are typical in such work as setups or heavy assembly. Even at this level, the method descriptions resulting from Maxi MOST are very practical for instructional purposes. Maxi MOST uses the same index values as Basic and Mini MOST. However the multiplier here is 100 instead of 1 as in Basic MOST and then converted as required.

Areas of application: Maintenance work, ship building, rail car fabrications etc.

4) TIME UNITS:

The time units used in MOST are identical to those used in the basic MTM (Methods-Time Measurement) system and are based on hours and parts of hours called Time Measurement Units (TMU). One TMU is equivalent to 0.00001 hour. The following conversion table is provided for calculating standard times:

The time in TMU for each sequence model is calculated by adding the index numbers and multiplying the sum by 10. It is then converted to hours, mins or secs. Total time for adding the computed sequence times arrives at the completion of MOST analysis. All time values established by MOST reflect the activity of an average skilled operator working at an average performance level or normal pace. This time represents pure work content at 100% performance level.

The various sub-activities in the various sequences are based on detailed M.T.M. backup analyses describing the different variations. The M.T.M. analyses are slotted into fixed time ranges represented by an index value corresponding to median. Time ranges are calculated using statistical accuracy principle theory. The parameter variants are listed on data cards for quick reference. Parameter indexing is the application of time related index value to each sequence model parameter base on the motion content. It is defined as the process of selecting the appropriate parameter variant from the reference table or data card and applying the corresponding index value.

5) SYSTEM SELECTION CHARTS

Figures 2 and 3 provide another approach to applying these selection guidelines. These charts are based on two principles: (1) the longer the analyzed time, the more accurate the analysis (due to the balancing effect); (2) the overall accuracy of a group of analyses improves as short-cycle analyses are properly combined. These charts are designed to ensure that a set of standards that includes short-cycle analyses will have the expected level of accuracy.

Each chart covers one of the two levels of accuracy most often required by government and industry. With either chart, if you know or can estimate the approximate length of the operation in minutes and the percentage of the standard calculation period occupied by repetitions of the operation, you can quickly determine which MOST version will be sufficiently accurate for the analysis. This provides a useful guideline for avoiding the extra work that would be required to analyze operations with a version of MOST more detailed than necessary.

For example, using Fig. 2 if the operation is about one minute long and will be repeated enough times to occupy about 30 % of the pay period, a Basic MOST analysis will be sufficiently accurate. If repetitions of this same operation occupy 70 % of the period, however, then Mini MOST must be used for the analysis. A similar determination is made for each analysis. When all analyses of the operations that fill the calculation period fall within the charted limits, overall accuracy within $\pm 5\%$ is assured. To maintain overall accuracy, when estimating the cycle time for the operation, do not include the time for any step or sequence of steps that is repeated identically within the operation cycle.

6) CONCLUSION

With the help of MOST method, its possible to achieve major times reduction in the manufacturing of the products. MOST nearly gives non-machining time reduction of 60 to 65 %. Which is measure achievement for MOST application. MOST gives alternative to the Time Study method.

With the help of this method its possible to get the production time of the products before its actual manufacturing starts. This helps in the production planning of FOK (First of Its Kind) products.

With the Most it's possible now to plan the production for one day before in the beginning of day itself. Since its provided with software support called as MDAT (MOST DATA) which eliminate the manual calculation and give ease in the time measurement.

