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## IBM 1401 TAPE IOCS TIMING CALCULATION FORMULAS

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IBM 1401 TAPE IOCS TIMING CALCULATION  
FORMULAS

ABSTRACT

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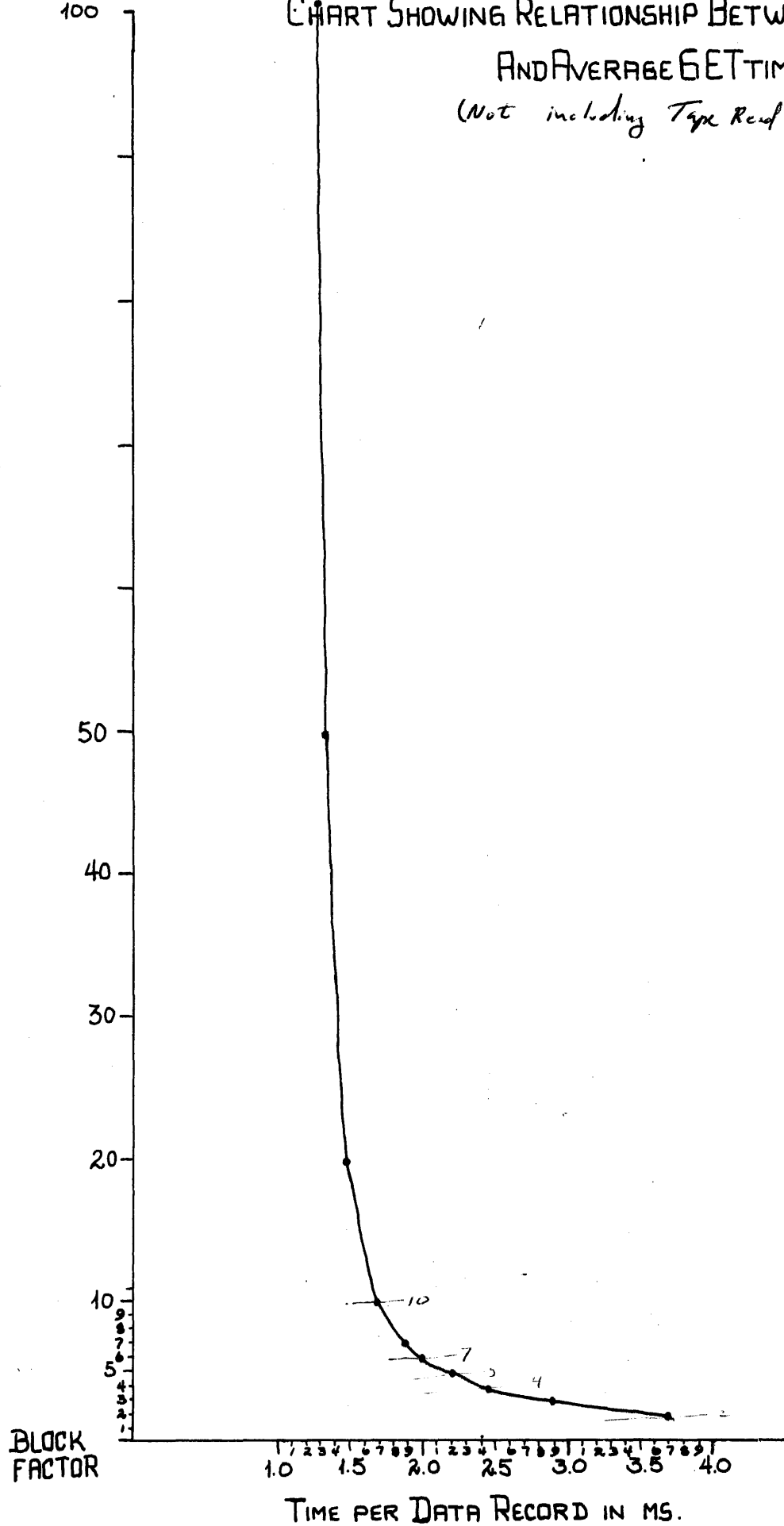
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The 1401 IOCS for a tape-based system has an unexpectedly high processing time which can be as high as 110% of the pure tape time itself. Obviously this important factor must be taken into account for any timing calculation but these figures are not, to the authors knowledge, previously published. The formulas are worked out on the basis of a typical fixed blocked DTF using a combination read/write DIOCS subroutine. The exact time for every single instruction which is normally run through was calculated. The timings thus calculated theoretically correlate very well with actual timing comparisons performed with and without IOCS.

