

**Stress Measurement  
during Launch of the  
M.V. Bromley Pearl  
H991**

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**Consultancy Services Report No. CR13**

**April 1990**

**SEA FISH INDUSTRY AUTHORITY**

**Seafish Technology**

**STRESS MEASUREMENT DURING LAUNCH OF THE**

**M.V. BROMLEY PEARL - H.991**

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Technical Director**

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**K. Hairsine  
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**STRESS MEASUREMENT DURING LAUNCH ON THE**

**M.V. BROMLEY PEARL - H.991**

1. **INTRODUCTION**

On the 14th March 1990, the Sea Fish Industry Authority were invited by Richard Dunston (Hessle) Limited to submit a quotation for the measurement of stresses induced at the launch of the above vessel.

The stresses were to be measured by means of resistive strain gauges at nine locations, (six on the main deck and three on the tank top) and records of strain levels maintained for subsequent analysis.

On the 19th March 1990, confirmation of the acceptance of the Seafish quotation was received from Richard Dunston (Hessle) Limited, to carry out stress measurements as previously identified. Launching time was set at 2015 hours on the 28th March, 1990

## 2. INSTRUMENTATION

### 2.1 Strain Measurement

The strain levels were measured by a system of strain gauges mounted in full bridge configuration at each location on the main deck and the tank top.

The strain gauges employed were 120 ohm encapsulated foil resistance strain gauges pre-bonded and pre-wired to 0.13mm metal carriers, two gauges in a half bridge "T" rosette format on each carrier. A capacitive discharge welding system was used to weld the carriers to the deck, two at each location to form a full bridge configuration.

The gauges were arranged to measure longitudinal compressive and tensile strains at four locations on the main deck and at three locations on the tank top; the two remaining installations were installed on the main deck starboard side forward and aft and displaced by 45<sup>o</sup> from the longitudinal axis to indicate the presence of any transverse strains.

Calibration factors for the strain gauge installation are provided by the manufacturers of the gauges, but were confirmed by preparation of a laboratory test piece.

### 2.2 Recording Instruments

Each strain gauge installation was connected via a screened six core cable to both a Micro-Movements M200-H ultra violet chart recorder and a Solatron data acquisition system.

Signal conditioning amplifiers within the ultra violet recorder provided the ten volts excitation and conditioned the output

strain levels of each strain gauge installation, utilising four cores of the six core cables.

The remaining two cores were used to inject a predetermined calibration signal equivalent to 153.8 micro strain at each location, on demand.

The chart recorder was set at a paper speed of 5mm/sec with timing marks at one second intervals.

The Solatron data acquisition system was programmed to sample each location at one second intervals and store the data on magnetic tape for later analysis.

### 2.3 Vessel Position

To be able to relate the vessel's position, as it travelled down the slipway, to the data from the strain gauge installation, a video camera was set up near the aft end of the ship on the adjacent quay.

Markings were affixed to the port side of the vessel's hull commencing from a welded butt located in the vicinity of frames 20/22 and on a welded seam at mid height of the side shell. The markings were spaced every 5m along the length of the vessel. The video camera used had cross-wire marking and a time display. This time display was synchronised with the strain gauge recording instrumentation.

The equipment was installed on the 26th-28th March and the vessel was successfully launched on the evening of the 28th March at 2000 hours.

3. DATA AVAILABLE PRIOR TO TRIALS

Plans of the General Arrangement, Profile and Decks and Structural Sections were provided by the shipbuilders.

4. RESULTS

A copy of the recorder output plot is shown in Fig. 2. This shows strains at the different locations on the vessel hull on a basis of strain against time. The same information is replotted on Fig. 3 as a function of strain against distance travelled by the vessel during the launch. The initial (i.e. pre-launch) situation has been taken as the zero strain situation. Stress change levels calculated from the strain recordings are shown in Fig. 4. Stresses are shown as related to the pre-launch stress values. Stress change levels as calculated for each of the different gauge positions are shown on Figs. 5.1. to 5.9. Strain and stress values are included in Tables 1 and 2. Note that the initial values of stress reflect gauge output values rather than absolute stress values.

A feature of the launch was the moderate level of stress change recorded. Maximum stress change recorded was some  $22000\text{KN/m}^2$  (in "Tension") at gauge position 3 and this represents a stress load of about 7.5% of the Yield Strength of the material. Gauge 3 was located on the upper deck at Frame 75/76 and had been predicted as a location of maximum stress during launching. It will be noted by reference to Fig. 5.3 that maximum stress (in "Tension") occurred after about 6m of vessel travel, but that stress levels then fell away before reversing into a compression



mode (vessel sagging) before reversing again into a tensile mode.

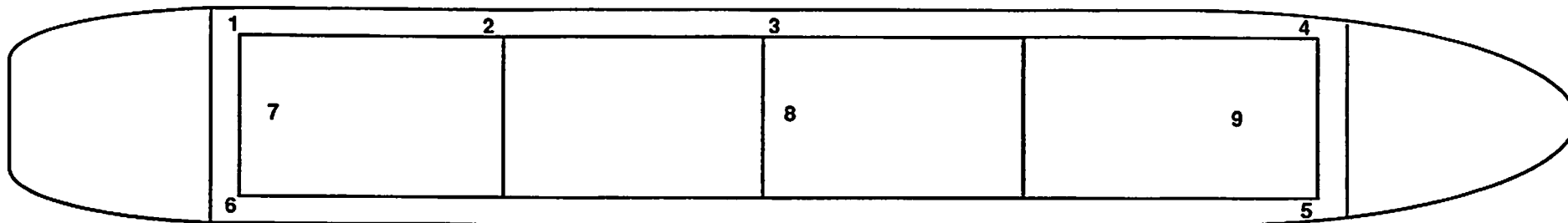
Stress recorded from Gauge 2 (frame 48/49) position showed that the initial stress change was into the compression mode (i.e. of opposite order to the Gauge 3 position some 27 frames further forward), but that after about 20m of travel, the direction of change of stress of the two locations was coincidental. Final stress levels were similar and both displaced to the tension side of the original stress level.

