

COMMITTEE T1  
CONTRIBUTION

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STANDARDS PROJECT: Analog Interface Performance Specifications for  
Digital Video Teleconferencing/Video Telephony  
Service

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TITLE: DIS/NCS Subjective Test Data

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## **INTRODUCTION**

The Delta/NCS (Lab X) portion of the Subjective Test was performed at the Advanced Television Test Center, 1330 Braddock Place, Alexandria, VA. The test started on April 25, and concluded on May 26. Delta personnel performed the test and NCS recruited viewers, almost exclusively from Federal employees.

## **TEST DESCRIPTION**

Video equipment for viewing the test tapes was provided by Sony Electronics, consisting of a Broadcast Television Monitor Model BVM 1911, and a Betacam SP tape player Model PVW2600. The BVW60 tape player that was intended to be used was replaced by Sony with the PVW2600, which has similar performance characteristics. The video equipment was powered for the entire duration of the test program to avoid warm-up drift.

Calibration of the video equipment was done each day prior to the scheduled viewing, consisting of checks of the tape player output amplitude (white = 714 IEEE units), monitor white balance (6500 degrees K), monitor peak white brightness (70.0 cd/square meter), and monitor chroma balance.

A total of 46 viewers were processed. Each viewer was typically scheduled for two tape sessions during a two-hour period on each of two days, for a total of four sessions per viewer. Vision checks were made after the first two sessions. There was considerable difficulty in managing the schedule, with many changes made in the availability of viewers. Only 38 viewers actually saw tapes, and of these three only saw two of the four tapes. Five viewers failed the null check, resulting in 30 qualified scores, 10 in each team, which was the original goal.

The results were compiled and analyzed using the SUMMARY program supplied by NTIA, and modified by them for use with a PC.

## **COLOR PERCEPTION**

Color vision checks were made with use of "Pseudo-Isochromatic Plates for Color Perception" made by Richmond Products, 1021 Rogers Circle, Boca Raton, FL, which tests for red-green color defects. The color checks were performed in the viewing room with room illumination at maximum level. The room illumination is D65, which is required for viewing the color plates. A score sheet was marked by the viewer and was retained for record purposes. Normal color vision was considered to be missing no more than four of the 14 color plates, per the instructions accompanying the test charts. Of the 38 viewers tested, two did not demonstrate normal color vision, and their tests were not continued.

## VISUAL ACUITY

Visual acuity was checked with the normal eye chart reduced in size for viewing at 5.5 feet, as distributed by NTIA. Viewers were expected to exhibit no errors on line 7. For the first two days, viewers were tested in the standing position. Several viewers confused the first character of line 7, recognizing it as a "P" rather than an "F". For the balance of the test, the viewers were tested in the sitting position, with far better results. Where possible, viewers were later rechecked in the sitting position and generally passed the test. Because it was not possible to recheck all viewers, the SUMMARY program was modified to not disqualify viewers that had perfect scores on line 6, since it was felt that all the viewers had normal visual acuity.

Table 1 shows the demographic data accumulated on the viewers. Under EYE TEST, the first number indicates the last line of the acuity chart that was read perfectly, and the second number indicates the number of color charts missed. This shows that five viewers only read line 6 perfectly.

## VIEWING POSITION

It was not realized that it was required that each viewer sit in the same seat at each session. This requirement is stated only in Appendix G of the STP. Adhering to this requirement would have added to the scheduling difficulties. The SUMMARY program would not accept the absence of a single seat designation in the demographic data. Therefore a seat was inserted for this item (generally that of the majority or the first session). In addition, the WordPerfect file, "seats" was generated which shows the seats used by each viewer in each session. This file should be used if statistical tests on the effect of viewing position are performed.

## VIEWING ORDER

Because of scheduling difficulties, it was not always possible to schedule viewers for the planned order of the tapes. Note that for each team, there are 24 possible orders of the 4 tapes. Four of these orders were assigned to each of the 3 labs, so at most only 12 of the 24 orders were scheduled. This was done so that more than one viewer could be assigned to a subteam, all having the same tape viewing order, and sitting in the same sessions. Using orders other than the scheduled ones tends to more evenly distribute the orders. In the following table, the letters xyz indicate the scheduled orders, and the numbers underneath indicate the total number of viewers at Lab X with each order for each team. The numbers in brackets indicate the number of qualified viewers, if that is different from the total number of viewers. Numbers that are not under an x (in bold) indicate viewers whose order was not according to the schedule.

1234 1243 1324 1342 1423 1432 2134 2143 2314 2341 2413 2431

RED

x x x y x YY z z  
3 1 2 1(0) 1(0) 1 1 1

GREEN

z y x x x z z  
1 4 2

ORANGE

y z x y  
2 1

3124 3142 3214 3241 3412 3421 4123 4132 4213 4231 4312 4321

RED

yz x z  
3(2)

GREEN

y x y y z  
3

ORANGE

y z x y z x z x  
1 1 1 3(2) 3(2)

Five otherwise qualified viewers (15x, 22x, 24x, 26x, 37x) viewed the tapes in an order that was not planned. Only one of these unplanned orders coincided with that of the same team at another lab, so diversity of order was increased.

#### MISSED REPEATS

Of the 9,030 scene combinations to be marked by all the viewers, 11 were missed, either because no score was marked, or because more than one score was marked. For two viewers, 09x and 27x, one of the missed scores was the second repeat. According to the Subjective Test Plan (STP), section 2.6, item 3, these viewers should be disqualified because they missed a quality check combination. However, 27x hit every null and all the other repeats exactly. The score on the first repeat was 4, so only a 1 on the second repeat would have been disqualifying otherwise. The repeat in question was not marked, and the previous combination was marked both 3 and 5. The situation for 09x is similar. She hit every null exactly, and the other repeats did not differ by more than 1. The first repeat score was 4, and the second repeat was scored both 3 and 5. It was not felt that this should be disqualifying, since the second repeat score does not count towards the results. Therefore the SUMMARY program was modified so that these viewers were not disqualified.

## MISSED SCORES

For another viewer, 10x, one score was missed on each of 3 tapes. According to the STP, section 2.6, item 3, this viewer should be disqualified because he missed more than two scores. Viewer 09x had a similar situation, missing two scores on one tape and one on another. Apparently the SUMMARY program does not check this, because 09x or 10x were not disqualified for this by the program.

## NULL CHECKS

Five viewers (07x, 30x, 31x, 33x, 36x) were disqualified because of the null check. Both 07x and 36x missed 2 nulls, with 36x giving a score of 2 to a null. The scenes missed were t (3 times), s (2 times), c, and h. No viewers failed the repeat check, and only 8 of 140 repeats had a difference as large as 2.

## VERIFICATION

The results were verified by having another person independently enter the results from the score sheets into the computer. The files created by this process were then compared with those originally created, using the DOS COMP command. Where differences were observed, the original score sheets were referenced to determine whether the original or repeated score was correct. Of the 9,030 scores keyed, 17 scores were corrected as a result of the verification process.

## RESULTS

The data was analyzed using the NTIA SUMMARY program. The results for HRC 20 are shown in Table 2. This HRC is of interest because all three teams view it, so data for all viewers is presented. Table 3 shows the summary results for all HRCs and scenes.

No statistical analysis has been performed on the results. However, a comparison was made with the NTIA results to check on the reasonableness of the data. Figure 1 is a comparison of the results from our subjective test with those obtained by NTIA, as described in T1A1.5/94-119R1. This is for HRC 20, which all teams (30 persons at each lab) viewed, and so should have the least variation. Each point corresponds to one of the 25 scenes. Ideally the points should lie on the dashed line. The data shows good correspondence between the data obtained from the two labs. There does not appear to be any significant bias between the two labs. The point furthest below the line corresponds to scene 's'.