1401 Tape I/O S - ver 2.

BLOCK  
FACTOR  
100

CHART SHOWING RELATIONSHIP BETWEEN BLOCK FACTOR  
AND AVERAGE GET TIME  
(Not including Tape Read Time)



TIME PER DATA RECORD IN MS.

IBM 1401 TAPE IOCS TIMING CALCULATION FORMULAS

TOTAL JOB TIME can be calculated as:

(Setup/rewind etc)+(IOCS time+read/write time)+program processing time

The following times are calculated on the basis of a typical fixed/blocked IOCS for input and output files. Every single normal instruction was timed individually to give the following times which are expressed in milliseconds (ms).

The times given here are processing times for GET/PUT and associated IOCS routines. They do not include the tape itself which may be calculated from standard tables (see form X22-6785-4).

GET	TOTAL INSTRUCTIONS EXECUTED	TIME/ms
1) Ordinary GET	12	1.23 pr. GET
2) +Data record movement to a workarea (if relevant)	Included in the above total	0.023 ms for each character in the record
3) +IOCS read/write routine used fore each new tape block	47	4.92 ms pr. block

Formula for GET

$$G = (1.23 \times A) + (0.023 \times R \times W) + ((A/B) \times 4.92)$$

where

R = data record length including record mark

B = block factor (total data records per tape block)

A = total data records which are GET'ed (including padded records)

W = total data record transferred to a work area by IOCS in conjunction with a PUT macro.

G = total GET time for all records in the job (expressed in ms.).

IBM 1401 Tape IOCS Timing Calculation Formulas

(cont.)

"GET" example

Record length = 81      Block factor = 10      Total records = 10,000  
 Total records transferred to a work area by the IOCS = 10,000

$$\begin{aligned} G \text{ ms} &= (1.23 \times 10,000) + 0.023 \times 81 \times 10,000 + ((10,000/10) \times 4.92) \\ &= \text{GET time} \quad + \text{move record time} + \text{read tape subroutine} \\ &= 12,300 \quad + 18,630 \quad + 4,920 \\ &= 35850 \text{ ms} = 35.85 \text{ seconds.} \end{aligned}$$

The ordinary tape time for 729II at 556 c.p.i. is  
 $(10,000/10) \times 30.3 \text{ ms} = 30.3 \text{ seconds.}$

In other words the IOCS time exceeds the tape time by over 1/6!

PUT

	TOTAL INSTRUCTIONS EXECUTED	TIME IN ms
1) Ordinary PUT (macro & DTF time)	14	1.35
2) + possible record movement		0.23 ms per character
3) + IOCS read/write subroutine for each block	31	3.96 ms

Formula for PUT

$$P = (1.35 \times A) + (R \times W \times 0.23) + ((A/B) \times 3.96) \text{ ms}$$

where

R = Data record length in characters including record mark

B = Block factor (total puts pr. block)

A = Total data records to be PUT (= total puts, including padding)

W = Total data records to be moved to the output area by IOCS.

This time should be included even if the movement is done by the user just before or after a PUT.

P = Total time in ms for all PUT's

PUT example

Record Length = 450    Block Factor = 2    Total data records = 100,000  
 Total records transferred to a workarea = 0 (indexed I/O area)

P = (1.35 x 100,000) + 0 + ((100,000/2) x 3.96)  
 = PUT time + move records + read/write routine  
 = 135,000 + 0 + 39,600  
 = 333,000 ms  
 = 333 seconds  
 729 II tape time at 556 C. P. I.  
= (100,000/2) x 32.40  
 = 1,620,000 ms.  
 = 1,620 seconds

In the case the IOCS time is a fifth the pure tape time. It is 21% of the pure tape time.

Total time for tape is in this case (exclusive rewind etc.):

1,620 + 333  
 = 1,953 seconds

These times are not official and they are not exact for all IOCS programs except fixed blocked with both input and output files. They can not be used for any other IOCS such as the 1401 IOCS which is compiled on "DISK".

TABLES FOR AVERAGE GET/PUT time, including I/O routine (IOCSRW) time.

GET TIME PER GET - fixed blocked.

Block Factor	Time per GET (average) in ms or time per 1000 records (in sec.)
2	3.69
3	2.86
4	2.46
5	2.21
6	2.05
7	1.93
10	1.72
20	1.48
50	1.33
100	1.28

PUT TIME PER PUT - fixed blocked.

Block Factor	Avg. PUT TIME ms/rec or in seconds per 100 records
2	3.33
3	2.67
4	2.34
5	2.14
6	2.01
7	1.92
10	1.75
20	1.55
50	1.43
100	1.27