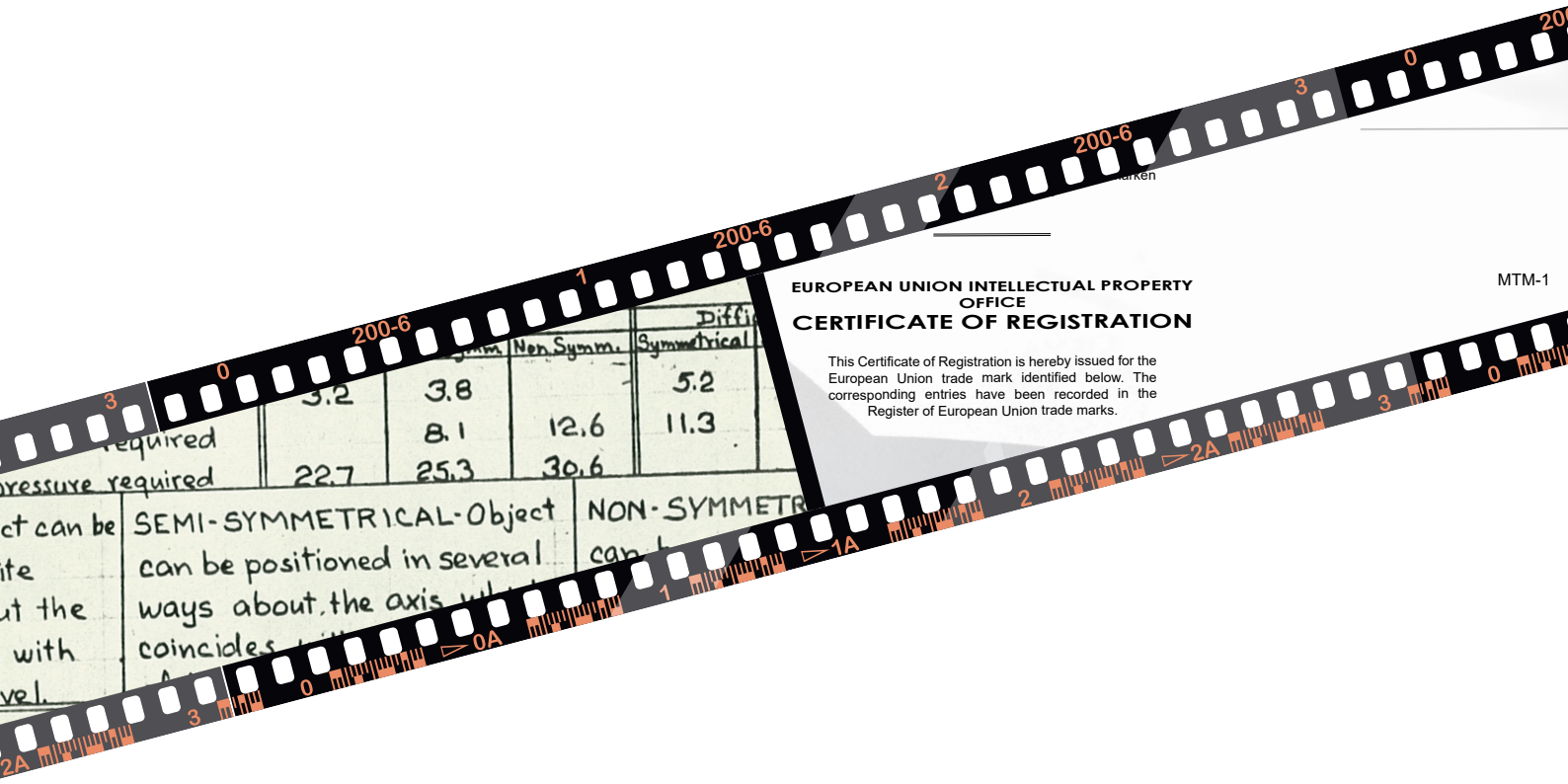
MTM TIME TO WIN



Von der ersten MTM-Datenkarte zur Marke MTM-1®

Vorwort
Peter Kuhlang

Sehr geehrte Leserin, sehr geehrter Leser!

die vorliegende, 17. Ausgabe der Schriftenreihe „MTM-Schriften Industrial Engineering“ ist eine Loseblattsammlung historisch wertvoller und aktueller Dokumente, die ich anlässlich des 60. Jahrestags der Gründung der Deutschen MTM-Vereinigung e. V. (heute: MTM ASSOCIATION e. V.) zusammengestellt habe und die im Rahmen der Festveranstaltung „60 Jahre MTM in Deutschland“ am 18. Oktober 2022 erstmals veröffentlicht worden ist.