Figure 2 is similar, but for scene 'd', where the points correspond to the 25 HRCs. Scene 'd' is "Man talking, pan", a typical teleconferencing scene. Again there is good correspondence between the two labs. The point at a score of 3.9 represents two different HRCs that have identical scores at both labs.

Figure 3 is similar to Figure 2, but for scene 's'. The point furthest below the line corresponds to HRC 20, showing that the data for the (HRC 20/scene 's') combination shows the greatest variation between the two labs. HRC 20 is H.261 with CIF at a video rate of 326.4 Kbps. Scene 's' is "Circuit diagram, zoom", which shows considerable distortion even without processing.

#### **CONCLUSIONS**

The results shown incorporate data from all viewers that completed the test, with the exception of the five viewers that failed the null check. It is felt that other minor deviations from the STP should not be cause for disqualification, and subsequent reduction of the sample size. This is to some degree confirmed by the good correlation of the data with the NTIA results.

TABLE 1 - DEMOGRAPHIC FILE

RED TEAM									
ID	DECADE	GENDER	INDUSTRY	JOB	PAST VIDEO	EYE TEST SEAT	SESSION ORDER		
01x	40	female	Government	Technical	Recent	7/2 center	2143		
09x	30	female	Broadcasting Newspapers	Professional	No	7/3 right	1234		
11x	40	male	Government	Professional	Recent	7/4 left	1234		
26x	30	male	Government	Professional	No	8/2 right	2431		
33x	40	female	Government	Professional	No	7/4 left	2134		
24x	30	male	Government	Technical	No	7/2 right	1243		
29x	40	male	Government	Professional	No	8/3 center	1342		
30x	30	male	Government	Professional	Yes	9/0 center	1423		
31x	30	male	Government	Technical	No	9/1 left	3412		
35x	20	male	Government	Professional	Recent	7/0 right	3412		
40x	50	female	Government	Secretarial	No	7/4 left	1234		
17x	50	male	Government	Administrative/ White Collar	No	6/1 center	1342		
41x	20	male	Telecommunication/ Utilities	Professional	No	7/0 right	3412		

GREEN TEAM									
ID	DECADE	GENDER	INDUSTRY	JOB	PAST VIDEO	EYE TEST SEAT	SESSION ORDER		
08x	30	female	Government	Administrative/ White Collar	Recent	7/3 left	1423		
23x	30	male	Government	Executive/ Managerial	No	7/1 right	1432		
14x	60	male	Government	Executive/ Managerial	Yes	10/1 center	1432		
10x	60	male	Government	Professional	Yes	8/3 right	2134		
27x	40	male	Government	Technical	Recent	7/1 left	2134		
04x	30	male	Telecommunication/ Utilities	Owner/ Operator	No	6/3 left	1432		
12x	30	female	Government	Secretarial	No	7/1 center	3214		
25x	20	male	Government	Professional	No	10/1 center	3214		
34x	50	male	Electronics/ Computers	Professional	Recent	7/4 left	3214		
03x	30	male	Government	Technical	Recent	9/1 center	1432		

ORANGE TEAM									
ID	DECADE	GENDER	INDUSTRY	JOB	PAST VIDEO	EYE TEST SEAT	SESSION ORDER		
02x	60	male	Government	Professional	No	6/4 right	3421		
06x	50	male	Government	Executive/ Managerial	Recent	6/4 right	1423		
07x	50	female	Government	Administrative/ White Collar	No	7/4 left	4321		
15x	20	male	Government	Professional	Recent	8/0 right	2314		

TABLE 1 - DEMOGRAPHIC FILE  
(Cont.)

20x	30	female	Government	Clerical/ Support	No	10/1 right	4321
21x	60	male	Government	Technical	No	7/1 center	4321
22x	20	female	Government	Professional	No	8/0 left	3214
28x	40	male	Government	Administrative/ White Collar	Yes	7/4 center	4231
37x	20	male	Government	Professional	No	10/0 left	4211
38x	20	female	Government	Secretarial	No	8/1 center	4231
32x	50	male	Government	Executive/ Managerial	No	7/4 center	1423
36x	20	male	Government	Technical	No	6/3 center	4231



TEAM	--VIEWER--		SCENE																	REPEAT								
	ID	QUALIFY	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	o
RED	01x	1	5	4	3	4	4	5	4	4	4	3	5	5	1	1	4	3	1	4	3	2	4	3	5	4	4	3
	09x	1	4	4	2	3	4	5	4	3	3	4	4	4	3	2	4	3	3	2	2	3	4	2	4	3	3	
	11x	1	4	3	2	4	4	4	4	4	2	3	4	5	3	3	4	3	2	3	4	4	5	3	4	3	4	3
	26x	1	3	1	2	1	2	2	3	1	1	4	3	4	1	1	2	1	1	2	1	1	2	1	2	1	3	2
	33x	0	2	3	2	3	3	5	5	5	4	5	3	2	1	3	1	4	3	2	3	3	4	4	4	3	4	1
	24x	1	5	4	3	4	4	5	4	3	4	4	4	4	3	4	4	3	3	3	4	4	4	3	4	4	4	4
	29x	1	3	3	1	2	2	3	2	1	1	1	1	4	1	1	2	3	1	1	2	1	3	2	3	2	1	2
	30x	0	4	3	3	4	3	4	4	3	1	4	4	3	3	3	4	3	3	2	3	4	3	4	3	3	4	4
	31x	0	3	3	3	4	3	4	4	2	2	3	4	4	2	3	3	3	2	3	2	3	4	3	4	3	3	3
	35x	1	5	3	3	4	3	4	4	3	2	3	4	4	2	2	3	4	2	4	3	3	4	3	4	4	3	4
	40x	1	5	4	3	3	4	4	4	3	3	4	4	4	3	2	1	4	3	4	3	3	4	4	4	4	4	3
	17x	1	4	4	2	3	3	5	4	3	3	3	4	3	3	2	4	5	3	3	2	3	4	3	3	3	3	2
	41x	1	5	4	3	4	4	4	4	3	3	4	4	4	3	3	4	4	3	3	4	4	5	4	4	4	4	4

TEAM	--VIEWER--		SCENE																	REPEAT									
	ID	QUALIFY	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	q	d
GREEN	08x	1	5	4	4	4	3	4	4	3	1	4	4	5	3	2	3	3	2	4	2	4	4	3	4	4	3	3	4
	23x	1	5	3	2	2	4	5	4	2	1	3	5	4	2	3	3	4	2	4	3	3	4	3	4	4	3	3	3
	14x	1	5	4	3	4	4	5	5	2	1	3	4	5	2	2	3	4	2	4	2	4	5	3	4	4	3	3	3
	10x	1	5	2	3	3	3	4	4	1	1	4	4	5	2	1	2	5	2	2	3	2	4	3	3	3	1	2	4
	27x	1	5	4	5	4	4	4	4	4	3	5	5	5	3	3	4	4	4	4	2	4	5	4	5	5	5	4	4
	04x	1	5	3	3	4	4	5	3	2	2	4	5	4	2	2	5	4	3	3	3	3	5	2	4	4	4	2	4
	12x	1	5	4	3	4	4	5	4	3	3	4	5	5	3	4	3	3	2	3	2	3	4	3	3	4	3	3	4
	25x	1	4	4	2	3	3	4	4	2	2	3	4	4	2	2	3	4	2	3	3	3	4	4	4	4	2	3	4
	34x	1	5	4	4	3	4	5	4	3	1	4	5	4	3	2	2	4	3	3	2	3	4	3	3	4	3	3	3
	03x	1	5	4	4	3	4	4	4	4	2	4	5	4	3	3	4	4	4	4	1	4	5	4	4	4	4	4	4