Of the gauges mounted on the tank top positions the maximum stress changes were again noted at the Frame 77 position. Stress levels were of the order of one-third to two-thirds those recorded at Gauge 3, but in an opposite mode.

Of the two readings of strain from gauges set up at  $45^{\circ}$  to the fore and aft positions, it can immediately be noted that strain levels at Gauge 5 position (frame 130/131) were generally less than the counterpart levels taken from Gauge 4, showing that fore and aft stresses were the dominant force in this location. At Gauge 6 position however there is evidence of stress levels higher than the counterpart fore and aft stresses (as shown by Gauge 1), during the first ten metres of vessel travel. This could be due to uneven weight distribution within the ship or relief of welding stresses; however the maximum stress level change is still very low at some 4% of Yield Strength level.

5. CONCLUSIONS

Stress change levels recorded during the launch were moderate. At no time was a stress change level higher than 7.5% of Yield Strength measured by reference to the pre-launch stress level.



1. LONGITUDINAL -FRAMES 25/26 200mm FROM HOLD SIDE.
2. LONGITUDINAL-FRAMES 48/49 200mm FROM HOLD SIDE.
3. LONGITUDINAL-FRAMES 75/76 200mm FROM HOLD SIDE.
4. LONGITUDINAL-FRAMES 130/131 200mm FROM HOLD SIDE.
5. DIAGONAL-FRAMES 130/131 200mm FROM HOLD SIDE.

6. DIAGONAL-FRAMES 25/26 200mm FROM HOLD SIDE.
7. LONGITUDINAL-FRAMES 25/26 945mm STBD OF CENTRELINE.
8. LONGITUDINAL-FRAME 77 945mm STBD OF CENTRELINE.
9. LONGITUDINAL-FRAME 133 945mm STBD OF CENTRELINE.

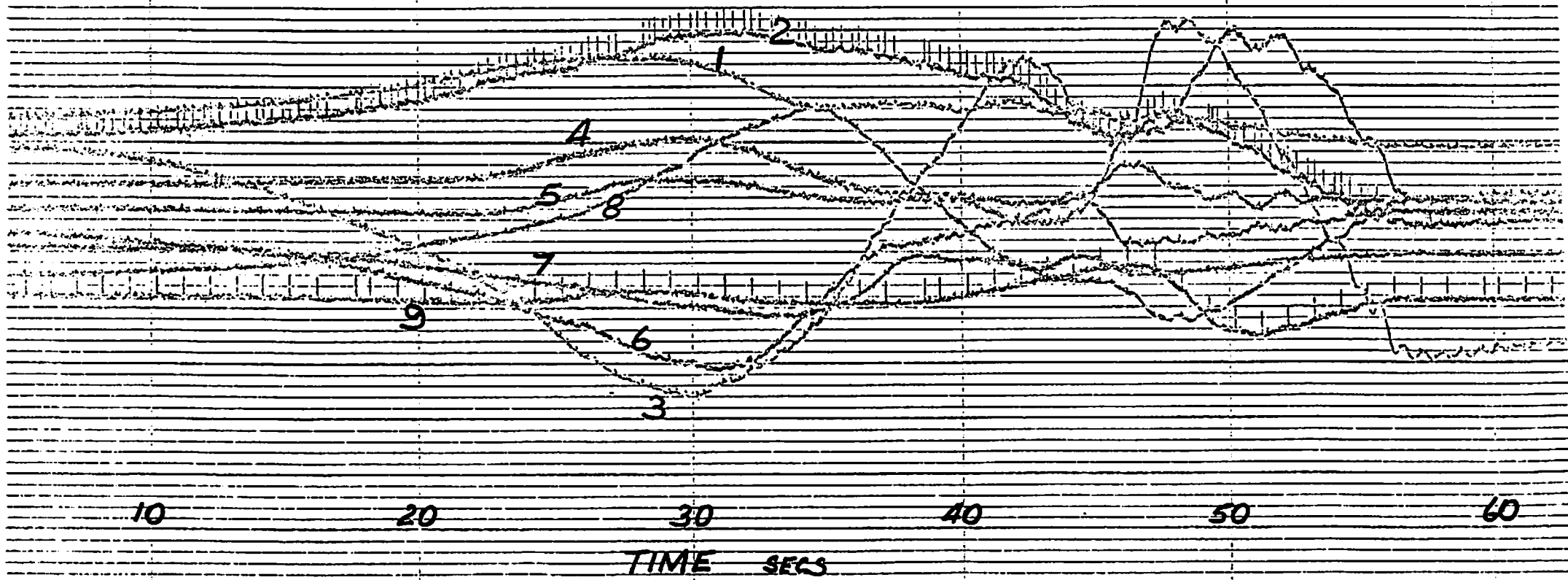
## LOCATION OF STRAIN GAUGES

FIG I

MV BROMLEY PEARL

LAUNCHING STRAIN PLOT

28th March 1990



MOOD OSCILLOGRAPH

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 17 13 13 20 T1  
MICRO MOVEMENTS LTD THE CENTRE EVERSLEY HANTS UK TEL (0734) 7392