Zu den wichtigsten, in der Gründungsschrift des MTM-Instituts festgelegten Aufgabengebieten zählen die Weiterentwicklung von MTM zur permanenten Ausweitung der MTM-Anwendung, das Herstellen von Netzwerken und die Verbesserung der Anwendungsvoraussetzungen sowie die Öffentlichkeitsarbeit für den (arbeits-)wissenschaftlichen Diskurs und breite (populär-)wissenschaftliche Wirkung. Aus dieser Tradition heraus bietet die Schriftenreihe „MTM-Schriften Industrial Engineering“ eine Plattform, um anwendungsorientierte und theoretische Arbeiten im Fachgebiet des Industrial Engineering in zitationsfähiger Form zu veröffentlichen.

Die diskontinuierlich erscheinenden Veröffentlichungen beschäftigen sich im Fachgebiet „Industrial Engineering“ im engeren und weiteren Sinne mit MTM. Dabei adressieren sie Neu- und Weiterentwicklungen, praktische Anwendungen in bekannten und neuen Fachgebieten, theoretische Erkenntnisse und Aspekte zur Fundierung und Verbreitung von MTM sowie historisch Wertvolles.

In vorliegenden Fall gibt die Veröffentlichung Einblick in die Anfänge der Entwicklung des MTM-Verfahrens. Zu sehen ist die erste Datenkarte, die im Jahre 1943 verfügbar gewesen ist. Außerdem gibt es einen Einblick in die Festlegung der MTM-Normleistung. MTM Origins schließt mit einer Aufnahme, die die Freude von Knuth Jasker und meiner Person ausdrückt, als wir im September 2020 die offizielle Eintragung der Markenrechte MTM-1® für die MTM ASSOCIATION e. V. erhalten haben.

Peter Kuhlang, im Oktober 2022

Geschäftsführer MTM ASSOCIATION e. V.
Leiter MTM-Institut

MTM-Schriften Industrial Engineering
Ausgabe 17

Von der ersten MTM-Datenkarte zur Marke MTM-1®

Historisch wertvolle und aktuelle Dokumente

MTM ASSOCIATION e. V.
Hamburg, 2022

Brief von John L. Schwab an die MTM Association (1974)

mit den nachfolgenden Anlagen:

- Original der (ersten) MTM-Datenkarte aus dem Jahre 1943 (item 1)
- Beispiel eines Analysebogens (analysis sheet, item 2). In diesen ist das LMS Levelling (Spalten: SK, Eff) erkennbar und damit die Festlegung der MTM-Normleistung nachvollziehbar dokumentiert.
- Typische Beschreibung einer „Element Analysis“, die im Vorfeld der eigentlichen Auswertungen der Filmaufnahmen vordefiniert worden sind, um Bewegungen in den Filmen einheitlich identifizieren und bewerten zu können (item 3).

JOHN L. SCHWAB
ASSOCIATES

OCT 2 1974

October 1, 1974

Mr. James O'Brien,
Executive Director
MTM Association
9-10 Saddle River Road
Fairlawn, N.J. 07410

Dear Jim:

As you requested, I am sending you a set of historical information which may be helpful. Since much of this information will be used in a book we are preparing for publication, I'm sure you will treat it in confidence as it is not for publication at this time.

Item 1 are the original Methods Time Data Tables. They are in motion picture frames instead of TMU's. This was the extent of MTM in 1943.

Item 2 are xerox copies of selected analysis sheets from which these data were derived. Note that at the time these were developed, we thought that the motion class would have an important bearing. CD represents Change of Direction, and PP means Prepositioning. I believe the other identifications are clear.

Item 3 is a typical element analysis which was pre-described prior to filming the studies used in the original data.

Item 4 is the methods evaluation sheet which we worked up at Bryant in 1944. I believe this was the first practical application of what is now MTM. The numbers were rounded out to simplify application and it later became known as the Simplified MTM Data.

These were the notes I used in teaching the first public course of what is now MTM in Bridgeport in 1944. Incidentally, this was the group whose work, ideas, and thoughts led to the development of the Position Table as now used, the entire principles of Limiting Motion Table, the refined Grasp Tables, the full Body Motion Data, etc.

Item 5 is a summary sheet of the information we developed when we reproduced the original MTM data by analyzing the SAM rating films instead of the ones from which the original hand motion data was developed.

Item 6, from the same series of analysis, are the data from which we derived some of the Partial Body Movement Tables which are shown on our MTM sheet.

Item 7 is the MTM data sheet which we have been using for some time. You will note several new tables; i.e. Term Velocity (for repetitive cranking, wiping,

scraping,etc.); Partial Body Movements (which are used extensively in extended bench operations, very heavy work such as shoveling, sawing wood, etc.); Head Motion Times (which are important in Inspection work, Laboratory work, Maintenance, etc.); Perception Reaction Times (which are mandatory for measuring highly repetitive operations; such as, business machines, banking operations, and the refined Foot, Foreleg, and Full Leg Motion Times which are required for highly repetitive work and for maintenance work).

Finally, I have included a small portion of the additional research we have been doing for the last 18 years which, I'm happy to report, has proven quite successful. Using the measurements of other professions, arranged in a sequence which they say occurs, we are able to duplicate our entire MTM table, motion by motion, category by category to within .01 to .02 TMU's per individual element value. I hope you find this interesting.