TEAM	--VIEWER--		SCENE																	REPEAT								
	ID	QUALIFY	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	p
ORANGE	02x	1	4	3	2	3	3	3	4	1	2	2	4	4	1	1	2	3	1	2	1	2	4	2	3	3	1	3
	06x	1	4	3	3	3	4	5	5	3	2	3	4	3	3	3	3	3	4	3	4	5	3	4	2	2	4	
	07x	0	4	4	4	4	3	4	4	5	3	2	4	5	4	4	3	3	3	2	4	3	4	4	4	5	3	4
	15x	1	4	3	2	4	3	5	4	3	2	3	4	3	3	2	3	3	4	3	1	2	3	2	4	4	3	4
	20x	1	4	4	2	4	4	4	4	2	1	4	4	4	1	1	3	4	1	3	3	3	4	4	4	4	3	4
	21x	1	5	4	4	4	3	5	5	2	2	5	5	5	4	3	3	5	4	3	2	4	4	3	3	3	3	3
	22x	1	4	4	2	3	3	4	4	2	3	3	4	4	3	2	2	3	2	3	1	3	3	3	3	3	3	2
	28x	1	4	4	4	3	4	4	4	4	2	3	4	4	4	3	3	4	3	4	2	3	3	3	3	4	3	3
	37x	1	5	3	3	4	3	4	4	3	4	3	5	4	2	4	3	4	2	3	4	3	4	4	4	4	4	4
	38x	1	4	3	3	3	3	4	4	2	2	2	2	3	2	2	3	3	2	2	2	2	3	2	3	4	3	2
	32x	1	4	4	1	4	4	5	5	4	4	4	5	5	3	3	3	4	4	4	3	4	5	3	4	5	5	4
	36x	0	4	3	3	4	2	4	3	3	2	3	4	4	3	3	2	4	2	3	3	4	4	2	3	4	2	4

MEAN	a	b	c	d	e	f	g	h	i	j	k	l	m
S.D.	0.63	0.73	0.94	0.76	0.63	0.75	0.59	0.96	1.01	0.86	0.90	0.65	0.90
S.E.	0.11	0.13	0.17	0.14	0.11	0.14	0.11	0.18	0.18	0.16	0.16	0.12	0.16
MAX	5	4	5	4	4	5	5	4	4	5	5	5	4
MIN	3	1	1	1	2	2	2	1	1	1	1	3	1

MEAN	n	o	p	q	r	s	t	u	v	w	x	y
S.D.	0.87	0.87	0.81	0.97	0.82	0.89	0.89	0.76	0.79	0.67	0.86	1.01
S.E.	0.16	0.16	0.15	0.18	0.15	0.16	0.16	0.14	0.14	0.12	0.16	0.18
MAX	4	5	5	4	4	4	4	5	4	5	5	5
MIN	1	1	1	1	1	1	1	2	1	2	1	1

TABLE 2 - RESULTS FOR HRC 20

TABLE 3 - SUMMARY OF RESULTS

HRC	a	b	c	d	e	f	g	h	i	j	k	l	m
1 MEAN	4.90	5.00	4.80	4.90	5.00	4.90	4.80	5.00	4.80	4.90	5.00	5.00	5.00
S.D.	0.32	0.00	0.42	0.32	0.00	0.32	0.42	0.00	0.63	0.32	0.00	0.00	0.00
S.E.	0.10	0.00	0.13	0.10	0.00	0.10	0.13	0.00	0.20	0.10	0.00	0.00	0.00
MAX	5	5	5	5	5	5	5	5	5	5	5	5	5
MIN	4	5	4	4	5	4	4	5	3	4	5	5	5
2 MEAN	4.80	4.20	4.20	4.40	4.70	4.20	4.60	4.20	4.50	4.10	4.60	4.80	4.67
S.D.	0.42	0.63	0.92	0.70	0.48	0.42	0.52	0.63	0.53	0.57	0.52	0.42	0.50
S.E.	0.13	0.20	0.29	0.22	0.15	0.13	0.16	0.20	0.17	0.18	0.16	0.13	0.17
MAX	5	5	5	5	5	5	5	5	5	5	5	5	5
MIN	4	3	3	3	4	4	4	3	4	3	4	4	4
3 MEAN	4.90	4.70	4.80	4.80	4.90	4.80	4.90	4.70	4.90	4.90	4.90	4.50	4.90
S.D.	0.32	0.67	0.42	0.42	0.32	0.42	0.32	0.48	0.32	0.32	0.32	0.53	0.32
S.E.	0.10	0.21	0.13	0.13	0.10	0.13	0.10	0.15	0.10	0.10	0.10	0.17	0.10
MAX	5	5	5	5	5	5	5	5	5	5	5	5	5
MIN	4	3	4	4	4	4	4	4	4	4	4	4	4
4 MEAN	3.00	2.60	2.45	2.45	2.15	3.25	2.85	2.25	1.45	3.10	3.15	3.55	1.85
S.D.	0.79	0.94	1.05	0.89	1.04	0.72	0.81	0.91	1.00	0.85	0.99	0.69	0.81
S.E.	0.18	0.21	0.23	0.20	0.23	0.16	0.18	0.20	0.22	0.19	0.22	0.15	0.18
MAX	4	4	5	4	4	4	4	4	5	4	5	5	3
MIN	2	1	1	1	1	1	1	1	1	1	1	2	1
5 MEAN	3.60	3.20	3.30	3.20	3.40	4.10	3.20	2.90	1.60	3.80	3.90	4.10	2.90
S.D.	0.70	0.79	0.95	0.79	0.97	0.57	0.92	0.74	0.52	0.63	0.88	0.32	0.57
S.E.	0.22	0.25	0.30	0.25	0.31	0.18	0.29	0.23	0.16	0.20	0.28	0.10	0.18
MAX	5	4	5	4	5	5	4	4	2	5	5	5	4
MIN	3	2	2	2	2	3	2	2	1	3	3	4	2
6 MEAN	3.70	2.50	2.90	2.50	2.20	4.20	3.00	1.70	1.20	2.70	3.70	3.70	1.70
S.D.	0.82	0.71	0.99	1.18	1.14	0.42	0.82	0.67	0.63	0.67	0.48	0.67	0.48
S.E.	0.26	0.22	0.31	0.37	0.36	0.13	0.26	0.21	0.20	0.21	0.15	0.21	0.15
MAX	5	4	4	5	4	5	4	3	3	4	4	5	2
MIN	2	2	1	1	1	4	2	1	1	2	3	3	1
7 MEAN	3.70	3.00	2.90	3.20	3.44	3.60	3.20	3.10	2.20	3.70	3.70	3.60	2.30
S.D.	0.82	0.82	0.99	1.14	0.88	0.84	0.92	0.74	0.79	0.67	0.82	0.84	0.95
S.E.	0.26	0.26	0.31	0.36	0.29	0.27	0.29	0.23	0.25	0.21	0.26	0.27	0.30
MAX	5	4	4	5	4	5	4	4	3	4	5	5	4
MIN	2	1	1	1	2	2	1	2	1	2	2	2	1
8 MEAN	4.00	3.50	2.70	3.60	3.40	3.70	3.80	3.00	2.50	4.20	3.90	4.20	3.50
S.D.	0.67	0.97	1.06	0.84	1.07	0.95	0.63	1.15	0.71	0.92	0.88	0.63	0.85
S.E.	0.21	0.31	0.33	0.27	0.34	0.30	0.20	0.37	0.22	0.29	0.28	0.20	0.27
MAX	5	5	4	5	4	5	5	4	4	5	5	5	4
MIN	3	2	1	2	1	2	3	1	2	2	2	3	2

TABLE 3 - SUMMARY OF RESULTS (Cont.)