FIG.2

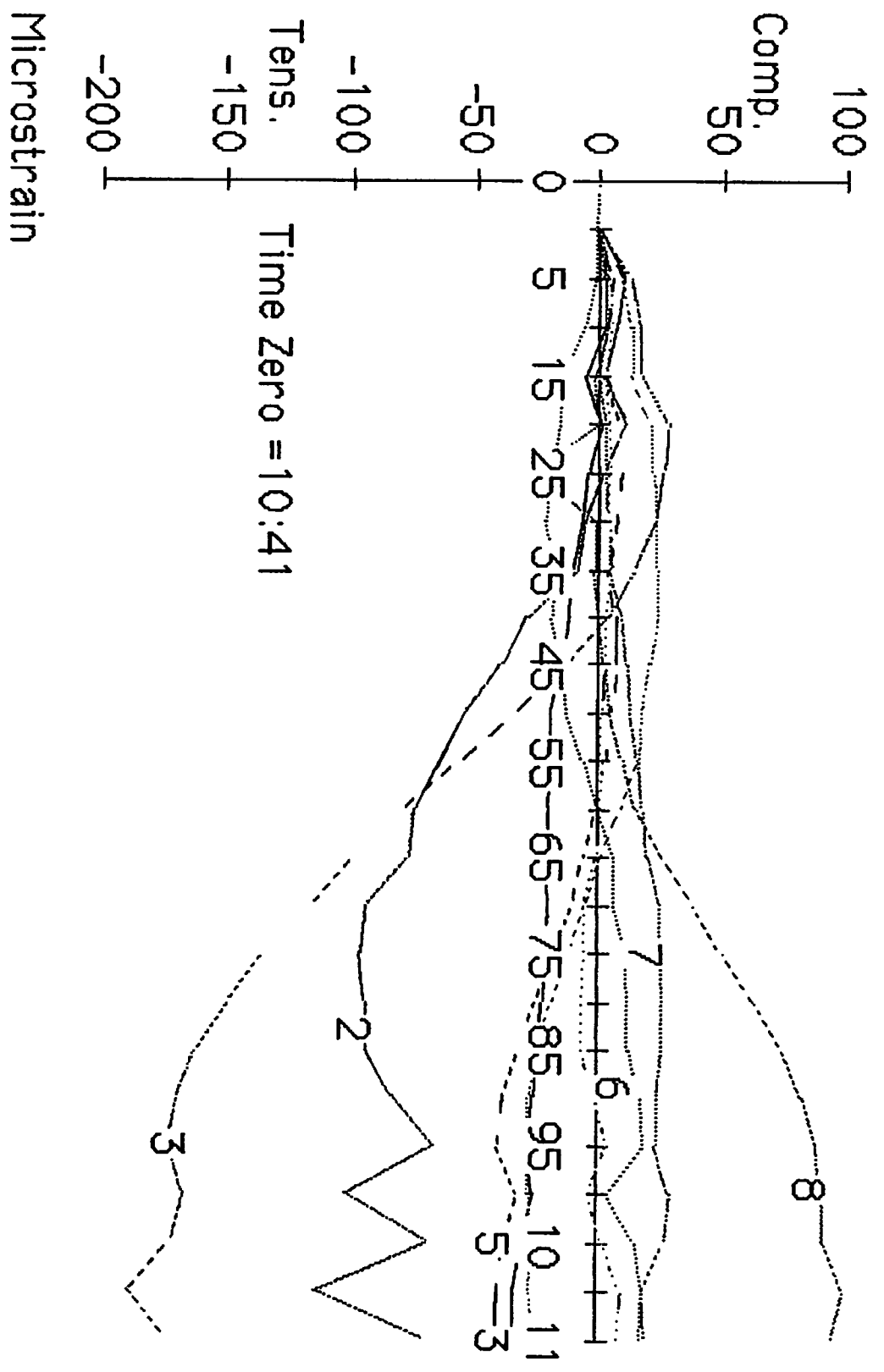


FIG. 7

MY BROMLEY PEARL

LAUNCHING STRAIN PLOT