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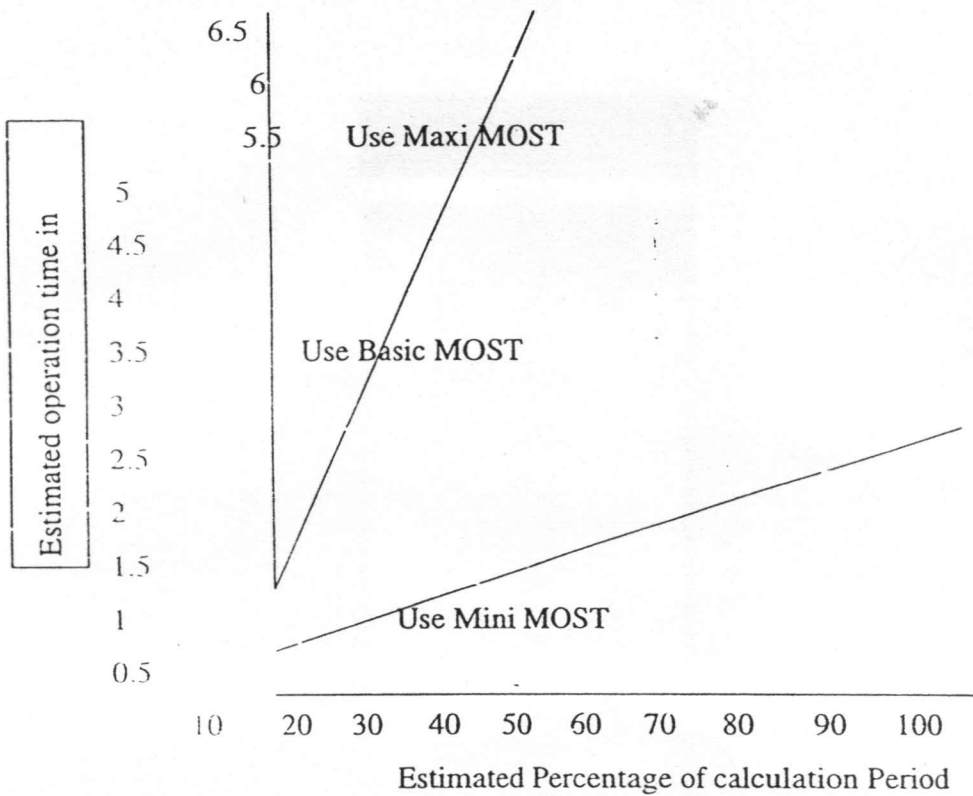


Fig 1. MOST system selection guidelines for $\pm 5\%$ accuracy at a 95 % confidence level

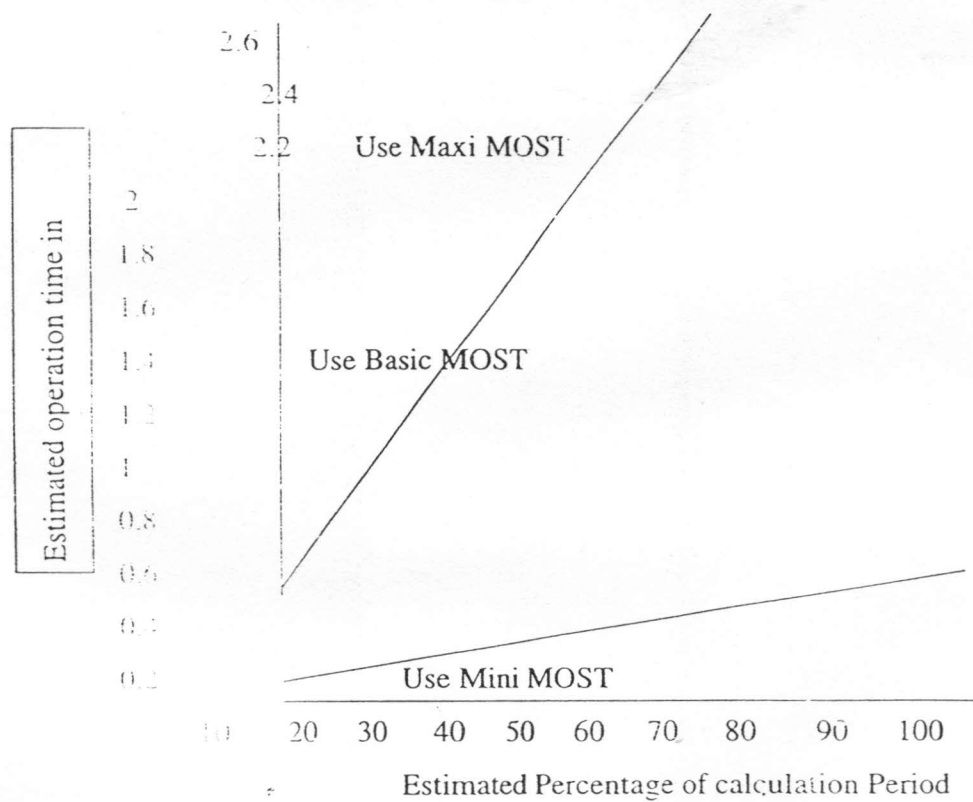


Fig 2. MOST system selection guidelines for $\pm 10\%$ accuracy at a 90 % confidence level

Basic MOST work measurement Technique		
ACTIVITY	SEQUENCE MODEL	SUB-ACTIVITIES
General Move	A B G A B P A	Action Distance, B- Body Motion G- Gain Control , P- Placement
Controlled Move	A B G M X I A	M- Move controlled , X – Process Time Alignment
Tool Use	A B G A B P A B P A	F-Fasten, L- Loosen, C- Cut, S- Surface Treat M- Measure, R- Record, T- Thick

Table 1 Sequence Models comprising the Basic MOST technique.