Hope this is helpful, and I'll be glad to meet with you to discuss any or all of these items at your convenience.

Sincerely,

Jack

John L. Schwab, Sr.

JLS:cz

METHODS-TIME DATA

TABLE I - REACH

CASE	DESCRIPTION
A	Move to object in fixed location, or to object in other hand or on which other hand rests.
B	Move to single object in location which may vary slightly from cycle to cycle.
C	Move to object in group
D	Move to very small object or where accurate grasp is required.
E	Move to indefinite location to get hand in position for body balance or next motion or out of way

Distance Moved Inches	Leveled Time = *Frames A Std.	A Hand in Motion	A With Slight Delay B	B Hand in Motion	C or D	E
1			1.2		2.1	
2			2.5		3.4	
3			3.4		4.2	
4	2.5	2.8	4.1	2.5	4.8	3.9
5	3.8	3.0	4.6	2.9	5.4	4.2
6	4.0	3.2	5.0	3.4	5.8	4.6
7	4.3	3.5	5.4	3.8	6.2	5.0
8	4.5	3.7	5.8	4.2	6.6	5.3
9	4.8	4.0	6.2	4.6	7.0	5.7
10	5.0	4.2	6.6	5.0	7.4	6.0
12	5.5	4.6	7.4	5.8	8.2	6.8
14	6.0	5.1	8.2	6.7	9.0	7.4
16	6.5	5.6	9.0	7.5	9.8	8.2
18	7.0	6.0	9.8	8.3	10.6	8.9
20	7.6	6.5	10.7		11.4	9.6
22	8.1	7.0	11.5		12.2	10.4
24	8.6	7.5	12.3		13.0	11.1
26	9.1	8.0	13.1		13.8	11.8
28	9.6	8.4	14.0		14.6	12.5
30	10.1	8.9	14.8		15.4	13.2

* 1 Frame = $\frac{1}{16}$ second
= .00104 minute
= .00001735 hour

TABLE II - MOVE

CASE	DESCRIPTION
A	Move object against stop
B	**Move object to** approximate location
C	Move object to exact location
D	Toss object aside
E	Move object to indefinite location

Distance Moved Inches	Leveled Time - Frames A	B or E	C	D-B Hand in Motion	Multiplying Factor Weight	Factor
1	1.0	1.0	1.0		Up to 5#	1.00
2	2.1	2.4	2.4			
3	2.8	3.3	3.3			
4	3.5	4.0	4.2	2.5	10	1.03
5	4.2	4.6	5.0	2.9		
6	4.8	5.1	5.6	3.3	15	1.05
7	5.3	5.6	6.2	3.7		
8	5.9	6.1	6.8	4.1	20	1.08
9	6.6	6.6	7.3	4.5		
10	7.2	7.0	7.8	4.9	25	1.11
12	8.3	7.7	8.8	5.8		
14	9.2	8.4	9.8	6.6	30	1.14
16	10.2	9.1	10.8	7.4		
18	11.1	9.8	11.8	8.2	35	1.16
20	11.8	10.5	12.8	9.0		
22	12.7	11.2	13.7	9.8	40	1.19
24	13.5	11.9	14.7	10.6		
26	14.3	12.6			45	1.22
28	14.9	13.3				
30	15.6	14.0			50	1.25

TABLE III - TURN

Degrees Turned	Leveled Frames	Degrees Turned	Leveled Frames
30°	1.6	120°	3.9
45°	2.0	135°	4.3
60°	2.4	150°	4.7
75°	2.8	165°	5.1
90°	3.2	180°	5.4
105°	3.6		

SMALL: No load or parts up to 2 pounds - Use table values

MEDIUM: Loads from 2.1 to 10 pounds 1.57× table values

LARGE: Loads from 10.1 to 35 pounds 3.0× table values

APPLY PRESSURE 9.3 frames

TURN is a special case of Reach or Move. It is accomplished by a turning or torsional motion, during which the hand and wrist turn. When Turn is combined with a normal Reach or Move, determine time for Turn and Reach or Move from the tables and use the larger value.

METHODS-TIME DATA

TABLE IV-GRASP X

CASE	DESCRIPTION	Leveled Time Frames
a	Pick up grasp-Small, medium, or large object by itself-easily grasped	1.0
1b	Very small object or tool handle lying close against flat surface	2.0
1c	Interference with grasp on bottom and one side of object	5.0
2	Regrasp	3.2
3	Transfer grasp	3.2
4	Object jumbled with other objects so that search and select occur	5.0
5	Contact, sliding, or hook grasp	0

TABLE V- POSITION AND *ASSEMBLE

CLASS OF FIT		Easy to Handle			Difficult to Handle		
		Symmetrical	Semi Symm.	Non Symm.	Symmetrical	Semi Symm.	Non Symm.
1 - Loose	No pressure required	3.2	3.8		5.2	7.9	9.4
2 - Close	Light pressure required		8.1	12.6	11.3	14.7	15.7
3 - Exact	Heavy pressure required	22.7	25.3	30.6			

SYMMETRICAL - Object can be positioned in an infinite number of ways about the axis which coincides with the direction of travel.