28th March 1990

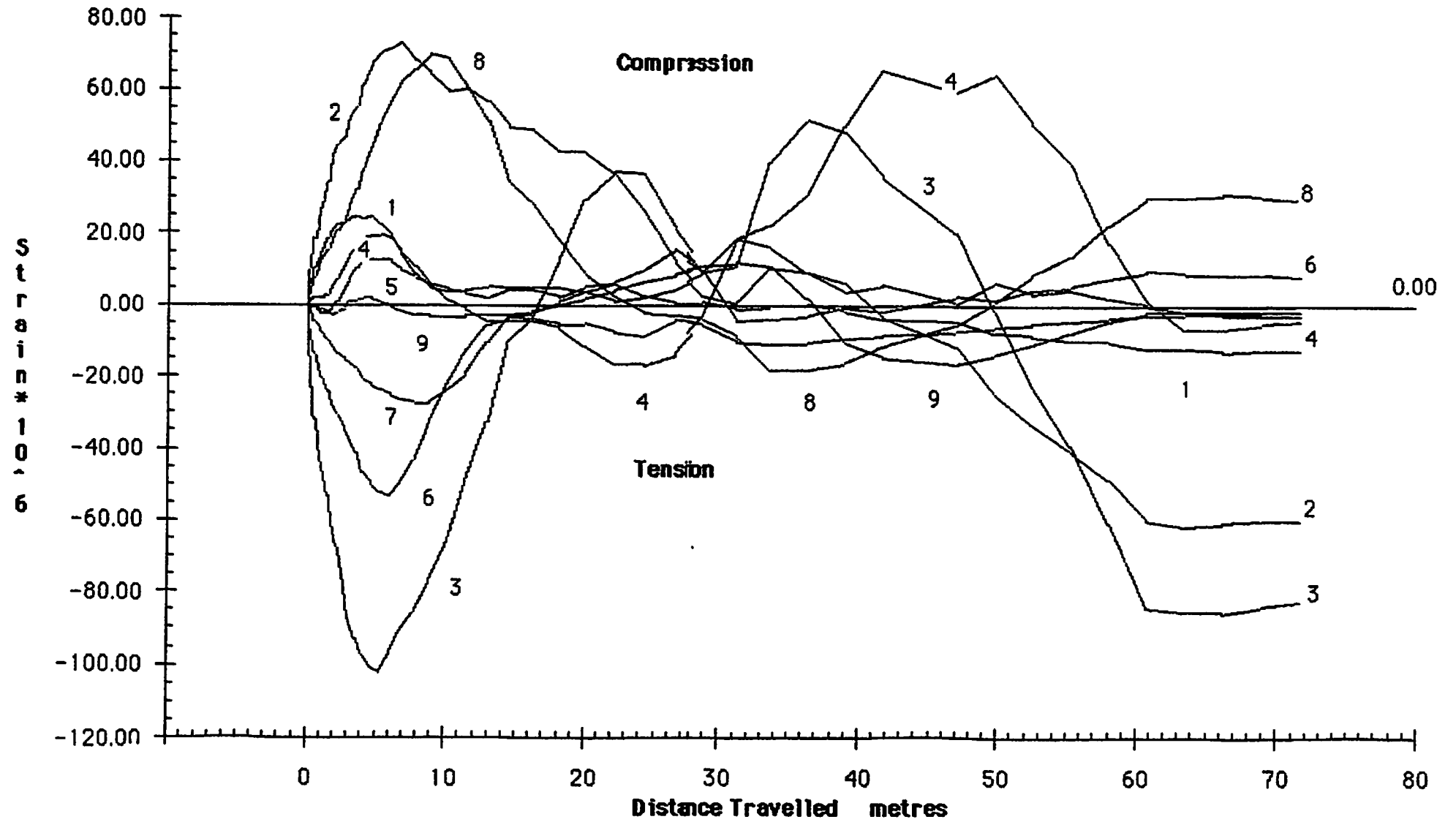
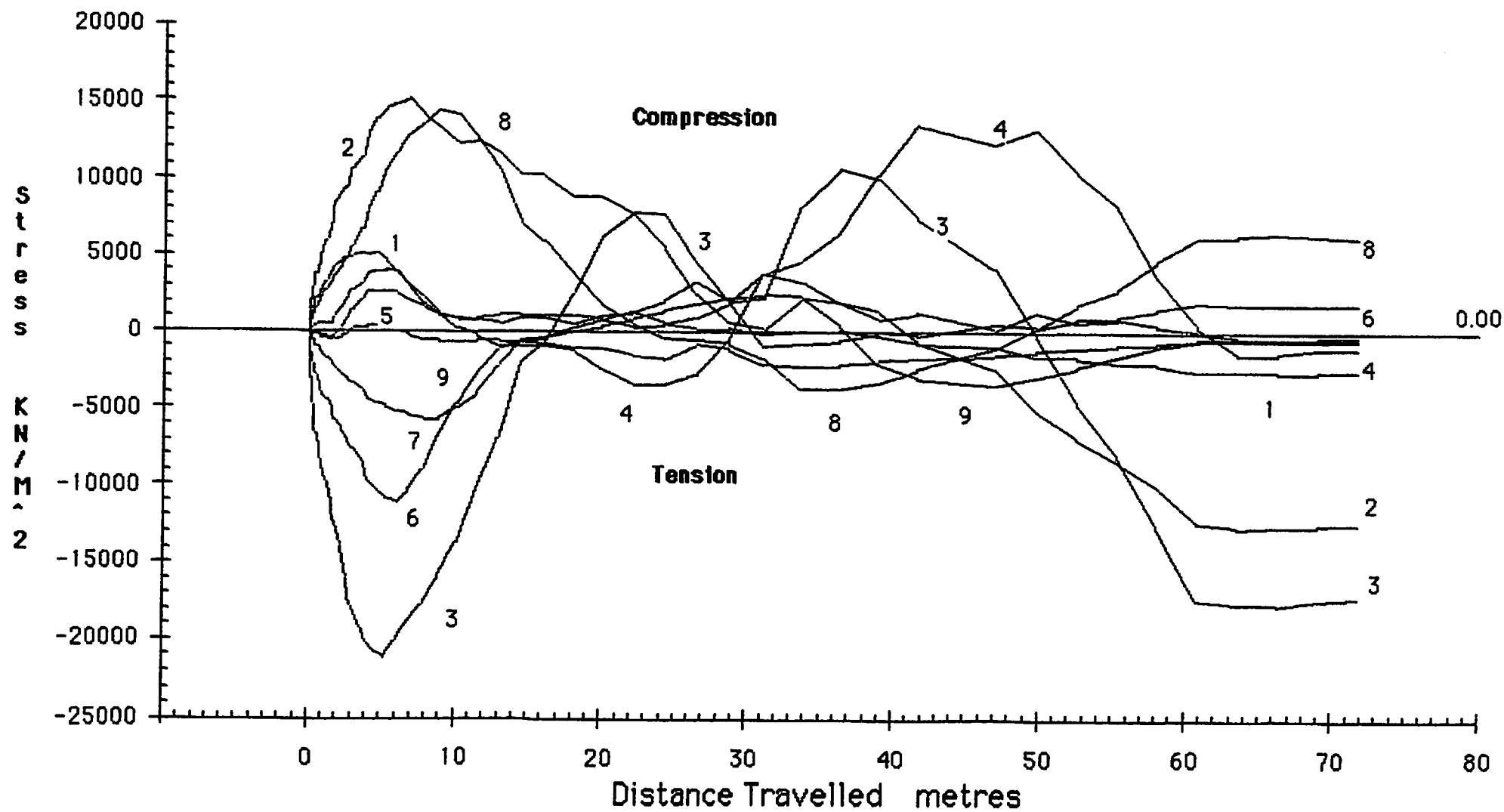


