Predetermined Motion Time Systems

IE 441

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History

- Fredrick Taylor
  - Time Study
- Frank and Lillian Gilbreth
  - Motion Studies
- Predetermined Motion Time Systems (PMTS)
  - Combination of time and motion studies

Therbligs

- Work can be described by these 17.
  - G Grasp
  - P Position
  - PP Pre-position
  - U Use
  - A Assemble
  - DA Disassemble
  - RL Release Load
  - TE Transport Empty
  - TL Transport Loaded
  - SH Search
  - ST Select
  - H Hold
  - UD Unavoidable Delay
  - AD Avoidable Delay
  - R Rest
  - PN Plan
  - I Inspect
- Effective/Productive: Reach, Move, Grasp, Release, Pre-Position, Use, Assemble & Disassemble.
- Ineffective/Non-Productive: Search, Select, Position, Inspect, Plan, Unavoidable Delay, Avoidable Delay, Hold, Rest to overcome fatigue.

Uses

- To predict standard times for new or modified jobs
- Used to improve method analysis
- Can identify ergonomic risk factors and risk of repetitive strain indices (RSI)

Composition

- Sets of motion-time tables with rules and instructions
- Specialized training is essential to the practical application of these techniques
- Times are at 100% - which eliminates performance rating
- May be slight variability among different people using the same tool

Types of Systems

- Take basic, fundamental, universal units of work
- Attach standard amounts of time
- Work-Factor
- Predetermined Time Standards Systems – Meyers
- MTM – Methods Time Measurement
- MOST (Maynard Operational Sequence Technique)
- MODAPTS

Maynard Operation Sequence Technique (MOST)

- The Maynard Operation Sequence Technique (MOST) is a high-level predetermined motion time system (PMTS) that is based on MTM.
- Developed in 1980 by Zjell Zandin
- Establishes standards at least 5 times faster than MTM-1, w/little if any sacrifice in accuracy
- Concentrates on the movements of objects
- MOST is a work measurement technique that concentrates on the movement of objects. It is used to analyze work and to determine the normal time that it would take to perform a particular process /operation.

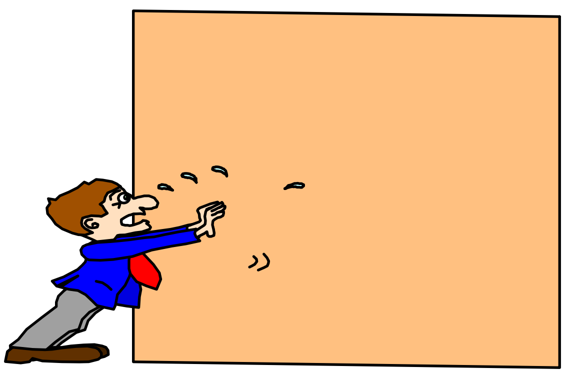
More specifically, MOST is used to:

- Break down the operation/process into smaller steps/units
- Analyze the motions in each step/unit by using a standard MOST method sequence.
- Assign indices to the parameters constituting the method sequence for each task
- Sum up the indices to arrive at a time value for each step/unit
- Sum up the time values for all the steps/units to arrive at the ‘normal time’ required to perform that operation/process