SEMI-SYMMETRICAL- Object can be positioned in several ways about the axis which coincides with the direction of travel.

NON-SYMMETRICAL- Object can be positioned in only one way about the axis which coincides with the direction of travel.

* Distance moved to assemble - 1" or less

TABLE VI - DISASSEMBLE

CLASS OF FIT			Easy to Handle	Difficult to Handle
1 - Loose	Very Slight Effort	Blends with subsequent Move	2.3	3.3
2 - Close	Normal Effort	Slight recoil	4.3	6.8
3 - Tight	Considerable Effort	Hand recoils markedly	13.2	20.0

TABLE VII - RELEASE

CASE	DESCRIPTION	Leveled Time Frames
1	Normal release performed by opening fingers as independent motion	1.0
2	Contact release	0

~~Page I~~ Data For Element "Get Part" II Case Table A D-1

Distance	Motion Class	Hand	Includes CD	Includes PP	Elapsed Frames	SK	Err	Allowed Time	Ref	Page	Remarks
3"	3	R			5	D	C		S-1	3	RH to Strap Jig
3"	4	L			3	D	C		S-1	4	LH to Strap Jig
14"	5	L	✓		5	D	C		S-1	6	
18"	5	R			6	D	C		S-1	9	RH to Strap Jig
6"	4	R	✓		5 ✓	D	C		S-1	10	
6"	4	R	✓		5 ✓	D	C		S-1	17	
10"	4	R			4	D	C		S-1	19	
6"	4	R			4	D	C		S-1	19	Move to Casting in L.H
15"	5	L	✓		8	D	C		S-1	21	Slow motion (seems slow)
12"	5	R			6	D	C		S-1	22	Slo Motion
18"	5	R			5	D	D		S-3	1	
15"	5	R			7	D	D		S-3	4	Move to part in L.H.
24"	5	R			5	D	D		S-3	1	
24"	5	R			5	D	D		S-3	8	Move to part in LH
12"	4	R			4	D	D		S-3	13	Move To part in LH
12"	4	R			4	D	D		S-3	17	Move To Part in L.H.
15"	4	R			4	C-1	C-1		S-2	1	Move To part in L.H.
3"	5	R	✓		11	C-1	C-1		S-2	11	Inc. CO, S & SE
12"	4	R			4	C-1	C-1		S-2	11	Move To Air Hose
10"	4	R	✓		6	C-1	C-1		S-2	21	A.H.
15"	5	R			6	C-1	C-1		S-2	21	A.H. — Move To Air Hose Hand already in motion from D-27
4"	4	R			2	B	C-2		S-5	1-A	Move To Brush
4"	4	Both			4	B	C-2		S-5	2-A	Move To Jig after Open Cover, preparatory to Move To Jig may be some PL here as Operator pre starts to Brush chips unnecessarily.
18"	5	R			8	B	C-2		S-5	2A	
24"	5	L			12	B	C-2		S-5	2A	AH — Move To next part
4"	4	R			3	B	C-2		S-5	5A	Hand in Motion from D-27 Move To Brush
4"	4	Both			4	B	C-2		S-5	5A	Move To Jig after Open Cover, prep to Turning
18"	5	R			12	B	C-2		S-5	6-A	Same as 2nd S5-2A. May be BD here.
24	5	L			11	↑	↑		↑	6-A	AH Move To Next Part
30	5	R			6					9-A	Move To Brush
4	4	Both			4					9-A	Move to Jig after Open Cover, Prep. To Turning
12	5	R			6					9-A	Same as 2nd S-5, 2A Looks Good.
24	5	L			13					9-A	AH Move to next part
18	4	R			6					11-A	Move To Brush
4	4	Both			4					12-A	Move to Jig after open cover prep to Turning
6	5	R			7					13-A	Move To brush
12	4	L	✓		6					14-A	Move To part
9	4	L	✓		6					14A	" " "
9	4	L			5	↓	↓		↓	16A	" " "

III

October 26, 1942

ELEMENT ANALYSIS

General Methods Formula #1

PROCESS PART - INCLUDING MOVE TO NEXT SPINDLE - HAND FEED

D-20 Case 11

In some cases when holes are to be drilled on two adjacent spindles, the operator, after completing drilling on the first spindle, will raise first spindle, move to second spindle without doing anything else, and lower second spindle. If he does something else between this such as lubricate drill or turn jig, a D-27 and a D-14 or the equivalent occur. If nothing else is done, then D-19, 20, 21, or 22 occurs. They are roughly equivalent to the first part of D-27 and a D-14 in which the movement to the spindle is longer than in the case of the regular D-14 element.