FIG. 3

**MY BROMLEY PEARL**

**LAUNCHING STRESS PLOT**  
**Youngs Mod. 'E' = 207\*10<sup>6</sup> KN/M<sup>2</sup>**

**28th March 1990**



**FIG. 4**

MY BROMLEY PEARL

LAUNCHING STRESS PLOT  
Youngs Mod. 'E' =  $207 \times 10^6$  KN/M<sup>2</sup>

28th March 1990

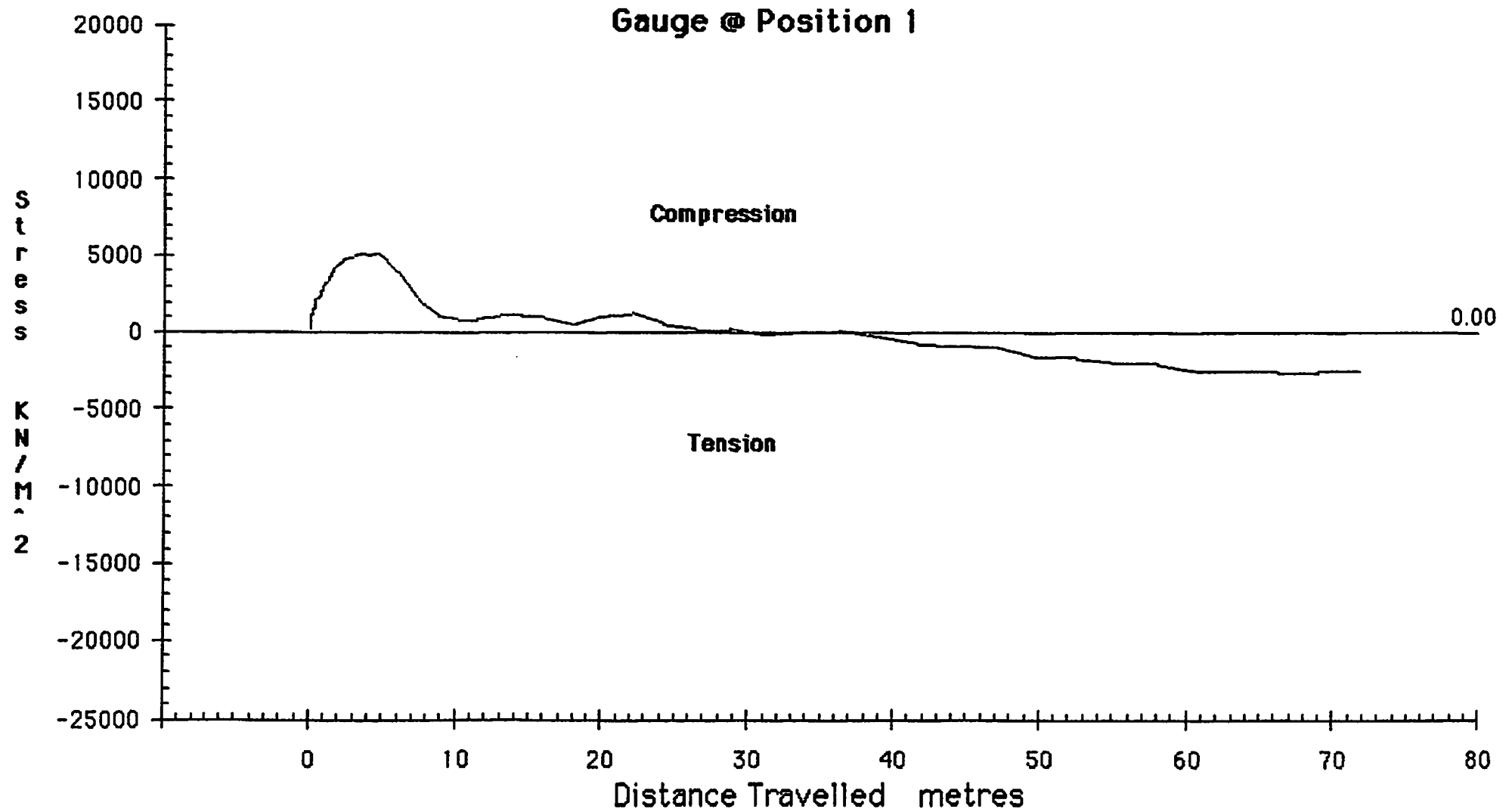


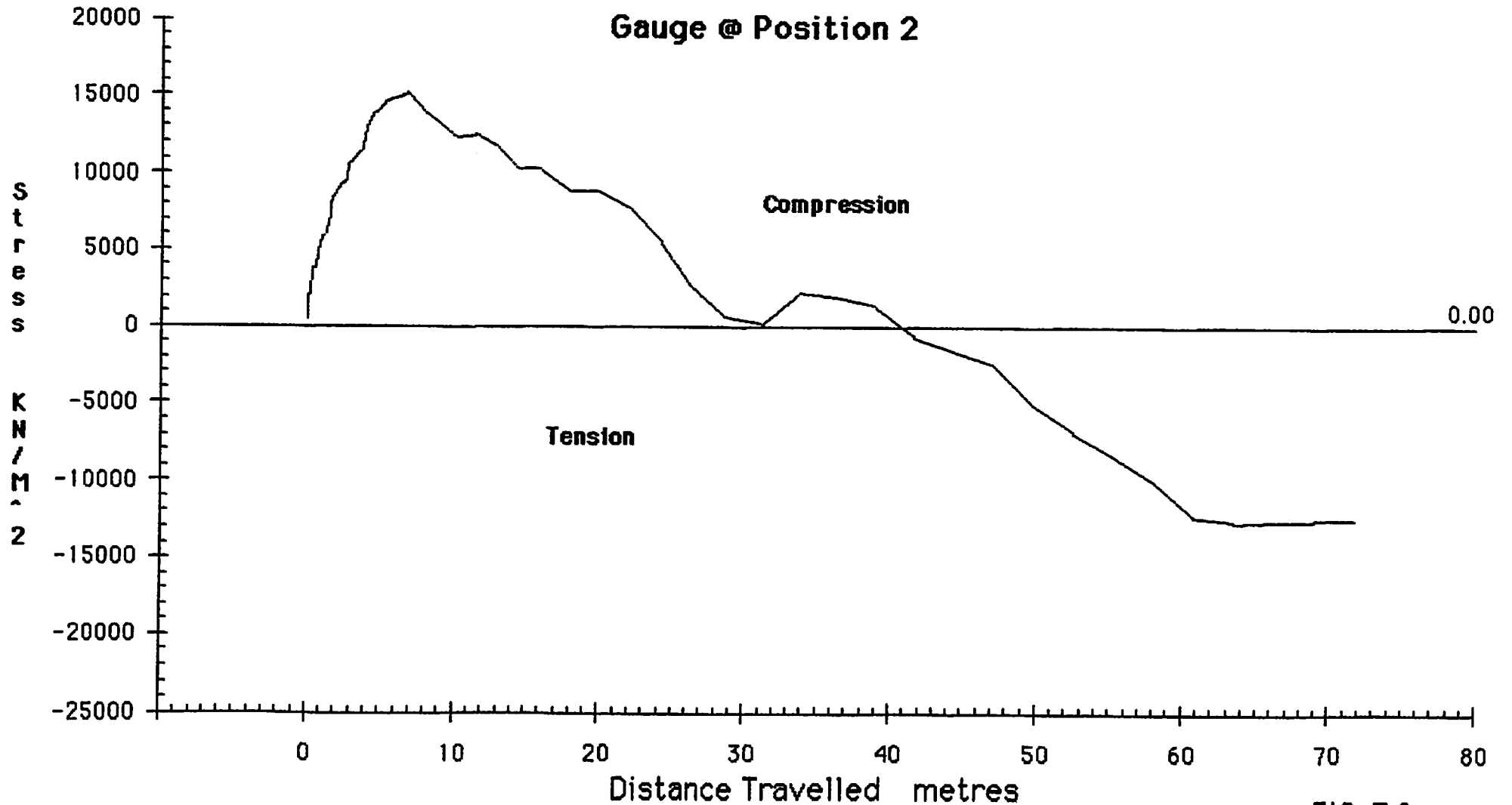
FIG. 5.1



**MV BROMLEY PEARL**

**LAUNCHING STRESS PLOT**  
**Youngs Mod. 'E' = 207 \* 10<sup>6</sup> KN/M<sup>2</sup>**

**28th March 1990**



**FIG. 5.2**

MV BROMLEY PEARL

LAUNCHING STRESS PLOT  