Concept of MOST

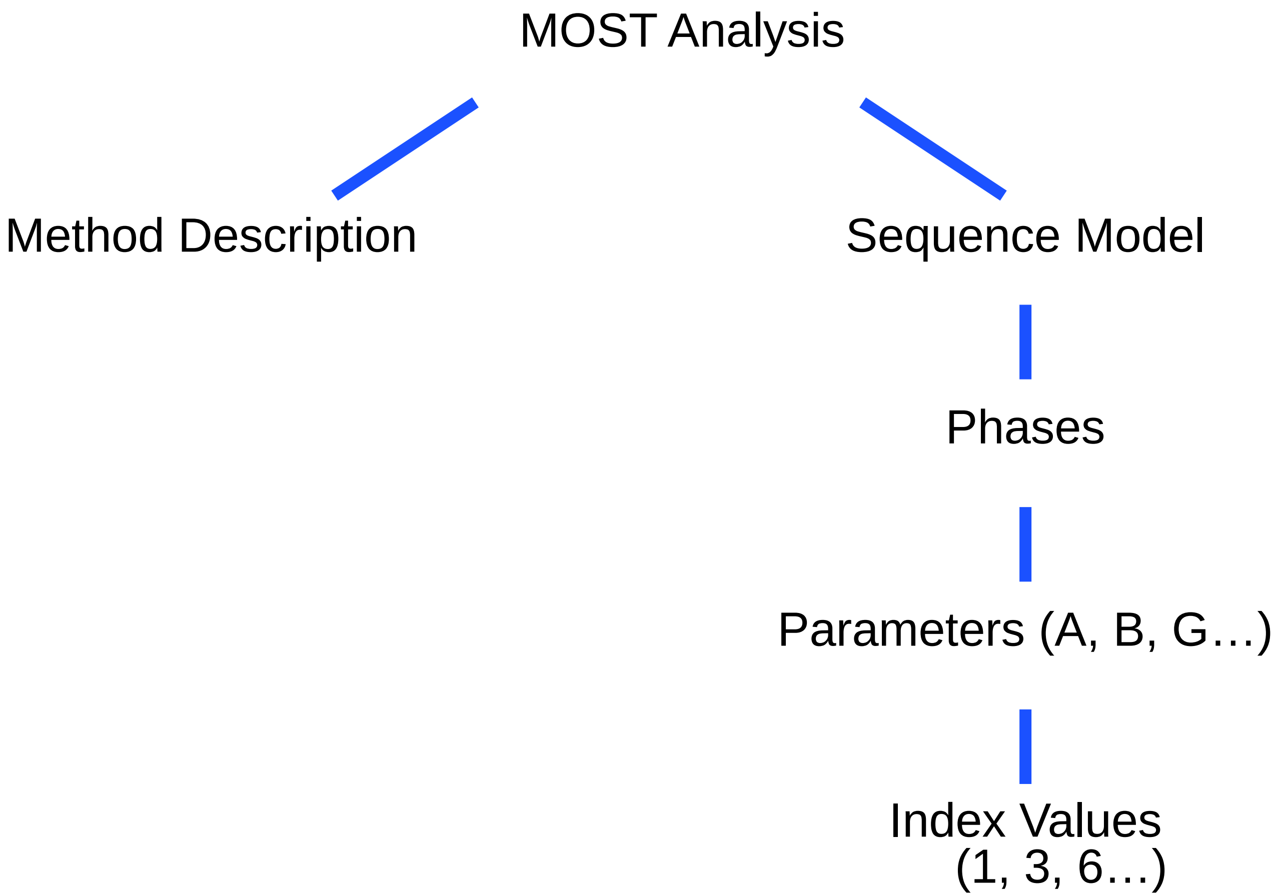
- Definition of work
- Work is the displacement of a mass or object
- Work = Force X Distance

f = 10 lbs.
d = 4 in.



f = 10 lbs.
d = 0 in.

Concept of MOST



MOST Procedure

- Watch job/task
- Determine sequence(s) to use
- Determine index values
- Add index values to determine TMU
- Multiply TMU by 10
- Convert TMU to seconds, minutes, hours

Method Description

- Documents the action performed
  - Clear, concise and easily understood
  - Comprised of recommended words
- Example:
  - Grasp marker located three steps away on the floor and put in holder.

Sequence Models

- Sequence models represent the sequence of events that occurs when an object is moved or a tool is used.
- Predefined sequence models represent different types of activities.
- Three sequence models can be used to analyze all types of manual work:
  - **General Move** (moved freely through space)
  - **Controlled Move** (movement restricted; attached or in contact)
  - **Tool Use** (using common hand tools)

Phases

- Sequence models are structured into phases used to describe the action performed.
- Each of the predefined sequence models has a different set of phases.
- From Method Description Example:
    - Grasp marker located three steps away on the floor and put in holder.

Phase:	Get	Put	Return
	How did I GET the marker?	*How did I PUT the marker?*	*Did I RETURN?*

Parameters

- Every Phases has a different set of parameters describe the type of action performed.
- Example:

A B G A B P A

  - A-Action
  - B- Body Movement
  - G-grasp type
  - P-Positioning style

Index Values

- Each parameter is assigned an index value based on the motion needed to perform the activity.
- Index values are then used to generate the total time required to perform a task.

A_6 B_6 G_1	A_6 B_0 P_1	A_0
Get	Put	Return

How is Work Measurement Done?

Example Method Description:

- Grasp book located within reach, walk Four steps, put on table and return to initial location.

A_1 B_0 G_1 — Get

A_6 B_0 P_1 — Put

A_6 — Return

Total index value = (1+0+1)+(6+0+1)+(6) = 15

TMU = 15 x 10 = 150

Time in sec = 0.036 x 150 = **5.4 sec**

MOST Analysis
of
Mouse Assembly

Document the action performed

1. Move within reach grasp wire & disengage, move within reach and hold.
2. Move within reach grasp circuit board, move within reach and hold.
3. Move within reach and place wire on circuit board with care.
4. Move within reach grasp circuit board sub-assembly and hold.
5. Move within reach collect bottom sub-assembly, move within reach and hold.
6. Move within reach place circuit board assembly into base sub-assembly.
7. Move within reach grasp wire, place with adjustment into slot.
8. Move within reach grasp upper cover, move within reach place on the sub-assembly with adjustment.
9. Move within reach grasp (2 times to turn the assembly).
10. Move within reach grasp screw, move within reach place with adjustment in the mouse assembly.
11. Move within reach grasp screw driver, move within reach place with adjustment on screw, fit with 9 wrist actions, within reach put screw driver aside,
12. Move within reach grasp (2 times to turn the assembly).
13. Move within reach grasp the wire, turn the wire around the mouse.
14. Within reach grasp the assembly, within reach put aside.