Case 11 or D-20 covers a light movable work holder with no safety positioning bar. The right hand raises and releases spindle lever on spindle just used and moves to next spindle lever as left hand pushes work holder or part under spindle. Right hand usually partially lowers spindle and then waits, while left hand positions work holder or part before completing lowering of spindle.

This operation occurred on only two studies, S-2 and S-36. In both cases, the drill press was improperly set up so that extra motions were necessary. The time for these was deducted in working up the data. The resultant data were quite consistent. They were, therefore, averaged to obtain a value to apply to this type of operation.

This element will need additional study before it can be considered to be complete. From the data available so far, however, the following tentative value can be established. D-20 allow 32.9 frames.

Definition des Bewegungselements „Move to Part“ (1942)

- Erste standardisierte Beschreibung der (Grund-) Bewegung „Move to Part“ (die Bezeichnung „Reach“ wurde offensichtlich zu diesem Zeitpunkt noch nicht genutzt).
- Erster dokumentierter Kurvenverlauf „Move to Part“ vom 5. Februar 1942 (Hinweis in der rechten unteren Ecke der Abbildung: HBM – Harold B. Maynard)

T. Job: Reach

May 22, 1942

ELEMENT ANALYSIS

General Methods Formula #1

MOVE TO PART

Data on the element "Move to Part" were collected by analysing 1350 feet of motion picture film taken of 36 different drill press operations. 242 values were thus obtained, some of them representing averages of a number of different observations of the same motion. In collecting these data, the distance moved, the motion class employed, hand used, whether or not the motion included change direction and/or preposition, the number of elapsed frames at 1/16 second per frame, the skill and effort rating of the operator, a description of the motion, and reference information were recorded for each motion listed.

When the data were at length assembled, they were carefully analysed on the basis of what they showed and the information gained during the course of the detailed film analysis. It was concluded that no single curve could be drawn for all data, but that there would be different curves depending upon the conditions under which the motions were made. Based upon this reasoning, the following classification of conditions was made.

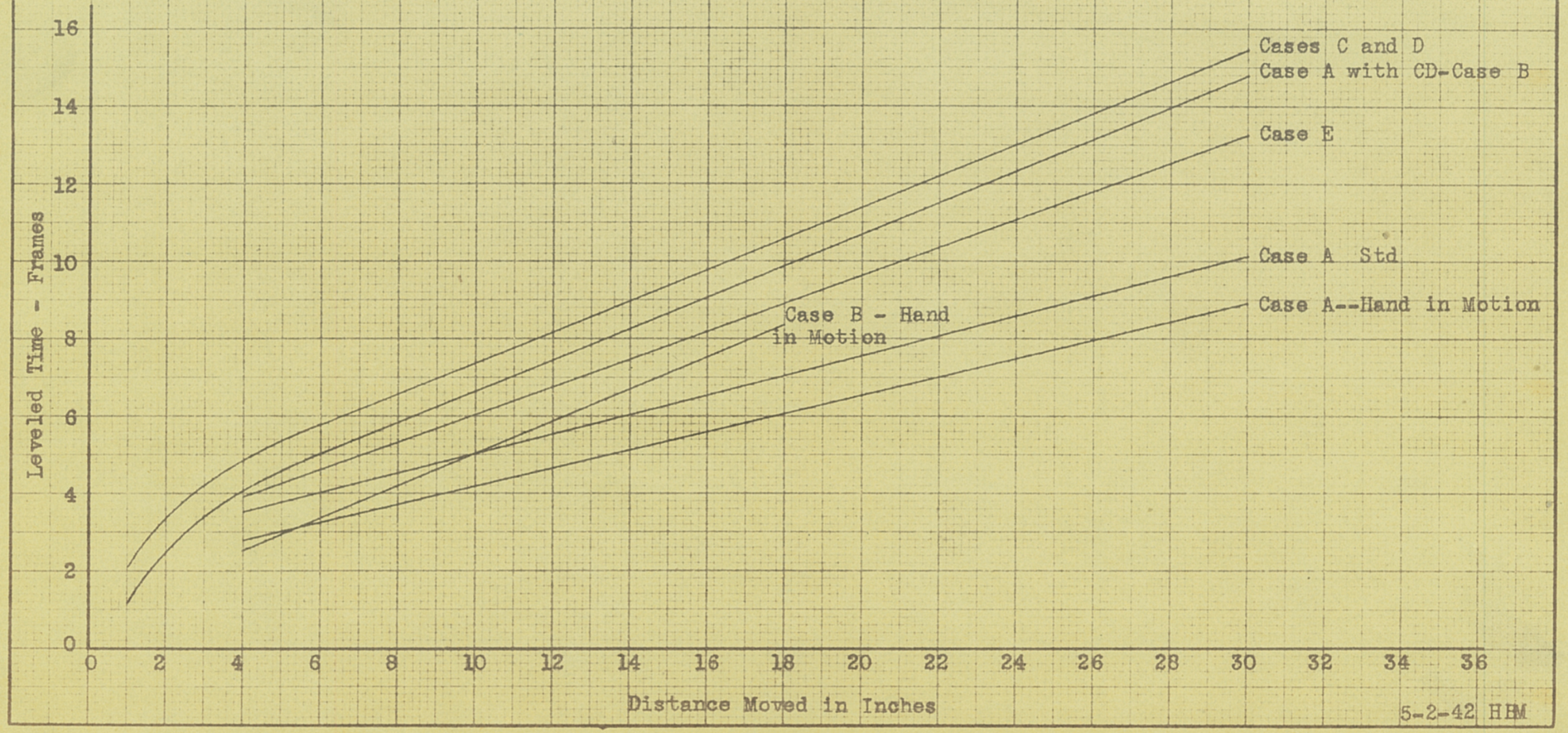
Class	Description	Example
A	Move to object in fixed location	Control lever on machine. Object held in other hand or on which other hand rests (kinesthetic sense assists).
B	Move to single object in location which may vary slightly from cycle to cycle.	Moveable jig, small, medium or large part, tool or bushing on machine table.
C	Move to object in group.	Small parts jumbled together in totepan or on table.
D	Move to very small object or where accurate grasp is required.	Very small part either alone or in group. Small screw on jig which can only be grasped in one way.
E	Move to indefinite location to get hand in position for body balance or next motion, or to get it out of way.	Drop hand from spindle lever to side, move hand out of way of hot chips during drilling.