Youngs Mod. 'E' =  $207 \times 10^6 \text{ KN/M}^2$

28th March 1990

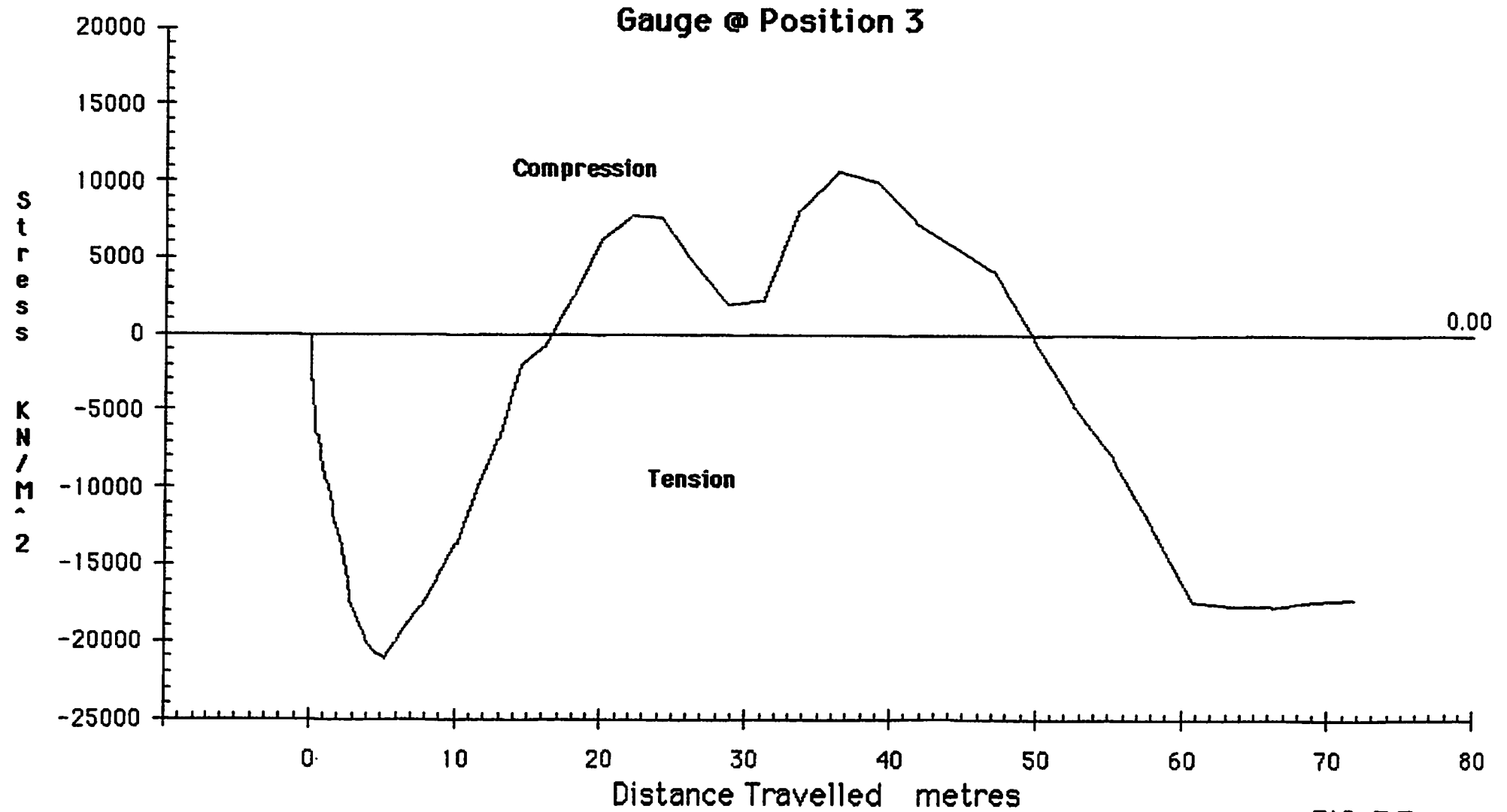


FIG. 5.3

MY BROMLEY PEARL

LAUNCHING STRESS PLOT  
Youngs Mod. 'E' =  $207 \times 10^6$  KN/M<sup>2</sup>

28th March 1990

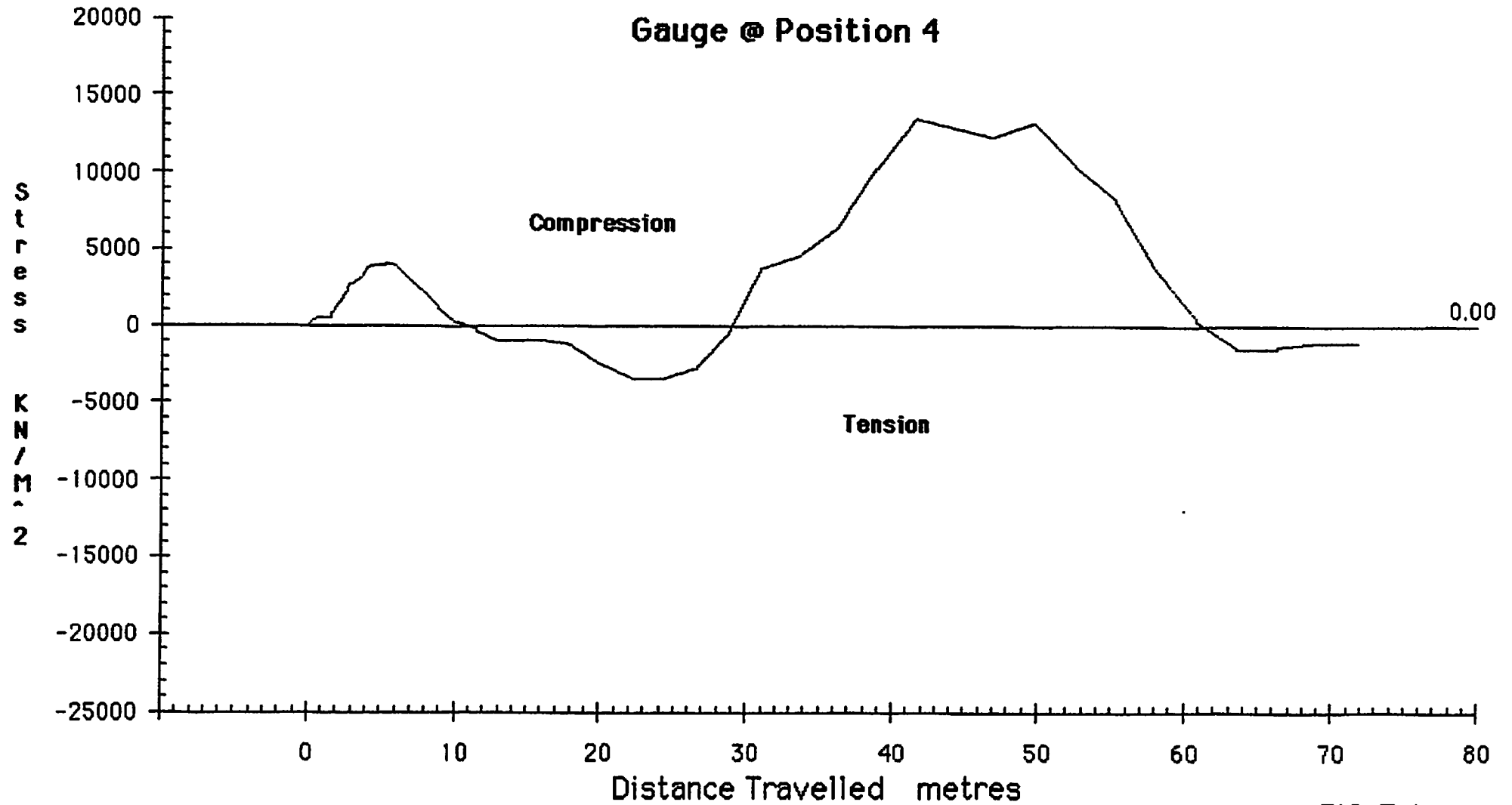


FIG. 5.4