HRC	a	b	c	d	e	f	g	h	i	j	k	l	m
9 MEAN	4.70	3.30	2.60	3.40	3.50	4.50	4.00	2.60	2.20	3.90	4.20	4.10	2.60
S.D.	0.48	0.67	0.52	0.84	0.53	0.53	0.67	0.84	0.79	0.57	0.63	0.74	0.70
S.E.	0.15	0.21	0.16	0.27	0.17	0.17	0.21	0.27	0.25	0.18	0.20	0.23	0.22
MAX	5	4	3	4	4	5	5	4	3	5	5	5	4
MIN	4	2	2	2	3	4	3	1	1	3	3	3	2
HRC	a	b	c	d	e	f	g	h	i	j	k	l	m
10 MEAN	4.90	4.00	3.20	3.67	3.60	4.90	4.40	3.40	2.80	4.60	4.80	4.60	4.00
S.D.	0.32	0.67	0.63	0.50	0.70	0.32	0.52	0.70	0.63	0.52	0.42	0.52	0.50
S.E.	0.10	0.21	0.20	0.17	0.22	0.10	0.16	0.22	0.20	0.16	0.13	0.16	0.17
MAX	5	5	4	4	5	5	5	4	4	5	5	5	5
MIN	4	3	2	3	3	4	4	2	2	4	4	4	3
HRC	a	b	c	d	e	f	g	h	i	j	k	l	m
11 MEAN	3.00	3.10	1.70	2.20	1.80	3.10	2.20	1.60	1.40	1.70	2.60	2.20	1.40
S.D.	0.82	0.57	0.67	0.79	0.79	0.88	0.79	0.84	0.70	0.67	0.70	0.92	0.70
S.E.	0.26	0.18	0.21	0.25	0.25	0.28	0.25	0.27	0.22	0.21	0.22	0.29	0.22
MAX	4	4	3	3	3	4	4	3	3	3	4	4	3
MIN	2	2	1	1	1	2	1	1	1	1	2	1	1
HRC	a	b	c	d	e	f	g	h	i	j	k	l	m
12 MEAN	2.60	1.90	1.70	1.90	1.50	2.90	2.50	1.90	1.30	2.20	2.30	3.00	1.30
S.D.	0.84	0.74	1.06	0.88	0.71	0.99	1.08	0.88	0.48	0.63	0.95	0.82	0.48
S.E.	0.27	0.23	0.33	0.28	0.22	0.31	0.34	0.28	0.15	0.20	0.30	0.26	0.15
MAX	4	3	4	3	3	4	4	3	2	4	4	4	2
MIN	1	1	1	1	1	2	1	1	1	2	1	2	1
HRC	a	b	c	d	e	f	g	h	i	j	k	l	m
13 MEAN	1.90	1.60	1.60	2.20	1.80	2.60	2.20	2.20	1.80	2.40	2.60	3.00	2.00
S.D.	0.74	0.84	0.52	0.79	0.79	0.97	1.23	1.03	0.92	0.84	1.07	0.94	0.67
S.E.	0.23	0.27	0.16	0.25	0.25	0.31	0.39	0.33	0.29	0.27	0.34	0.30	0.21
MAX	3	3	2	3	3	4	4	4	3	4	4	4	3
MIN	1	1	1	1	1	1	1	1	1	1	1	1	1
HRC	a	b	c	d	e	f	g	h	i	j	k	l	m
14 MEAN	2.10	2.70	2.10	2.40	1.90	2.80	1.90	2.40	2.20	3.30	3.00	3.30	3.20
S.D.	0.88	1.34	0.99	1.07	0.88	0.92	0.88	0.97	0.63	0.67	0.82	0.95	0.63
S.E.	0.28	0.42	0.31	0.34	0.28	0.29	0.28	0.31	0.20	0.21	0.26	0.30	0.20
MAX	4	5	4	4	3	4	3	4	3	4	4	5	4
MIN	1	1	1	1	1	2	1	1	1	2	2	2	2
HRC	a	b	c	d	e	f	g	h	i	j	k	l	m
15 MEAN	2.80	2.40	1.55	2.10	1.35	3.10	2.50	1.95	1.55	2.05	2.95	2.40	1.70
S.D.	0.77	0.94	0.76	0.85	0.67	0.97	0.89	0.83	0.69	0.83	0.89	0.94	0.66
S.E.	0.17	0.21	0.17	0.19	0.15	0.22	0.20	0.18	0.15	0.18	0.20	0.21	0.15
MAX	4	4	3	4	3	5	4	3	3	4	4	4	3
MIN	2	1	1	1	1	1	1	1	1	1	1	1	1
HRC	a	b	c	d	e	f	g	h	i	j	k	l	m
16 MEAN	3.40	3.20	2.90	2.56	1.90	3.30	2.40	2.30	1.10	1.80	2.60	3.30	1.40
S.D.	0.97	0.63	1.37	0.88	0.74	1.06	0.70	0.95	0.32	0.63	0.70	0.82	0.52
S.E.	0.31	0.20	0.43	0.29	0.23	0.33	0.22	0.30	0.10	0.20	0.22	0.26	0.16
MAX	4	4	5	4	3	5	4	4	2	3	4	5	2
MIN	1	2	1	1	1	2	2	1	1	1	2	2	1

HRC		a	b	c	d	e	f	g	h	i	j	k	l	m
17	MEAN	3.65	3.05	2.45	2.65	1.95	3.70	3.00	1.95	1.65	2.40	3.05	3.15	1.70
	S.D.	0.67	0.83	1.05	1.04	0.89	0.73	0.73	1.00	0.88	0.99	0.69	0.81	0.92
	S.E.	0.15	0.18	0.23	0.23	0.20	0.16	0.16	0.22	0.20	0.22	0.15	0.18	0.21
	MAX	5	5	4	5	4	5	4	4	4	5	4	5	4
	MIN	2	2	1	1	1	2	2	1	1	1	2	2	1

HRC		a	b	c	d	e	f	g	h	i	j	k	l	m
18	MEAN	4.00	2.90	2.60	2.70	2.60	4.30	3.40	2.40	1.40	2.90	3.60	3.80	1.40
	S.D.	0.67	0.74	1.07	0.67	0.70	0.48	0.70	0.84	0.70	0.88	0.52	0.63	0.52
	S.E.	0.21	0.23	0.34	0.21	0.22	0.15	0.22	0.27	0.22	0.28	0.16	0.20	0.16
	MAX	5	4	5	4	4	5	4	3	3	4	4	5	2
	MIN	3	2	1	2	2	4	2	1	1	2	3	3	1

HRC		a	b	c	d	e	f	g	h	i	j	k	l	m
19	MEAN	3.70	2.50	2.10	2.80	2.60	3.60	3.50	2.60	2.60	2.70	3.40	3.80	2.40
	S.D.	0.67	0.71	1.10	0.92	0.84	0.97	0.71	1.07	0.97	0.82	1.07	0.63	0.97
	S.E.	0.21	0.22	0.35	0.29	0.27	0.31	0.22	0.34	0.31	0.26	0.34	0.20	0.31
	MAX	5	3	4	4	4	5	4	4	4	4	4	5	4
	MIN	3	1	1	1	1	2	2	1	1	1	1	3	1