It was further recognized that there might be two sub classes under each major classification, namely when the object moved towards was visible and when it was not visible. No motions made to objects invisible to the operator were observed so this point could not be definitely determined.

The reasoning upon which the above classification is based is as follows. When an object is in a fixed location, the hand always moves to exactly the same point. As the motion is repeated frequently, habits of automaticity are established. Thus the hand moves with a minimum of conscious direction, or in other words the factors of plan and control practically disappear.

CHART D-1
Move Hand Empty

CASE	DESCRIPTION	EXAMPLE
A	Move to object in fixed location	Control lever on machine - Object held in other hand or on which other hand rests (Kinesthetic sense assists)
B	Move to single object in location which may vary slightly from cycle to cycle.	Movable jig; part; tool; or bushing on machine table
C	Move to object in group	Small parts jumbled together in totepan or on table
D	Move to very small object or where accurate grasp is required	Very small part either alone or in group. Small screw on jig which can only be grasped in one way.
E	Move to indefinite location to get hand in position for body balance or next motion or out of way	Drop hand from spindle lever to side; move hand out of way of hot chips during drilling



Übertragung des Copyrights an der MTM data card an die MTM Association (1951)

Copyright bedeutet in diesem Falle das Eigentumsrecht.

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SYDNEY, AUSTRALIA

October 2, 1951

Mr. Andrews M. Lang, Executive Secretary
MTM Association for Standards and Research
620 Penn Avenue
Pittsburgh 21, Pennsylvania

Dear Andy:

Methods Engineering Council is pleased to transfer its copyright for the MTM Data Card, known as MEC Form #204A, to the MTM Association for Standards and Research.

Very truly yours,

John W. Hannon

John W. Hannon
Assistant to the President

JWH:lf

Registrierung des Copyrights an der MTM-Datenkarte (1955)

Auf diese Registrierung nehmen wir auch heute noch auf der MTM-1 Datenkarte Bezug!

JAN 31 1957

FORM A

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Name

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2. Title: Methods Time Measurement Application Data in T M U

3. Authors:

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Domiciled in U. S. A. Yes No Address

Name Citizenship (Name of country)

Domiciled in U. S. A. Yes No Address

4. Date and Place of Publication:

(a) Date of Publication:

April 1, 1955

(b) Place of Publication:

Ann Arbor, Michigan

5. Previous Publication:

(a) New matter in this version:

One table of data has been replaced with a "notice to users", other tables have been modified with respect to changes in certain values and inclusion of new values.

(b) United States edition of a work subject to the ad interim provisions of the Copyright Law:

Year date of first publication outside the United States. —— Claim to ad interim copyright registered. Yes ☐ No ☒

16—63824-2

See next page

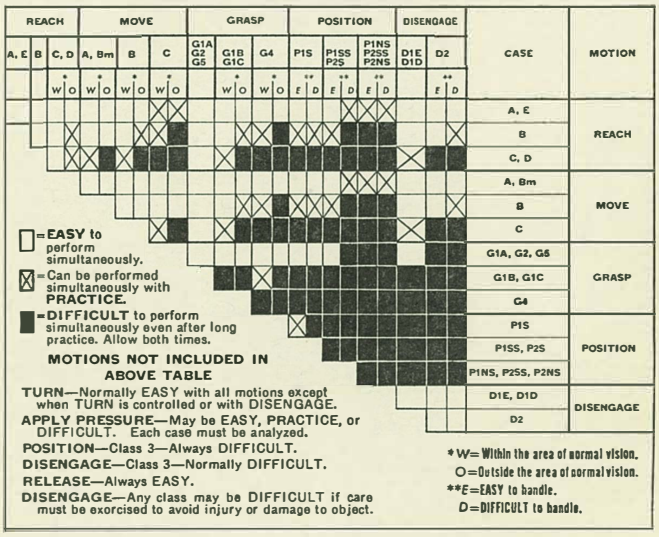
Methods-Time Measurement Application Data (1955)

Die erste offiziell registrierte, originale Fassung/Version der MTM-Datenkarte; damals hieß das Verfahren noch nicht MTM-1. Diese Datenkarte repräsentiert das „Urmeter menschlicher Leistung“.