Sequence No. 1

Move within reach grasp wire & disengage, move within reach and hold

$A_1 \; B_0 \; G_3$ $A_1 \; B_0 \; P_0$ A_0

Get Put Return

Total index value = (1+0+1)+(1+0+0)+(0) = 5

TMU = 5 x 10 = 50

Sequence No. 2

Move within reach grasp circuit board, move within reach and hold

A_1 B_0 G_1	A_1 B_0 P_0	A_0
Get	Put	Return

Total index value = (1+0+1)+(1+0+0)+(0) = 3

TMU = 3 x 10 = 30

Sequence No. 3

Move within reach and place wire on circuit board with care

A_0 B_0 G_0 — Get

A_1 B_0 P_6 — Put

A_0 — Return

Total index value = (0+0+0)+(1+0+6)+(0) = 7

TMU = 7 x 10 = 70

Sequence No. 4

Move within reach grasp circuit board sub-assembly and hold

$A_1 \; B_0 \; G_1$ — Get

$A_0 \; B_0 \; P_0$ — Put

A_0 — Return

Total index value = (1+0+1)+(0+0+0)+(0) = 2

TMU = 2 x 10 = 20

Sequence No. 5

Move within reach collect bottom sub-assembly, move within reach and hold

A_1 B_0 G_3 A_1 B_0 P_0 A_0

Get Put Return

Total index value = (1+0+3)+(1+0+0)+(0) = 5

TMU = 5 x 10 = 50

Sequence No. 6

Move within reach place circuit board assembly into base sub-assembly

A_0 B_0 G_0	A_1 B_0 P_3	A_0
Get	Put	Return

Total index value = (0+0+0)+(1+0+3)+(0) = 4

TMU = 4 x 10 = 40

Sequence No. 7

Move within reach grasp wire, place with adjustment into slot

A_1 B_0 G_1 — Get

A_0 B_0 P_3 — Put

A_0 — Return

Total index value = (1+0+0)+(1+0+3)+(0) = 5

TMU = 5 x 10 = 50

Sequence No. 8

Move within reach grasp upper cover, move within reach place on the sub-assembly with adjustment

A_1 B_0 G_1 — Get

A_1 B_0 P_3 — Put

A_0 — Return

Total index value = (1+0+1)+(1+0+3)+(0) = 6

TMU = 6 x 10 = 60

Sequence No. 9

Move within reach grasp (2 times to turn the assembly)

A_1 B_0 G_1	A_0 B_0 P_0	A_0
Get	Put	Return

Total index value = (1+0+1)+(0+0+0)+(0) = 2

TMU = 2 x 2 x 10 = 40

Sequence No. 10

Move within reach grasp screw, move within reach place with adjustment in the mouse assembly

Get	Put	Return
$A_1 \; B_0 \; G_1$	$A_1 \; B_0 \; P_3$	A_0

Total index value = (1+0+1)+(1+0+3)+(0) = 6

TMU = 6 x 10 = 60

Sequence No. 11

Move within reach grasp screw driver, move within reach place with adjustment on screw, fit with 9 wrist actions, within reach put screw driver aside

A_1 B_0 G_1 A_1 B_0 P_3 F_{16} A_1 B_0 P_1 A_0

Get Put Tool Use Put Return

Total index value = (1+0+1)+(1+0+3)+(16)+(1+0+1)+(0) = 24

TMU = 24 x 10 = 240

Sequence No. 12

Move within reach grasp (2 times to turn the assembly)

A_1 B_0 G_1	A_0 B_0 P_0	A_0
Get	Put	Return

Total index value = (1+0+1)+(0+0+0)+(0) = 2

TMU = 2 x 2 x 10 = 40

Sequence No. 13

Move within reach grasp the wire, turn the wire around the mouse

A_1 B_0 G_1 M_3 X_0 I_0 A_0

Get Move Control Return

Total index value = (1+0+1)+(3+0+0)+(0) = 5

TMU = 5 x 10 = 50

Sequence No. 14

Within reach grasp the assembly, within reach put aside

Get	Put	Return
A_1 B_0 G_1	A_1 B_0 P_1	A_0

Total index value = (1+0+1)+(1+0+1)+(0) = 4

TMU = 4 x 10 = 40

Total Index value for complete operation (mouse assembly).

Total = 50+30+70+20+50+40+50+60+40+60+240+40+50+40

Total = 840

Time in sec. = 840 x 0.036 = 30.24 sec.

Normal time required complete the mouse assembly operation is 30.24 seconds