HRC		a	b	c	d	e	f	g	h	i	j	k	l	m
20	MEAN	4.47	3.50	2.77	3.37	3.50	4.30	4.00	2.67	2.23	3.43	4.13	4.17	2.50
	S.D.	0.63	0.73	0.94	0.76	0.63	0.75	0.59	0.96	1.01	0.86	0.90	0.65	0.90
	S.E.	0.11	0.13	0.17	0.14	0.11	0.14	0.11	0.18	0.18	0.16	0.16	0.12	0.16
	MAX	5	4	5	4	4	5	5	4	4	5	5	5	4
	MIN	3	1	1	1	2	2	2	1	1	1	1	3	1

HRC		a	b	c	d	e	f	g	h	i	j	k	l	m
21	MEAN	3.80	2.90	2.90	2.50	2.40	3.20	3.40	2.90	1.40	2.60	3.40	3.20	2.40
	S.D.	0.63	0.74	0.57	0.71	0.84	0.79	0.84	0.74	0.52	0.70	0.52	0.63	0.52
	S.E.	0.20	0.23	0.18	0.22	0.27	0.25	0.27	0.23	0.16	0.22	0.16	0.20	0.16
	MAX	5	4	4	4	4	4	5	4	2	4	4	4	3
	MIN	3	2	2	2	1	2	2	2	1	2	3	2	2

HRC		a	b	c	d	e	f	g	h	i	j	k	l	m
22	MEAN	4.20	3.00	2.80	3.90	3.80	4.10	4.20	3.30	2.80	4.40	4.30	4.20	3.20
	S.D.	0.92	1.05	1.32	0.88	1.03	0.99	0.79	1.16	0.63	0.70	0.82	0.92	1.03
	S.E.	0.29	0.33	0.42	0.28	0.33	0.31	0.25	0.37	0.20	0.22	0.26	0.29	0.33
	MAX	5	4	4	5	5	5	5	5	4	5	5	5	4
	MIN	2	1	1	2	2	2	3	1	2	3	3	2	1

HRC		a	b	c	d	e	f	g	h	i	j	k	l	m
23	MEAN	4.10	3.60	3.20	3.20	3.50	3.80	4.40	1.70	1.70	4.30	4.80	4.20	2.50
	S.D.	0.88	0.70	0.63	1.03	0.97	0.79	0.70	0.82	0.67	0.48	0.42	0.63	0.85
	S.E.	0.28	0.22	0.20	0.33	0.31	0.25	0.22	0.26	0.21	0.15	0.13	0.20	0.27
	MAX	5	4	4	4	5	5	5	3	3	5	5	5	4
	MIN	2	2	2	1	2	2	3	1	1	4	4	3	1

HRC		a	b	c	d	e	f	g	h	i	j	k	l	m
24	MEAN	4.40	4.00	3.70	3.90	3.70	4.30	4.40	3.60	3.30	4.50	4.30	3.60	3.70
	S.D.	0.84	0.94	0.67	1.10	1.06	1.25	0.84	1.07	1.06	0.71	1.25	0.97	0.95
	S.E.	0.27	0.30	0.21	0.35	0.33	0.40	0.27	0.34	0.33	0.22	0.40	0.31	0.30
	MAX	5	5	4	5	5	5	5	5	5	5	5	5	5
	MIN	3	2	2	2	2	2	3	2	2	3	1	2	2

HRC		a	b	c	d	e	f	g	h	i	j	k	l	m
25	MEAN	4.30	3.50	3.20	3.60	3.90	4.40	3.80	3.30	3.20	4.20	4.30	4.40	3.80
	S.D.	0.48	0.53	0.79	0.70	0.57	0.70	0.79	0.82	0.79	0.42	0.67	0.52	0.63
	S.E.	0.15	0.17	0.25	0.22	0.18	0.22	0.25	0.26	0.25	0.13	0.21	0.16	0.20
	MAX	5	4	4	5	5	5	5	4	4	5	5	5	5
	MIN	4	3	2	3	3	3	3	2	2	4	3	4	3

HRC	n	o	p	q	r	s	t	u	v	w	x	y
1 MEAN	4.60	4.90	4.70	5.00	5.00	5.00	5.00	4.90	4.70	5.00	4.90	5.00
S.D.	1.26	0.32	0.48	0.00	0.00	0.00	0.00	0.32	0.48	0.00	0.32	0.00
S.E.	0.40	0.10	0.15	0.00	0.00	0.00	0.00	0.10	0.15	0.00	0.10	0.00
MAX	5	5	5	5	5	5	5	5	5	5	5	5
MIN	1	4	4	5	5	5	5	4	4	5	4	5

HRC	n	o	p	q	r	s	t	u	v	w	x	y
2 MEAN	5.00	4.60	4.60	4.90	4.50	4.10	4.00	4.40	4.30	4.40	4.60	4.60
S.D.	0.00	0.52	0.52	0.32	0.53	0.57	0.82	0.52	0.82	0.52	0.52	0.70
S.E.	0.00	0.16	0.16	0.10	0.17	0.18	0.26	0.16	0.26	0.16	0.16	0.22
MAX	5	5	5	5	5	5	5	5	5	5	5	5
MIN	5	4	4	4	4	3	3	4	3	4	4	3

HRC	n	o	p	q	r	s	t	u	v	w	x	y
3 MEAN	4.70	4.70	4.40	4.90	4.70	4.70	4.90	4.70	4.60	4.70	4.70	4.50
S.D.	0.67	0.67	0.84	0.32	0.48	0.48	0.32	0.67	0.52	0.48	0.67	0.53
S.E.	0.21	0.21	0.27	0.10	0.15	0.15	0.10	0.21	0.16	0.15	0.21	0.17
MAX	5	5	5	5	5	5	5	5	5	5	5	5
MIN	3	3	3	4	4	4	4	3	4	4	3	4

HRC	n	o	p	q	r	s	t	u	v	w	x	y
4 MEAN	1.65	2.55	2.40	1.70	1.55	1.60	1.75	2.90	2.30	2.75	2.65	1.60
S.D.	0.67	0.69	0.88	0.66	0.76	1.05	0.85	0.97	0.98	0.79	0.88	0.88
S.E.	0.15	0.15	0.20	0.15	0.17	0.23	0.19	0.22	0.22	0.18	0.20	0.20
MAX	3	4	4	3	3	5	4	4	4	4	4	4
MIN	1	1	1	1	1	1	1	1	1	1	1	1

HRC	n	o	p	q	r	s	t	u	v	w	x	y
5 MEAN	2.60	3.20	3.40	2.20	3.20	1.20	2.50	3.90	3.30	3.40	3.10	3.00
S.D.	0.70	0.63	0.84	0.79	0.79	0.42	0.71	0.57	0.67	0.84	0.74	0.82
S.E.	0.22	0.20	0.27	0.25	0.25	0.13	0.22	0.18	0.21	0.27	0.23	0.26
MAX	4	4	4	3	5	2	3	5	4	5	4	4
MIN	2	2	2	1	2	1	1	3	2	2	2	2

HRC	n	o	p	q	r	s	t	u	v	w	x	y
6 MEAN	1.70	2.30	2.90	1.20	2.10	1.20	2.00	3.80	2.00	2.70	2.90	2.20
S.D.	0.67	0.95	0.88	0.42	0.32	0.42	0.94	0.42	0.82	0.82	0.99	1.03
S.E.	0.21	0.30	0.28	0.13	0.10	0.13	0.30	0.13	0.26	0.26	0.31	0.33
MAX	3	4	4	2	3	2	4	4	3	4	5	4
MIN	1	1	2	1	2	1	1	3	1	2	2	1