TABLE IX—BODY, LEG AND FOOT MOTIONS

DESCRIPTION	SYMBOL	DISTANCE	TIME TMU
Foot Motion—Hinged at Ankle. With heavy pressure. Leg or Foreleg Motion.	FM FMP LM —	Up to 4" Up to 6" Each add'l. inch	8.5 19.1 7.1 1.2
Sidestep—Case 1—Complete when leading leg contacts floor.	SS-C1	Less than 12" 12" Each add'l. inch	Use REACH or MOVE Time 17.0 .6
Case 2—Lagging leg must contact floor before next motion can be made.	SS-C2	12" Each add'l. inch	34.1 1.1
Bend, Stoop, or Kneel on One Knee. Arise. Kneel on Floor—Both Knees. Arise.	B,S,KOK AB,AS,AKOK KBK AKBK		29.0 31.9 69.4 76.7
Sit. Stand from Sitting Position. Turn Body 45 to 90 degrees— Case 1—Complete when leading leg contacts floor. Case 2—Lagging leg must contact floor before next motion can be made.	SIT STD TBC1 TBC2		34.7 43.4 18.6 37.2
Walk. Walk.	W-FT. W-P	Per Foot Per Pace	5.3 15.0

TABLE X—SIMULTANEOUS MOTIONS



METHODS-TIME MEASUREMENT APPLICATION DATA IN TMU

1 TMU = .00001 hour
= .0006 minute
= .036 second

Do not attempt to use this chart or apply Methods-Time Measurement in any way unless you understand the proper application of the data. This statement is included as a word of caution to prevent difficulties resulting from misapplication of the data.

MTM ASSOCIATION FOR STANDARDS AND RESEARCH
531 East Liberty Street
ANN ARBOR, MICHIGAN

TABLE I—REACH—R

Distance Moved Inches	Time TMU				Hand In Motion	
	A	B	C or D	E	A	B
¾ or less	2.0	2.0	2.0	2.0	1.6	1.6
1	2.5	2.5	3.6	2.4	2.3	2.3
2	4.0	4.0	5.9	3.8	3.5	2.7
3	5.3	5.3	7.3	5.3	4.5	3.6
4	6.1	6.4	8.4	6.8	4.9	4.3
5	6.5	7.8	9.4	7.4	5.3	5.0
6	7.0	8.6	10.1	8.0	5.7	5.7
7	7.4	9.3	10.8	8.7	6.1	6.5
8	7.9	10.1	11.5	9.3	6.5	7.2
9	8.3	10.8	12.2	9.9	6.9	7.9
10	8.7	11.5	12.9	10.5	7.3	8.6
12	9.6	12.9	14.2	11.8	8.1	10.1
14	10.5	14.4	15.6	13.0	8.9	11.5
16	11.4	15.8	17.0	14.2	9.7	12.9
18	12.3	17.2	18.4	15.5	10.5	14.4
20	13.1	18.6	19.8	16.7	11.3	15.8
22	14.0	20.1	21.2	18.0	12.1	17.3
24	14.9	21.5	22.5	19.2	12.9	18.8
26	15.8	22.9	23.9	20.4	13.7	20.2
28	16.7	24.4	25.3	21.7	14.5	21.7
30	17.5	25.8	26.7	22.9	15.3	23.2

CASE AND DESCRIPTION
A Reach to object in fixed location, or to object in other hand or on which other hand rests.
B Reach to single object in location which may vary slightly from cycle to cycle.
C Reach to object jumbled with other objects in a group so that search and select occur.
D Reach to a very small object or where accurate grasp is required.
E Reach to indefinite location to get hand in position for body balance or next motion or out of way.

TABLE II—MOVE—M

Distance Moved Inches	Time TMU				Wt. Allowance		
	A	B	C	Hand In Motion B	Wt. (lb.) Up to	Factor	Constant TMU
¾ or less	2.0	2.0	2.0	1.7	2.5	1.00	0
1	2.5	2.9	3.4	2.3			
2	3.6	4.6	5.2	2.9	7.5	1.06	2.2
3	4.9	5.7	6.7	3.6			
4	6.1	6.9	8.0	4.3	12.5	1.11	3.9
5	7.3	8.0	9.2	5.0			
6	8.1	8.9	10.3	5.7	17.5	1.17	5.6
7	8.9	9.7	11.1	6.5			
8	9.7	10.6	11.8	7.2	22.5	1.22	7.4
9	10.5	11.5	12.7	7.9			
10	11.3	12.2	13.5	8.6	27.5	1.28	9.1
12	12.9	13.4	15.2	10.0			
14	14.4	14.6	16.9	11.4	32.5	1.33	10.8
16	16.0	15.8	18.7	12.8			
18	17.6	17.0	20.4	14.2	37.5	1.39	12.5
20	19.2	18.2	22.1	15.6			
22	20.8	19.4	23.8	17.0	42.5	1.44	14.3
24	22.4	20.6	25.5	18.4			
26	24.0	21.8	27.3	19.8	47.5	1.50	16.0
28	25.5	23.1	29.0	21.2			
30	27.1	24.3	30.7	22.7			

CASE AND DESCRIPTION
A Move object to other hand or against stop.
B Move object to approximate or indefinite location.
C Move object to exact location.

TABLE III—TURN AND APPLY PRESSURE—T AND AP

Weight	Time TMU for Degrees Turned										
	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°
Small— 0 to 2 Pounds	2.8	3.5	4.1	4.8	5.4	6.1	6.8	7.4	8.1	8.7	9.4
Medium—2.1 to 10 Pounds	4.4	5.5	6.5	7.5	8.5	9.6	10.6	11.6	12.7	13.7	14.8
Large— 10.1 to 35 Pounds	8.4	10.5	12.3	14.4	16.2	18.3	20.4	22.2	24.3	26.1	28.2

APPLY PRESSURE CASE 1—16.2 TMU. APPLY PRESSURE CASE 2—10.6 TMU

TABLE IV—GRASP—G

Case	Time TMU	DESCRIPTION
1A	2.0	**Pick Up Grasp**—Small, medium or large object by itself, easily grasped.
1B	3.5	Very small object or object lying close against a flat surface.
1C1	7.3	Interference with grasp on bottom and one side of nearly cylindrical object. Diameter larger than ½".
1C2	8.7	Interference with grasp on bottom and one side of nearly cylindrical object. Diameter ¼" to ½".
1C3	10.8	Interference with grasp on bottom and one side of nearly cylindrical object. Diameter less than ¼".
2	5.6	**Regrasp.**
3	5.6	**Transfer Grasp.**
4A	7.3	Object jumbled with other objects so search and select occur. Larger than 1" x 1" x 1".
4B	9.1	Object jumbled with other objects so search and select occur. ¼" x ¼" x ⅛" to 1" x 1" x 1".
4C	12.9	Object jumbled with other objects so search and select occur. Smaller than ¼" x ¼" x ⅛".
5	0	Contact, sliding or hook grasp.

TABLE V—POSITION*—P

CLASS OF FIT		Symmetry	Easy To Handle	Difficult To Handle
1—Loose	No pressure required	S	5.6	11.2
		SS	9.1	14.7
		NS	10.4	16.0
2—Close	Light pressure required	S	16.2	21.8
		SS	19.7	25.3
		NS	21.0	26.6
3—Exact	Heavy pressure required.	S	43.0	48.6
		SS	46.5	52.1
		NS	47.8	53.4

*Distance moved to engage—1" or less.

TABLE VI—RELEASE—RL

Case	Time TMU	DESCRIPTION
1	2.0	Normal release performed by opening fingers as independent motion.
2	0	Contact Release.

TABLE VII—DISENGAGE—D

CLASS OF FIT	Easy to Handle	Difficult to Handle
1—Loose—Very slight effort, blends with subsequent move.	4.0	5.7
2—Close — Normal effort, slight recoil.	7.5	11.8
3—Tight — Considerable effort, hand recoils markedly.	22.9	34.7

TABLE VIII—EYE TRAVEL TIME AND EYE FOCUS—ET AND EF

Eye Travel Time = $15.2 \times \frac{T}{D}$ TMU, with a maximum value of 20 TMU.

where T = the distance between points from and to which the eye travels.
D = the perpendicular distance from the eye to the line of travel T.

Eye Focus Time = 7.3 TMU.

Die eingetragene Marke: MTM-1®

Der Kreis schließt sich:
Bestätigung der Eintragung der Marke MTM-1® im September 2020 in das EU-Markenregister;
Inhaber der Marke ist die MTM ASSOCIATION e. V.

Im September 2020 gibt es für die MTM ASSOCIATION e. V. etwas zu feiern: Der damalige Geschäftsführer Knuth Jasker sowie Institutsleiter Prof. Dr. Peter Kuhlang freuen sich über die Markeneintragung. Sie ist eine wichtige Grundlage, um MTM erfolgreich als weltweiten Standard zu etablieren.

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Diese Eintragungsurkunde wird für die unten angegebene Unionsmarke ausgestellt. Die betreffenden Angaben sind in das Register der Unionsmarken eingetragen worden.

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Der Exekutivdirektor / The Executive Director

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