HRC	n	o	p	q	r	s	t	u	v	w	x	y
7 MEAN	2.70	3.40	3.50	2.90	3.10	2.30	2.67	3.60	2.80	3.20	3.50	2.90
S.D.	1.16	0.97	0.71	1.10	1.10	0.95	1.12	0.70	1.03	0.92	0.71	0.99
S.E.	0.37	0.31	0.22	0.35	0.35	0.30	0.37	0.22	0.33	0.29	0.22	0.31
MAX	5	5	4	4	4	4	4	4	4	4	4	4
MIN	1	2	2	1	1	1	1	2	1	1	2	1

HRC	n	o	p	q	r	s	t	u	v	w	x	y
8 MEAN	3.00	3.40	3.70	2.90	3.50	2.40	2.80	3.70	3.00	3.50	3.90	3.40
S.D.	1.15	0.97	0.48	0.99	0.97	0.97	0.79	0.82	1.15	0.85	0.88	1.17
S.E.	0.37	0.31	0.15	0.31	0.31	0.31	0.25	0.26	0.37	0.27	0.28	0.37
MAX	4	5	4	4	5	4	4	5	4	4	5	5
MIN	1	2	3	1	2	1	1	2	1	2	2	1

HRC	n	o	p	q	r	s	t	u	v	w	x	y
9 MEAN	2.90	3.00	3.10	2.30	3.20	2.40	2.80	4.00	3.00	3.10	3.90	3.70
S.D.	1.10	0.67	0.74	0.95	0.79	1.35	0.79	0.94	1.05	0.88	0.57	0.82
S.E.	0.35	0.21	0.23	0.30	0.25	0.43	0.25	0.30	0.33	0.28	0.18	0.26
MAX	4	4	4	4	4	5	4	5	5	4	5	5
MIN	1	2	2	1	2	1	2	2	2	2	3	3

HRC	n	o	p	q	r	s	t	u	v	w	x	y
10 MEAN	3.70	3.67	3.90	3.50	4.20	2.70	3.10	4.90	4.30	4.10	4.00	4.20
S.D.	0.67	0.50	0.74	0.71	0.63	0.95	0.74	0.32	0.67	0.32	0.47	0.63
S.E.	0.21	0.17	0.23	0.22	0.20	0.30	0.23	0.10	0.21	0.10	0.15	0.20
MAX	5	4	5	5	5	4	4	5	5	5	5	5
MIN	3	3	3	3	3	1	2	4	3	4	3	3

HRC	n	o	p	q	r	s	t	u	v	w	x	y
11 MEAN	1.80	1.90	1.70	1.40	1.60	1.10	1.50	2.70	1.70	2.00	1.60	1.80
S.D.	0.79	0.88	0.48	0.52	0.84	0.32	0.97	0.82	0.82	0.67	0.97	1.23
S.E.	0.25	0.28	0.15	0.16	0.27	0.10	0.31	0.26	0.26	0.21	0.31	0.39
MAX	3	3	2	2	3	2	4	4	3	3	4	4
MIN	1	1	1	1	1	1	1	2	1	1	1	1

HRC	n	o	p	q	r	s	t	u	v	w	x	y
12 MEAN	1.50	1.70	2.40	1.70	1.40	1.50	1.20	2.20	1.20	2.00	2.40	1.10
S.D.	0.71	0.67	0.84	0.95	0.97	1.27	0.63	0.92	0.63	0.82	0.84	0.32
S.E.	0.22	0.21	0.27	0.30	0.31	0.40	0.20	0.29	0.20	0.26	0.27	0.10
MAX	3	3	4	3	4	5	3	4	3	4	4	2
MIN	1	1	1	1	1	1	1	1	1	1	1	1

HRC	n	o	p	q	r	s	t	u	v	w	x	y
13 MEAN	2.10	2.10	2.10	1.30	1.50	1.40	1.60	1.90	1.30	2.00	2.10	2.10
S.D.	0.88	1.10	0.88	0.48	0.71	0.70	0.52	0.88	0.48	1.05	0.74	0.74
S.E.	0.28	0.35	0.28	0.15	0.22	0.22	0.16	0.28	0.15	0.33	0.23	0.23
MAX	3	4	3	2	3	3	2	3	2	4	3	3
MIN	1	1	1	1	1	1	1	1	1	1	1	1

HRC	n	o	p	q	r	s	t	u	v	w	x	y
14 MEAN	2.70	2.30	2.30	1.60	2.80	1.10	2.20	1.80	1.80	2.70	2.10	2.60
S.D.	0.48	0.67	0.67	1.07	0.79	0.32	1.23	1.03	0.79	0.82	0.99	0.84
S.E.	0.15	0.21	0.21	0.34	0.25	0.10	0.39	0.33	0.25	0.26	0.31	0.27
MAX	3	3	3	4	4	2	5	4	3	4	4	4
MIN	2	1	1	1	2	1	1	1	1	2	1	2

HRC	n	o	p	q	r	s	t	u	v	w	x	y
15 MEAN	1.55	1.90	2.00	1.40	1.35	1.40	1.75	2.55	1.50	2.15	1.55	1.85
S.D.	0.76	0.97	0.65	0.60	0.49	0.60	0.85	0.69	0.76	0.88	0.69	0.93
S.E.	0.17	0.22	0.15	0.13	0.11	0.13	0.19	0.15	0.17	0.20	0.15	0.21
MAX	3	4	3	3	2	3	3	4	3	4	3	4
MIN	1	1	1	1	1	1	1	1	1	1	1	1

HRC	n	o	p	q	r	s	t	u	v	w	x	y
16 MEAN	1.50	1.30	2.40	1.30	1.60	1.30	2.00	3.00	1.90	2.70	2.00	1.50
S.D.	0.97	0.48	0.70	0.67	0.70	0.48	1.25	0.94	0.88	0.67	0.94	0.97
S.E.	0.31	0.15	0.22	0.21	0.22	0.15	0.39	0.30	0.28	0.21	0.30	0.31
MAX	4	2	4	3	3	2	4	5	4	4	4	4
MIN	1	1	2	1	1	1	1	2	1	2	1	1

HRC	n	o	p	q	r	s	t	u	v	w	x	y
17 MEAN	1.50	1.55	2.90	1.45	1.60	1.85	2.30	2.90	1.90	2.85	2.75	1.60
S.D.	0.61	0.69	0.91	0.89	0.60	0.99	1.13	0.72	0.91	0.67	1.02	0.75
S.E.	0.14	0.15	0.20	0.20	0.13	0.22	0.25	0.16	0.20	0.15	0.23	0.17
MAX	3	3	4	4	3	5	5	4	4	4	5	4
MIN	1	1	1	1	1	1	1	2	1	2	1	1

HRC	n	o	p	q	r	s	t	u	v	w	x	y
18 MEAN	1.70	1.90	2.60	1.70	1.90	1.40	1.80	3.30	1.30	2.90	3.10	1.70
S.D.	0.67	0.57	0.84	0.82	0.74	0.70	0.63	0.67	0.67	0.74	0.57	0.82
S.E.	0.21	0.18	0.27	0.26	0.23	0.22	0.20	0.21	0.21	0.23	0.18	0.26
MAX	3	3	4	3	3	3	3	4	3	4	4	3
MIN	1	1	1	1	1	1	1	2	1	2	2	1

TABLE 3 - SUMMARY OF RESULTS (Cont.)

HRC	n	o	p	q	r	s	t	u	v	w	x	y
19 MEAN	2.60	2.50	3.10	1.90	2.00	1.80	2.10	3.70	2.20	2.60	3.20	3.00
S.D.	1.07	0.97	0.74	0.88	0.82	0.63	0.74	1.06	0.79	0.70	0.92	0.94
S.E.	0.34	0.31	0.23	0.28	0.26	0.20	0.23	0.33	0.25	0.22	0.29	0.30
MAX	4	4	4	3	3	3	3	5	3	4	4	4
MIN	1	1	2	1	1	1	1	1	1	2	1	1
20 MEAN	2.27	3.07	3.63	2.47	3.13	2.40	3.03	4.03	3.00	3.63	3.60	3.13
S.D.	0.87	0.87	0.81	0.97	0.82	0.89	0.89	0.76	0.79	0.67	0.86	1.01
S.E.	0.16	0.16	0.15	0.18	0.15	0.16	0.16	0.14	0.14	0.12	0.16	0.18
MAX	4	5	5	4	4	4	4	5	4	5	5	5
MIN	1	1	1	1	1	1	1	2	1	2	1	1
21 MEAN	2.50	2.00	3.10	1.90	2.30	2.20	2.90	3.50	2.40	3.30	3.10	2.50
S.D.	0.71	0.82	0.74	0.57	0.82	1.14	0.32	0.53	0.84	0.67	0.74	0.85
S.E.	0.22	0.26	0.23	0.18	0.26	0.36	0.10	0.17	0.27	0.21	0.23	0.27
MAX	4	3	4	3	3	4	3	4	4	4	4	4
MIN	2	1	2	1	1	1	2	3	1	2	2	1
22 MEAN	2.80	3.50	4.10	3.30	3.80	2.00	2.90	4.20	4.00	3.70	3.50	4.00
S.D.	0.79	0.97	0.88	0.67	0.63	0.82	0.74	0.92	0.82	1.06	0.85	1.25
S.E.	0.25	0.31	0.28	0.21	0.20	0.26	0.23	0.29	0.26	0.33	0.27	0.39
MAX	4	5	5	4	4	3	4	5	5	5	4	5
MIN	1	2	3	2	2	1	2	2	2	1	2	1
23 MEAN	2.10	3.70	3.80	3.40	4.20	2.70	3.50	3.90	3.50	3.90	3.60	2.60
S.D.	0.88	0.48	1.03	0.70	0.92	1.16	0.71	0.57	0.53	1.10	0.70	0.97
S.E.	0.28	0.15	0.33	0.22	0.29	0.37	0.22	0.18	0.17	0.35	0.22	0.31
MAX	4	4	5	4	5	4	4	5	4	5	4	4
MIN	1	3	2	2	2	1	2	3	3	1	2	1
24 MEAN	3.60	3.56	4.00	2.90	3.40	3.10	3.90	4.40	3.90	3.90	3.60	3.20
S.D.	0.97	1.13	1.25	0.99	0.84	0.99	0.57	0.97	1.10	0.88	0.84	1.14
S.E.	0.31	0.38	0.39	0.31	0.27	0.31	0.18	0.31	0.35	0.28	0.27	0.36
MAX	5	5	5	4	4	4	5	5	5	5	4	5
MIN	2	2	2	1	2	1	3	2	2	2	2	1
25 MEAN	3.70	3.20	3.80	3.40	3.90	2.50	3.30	4.30	4.00	3.80	4.20	4.40
S.D.	0.48	0.79	0.92	0.52	0.57	0.85	0.67	0.48	0.67	0.42	0.63	0.70
S.E.	0.15	0.25	0.29	0.16	0.18	0.27	0.21	0.15	0.21	0.13	0.20	0.22
MAX	4	4	5	4	5	4	4	5	5	4	5	5
MIN	3	2	2	3	3	1	2	4	3	3	3	3

# COMPARISON OF NTIA AND DELTA SCORES

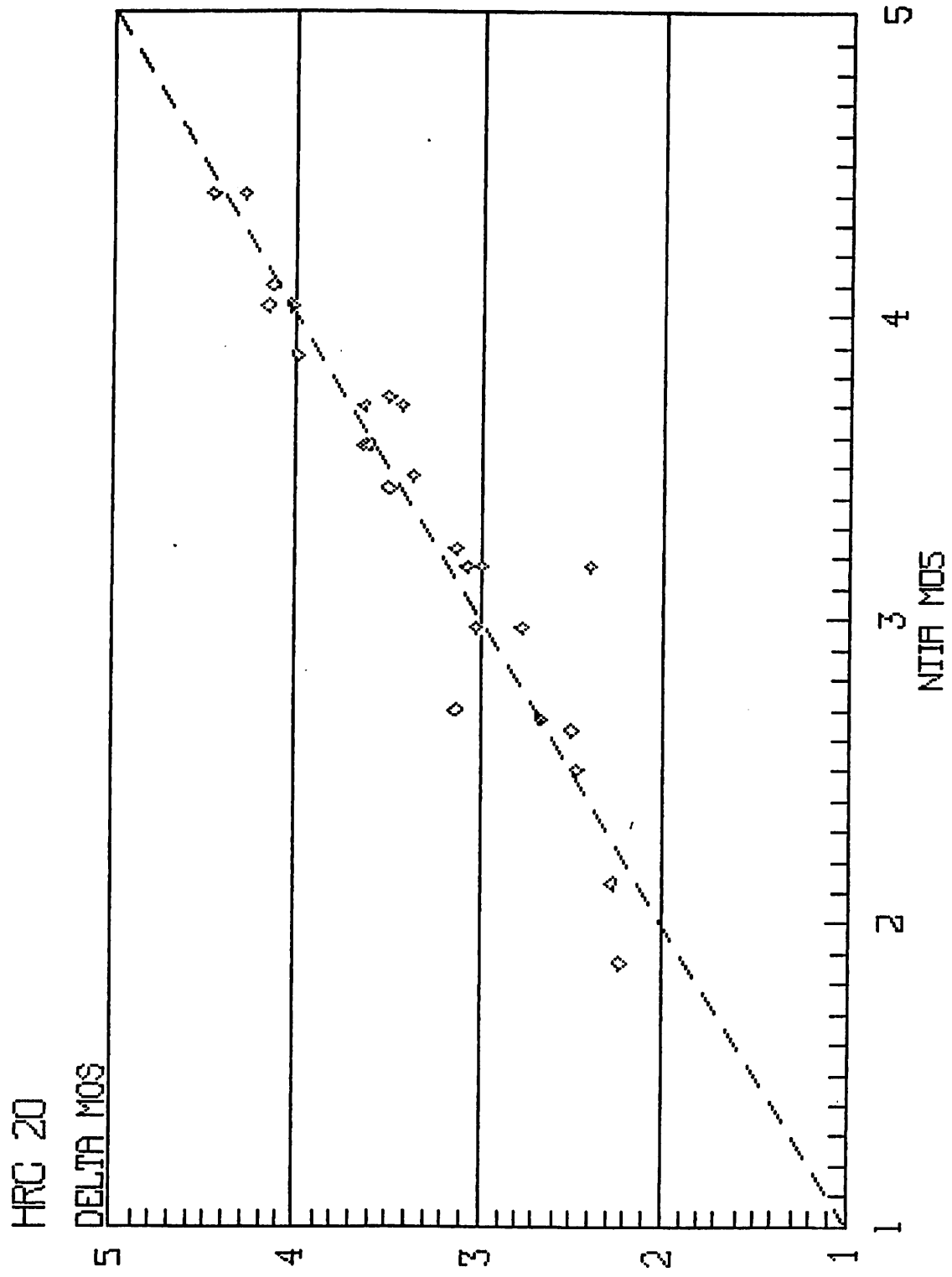


FIGURE 1



# COMPARISON OF NTIA AND DELTA SCORES

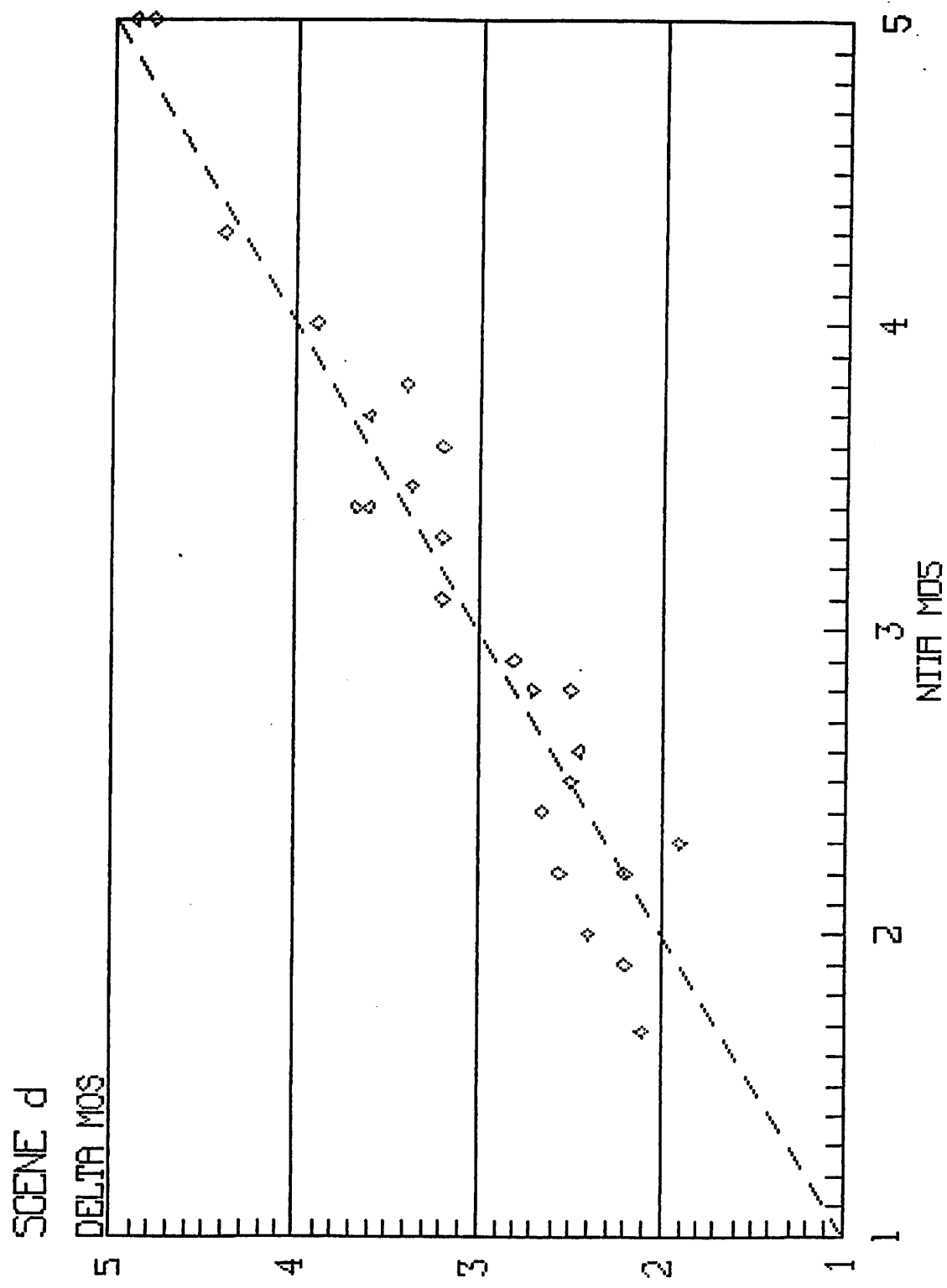


FIGURE 2

# COMPARISON OF NTIA AND DELTA SCORES

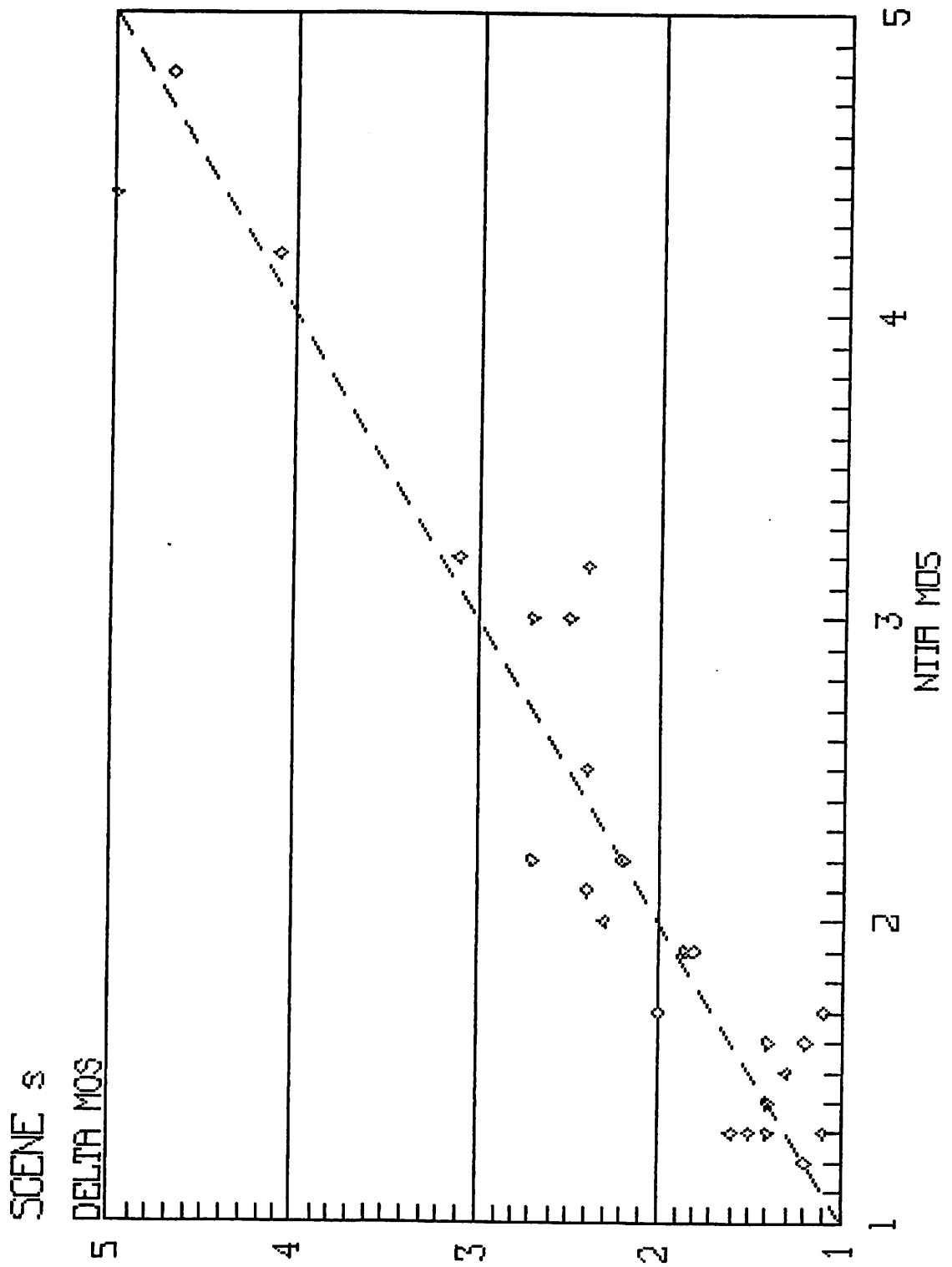


FIGURE 3