MY BROMLEY PEARL

LAUNCHING STRESS PLOT  
Youngs Mod. 'E' =  $207 \times 10^6 \text{ KN/M}^2$

28th March 1990

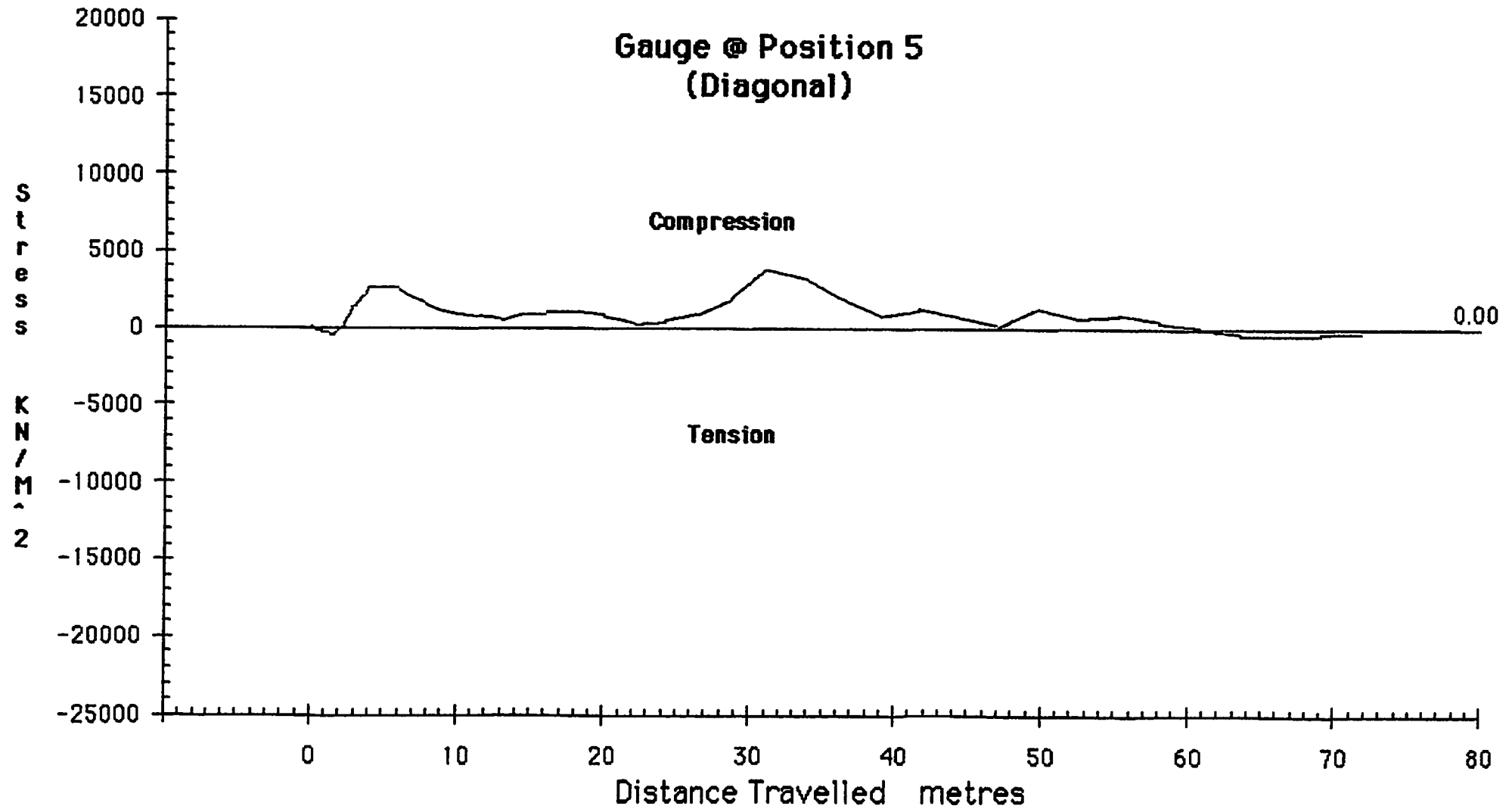


FIG. 5.5

MY BROMLEY PEARL

LAUNCHING STRESS PLOT  
Youngs Mod. 'E' =  $207 \times 10^6$  KN/M<sup>2</sup>

28th March 1990

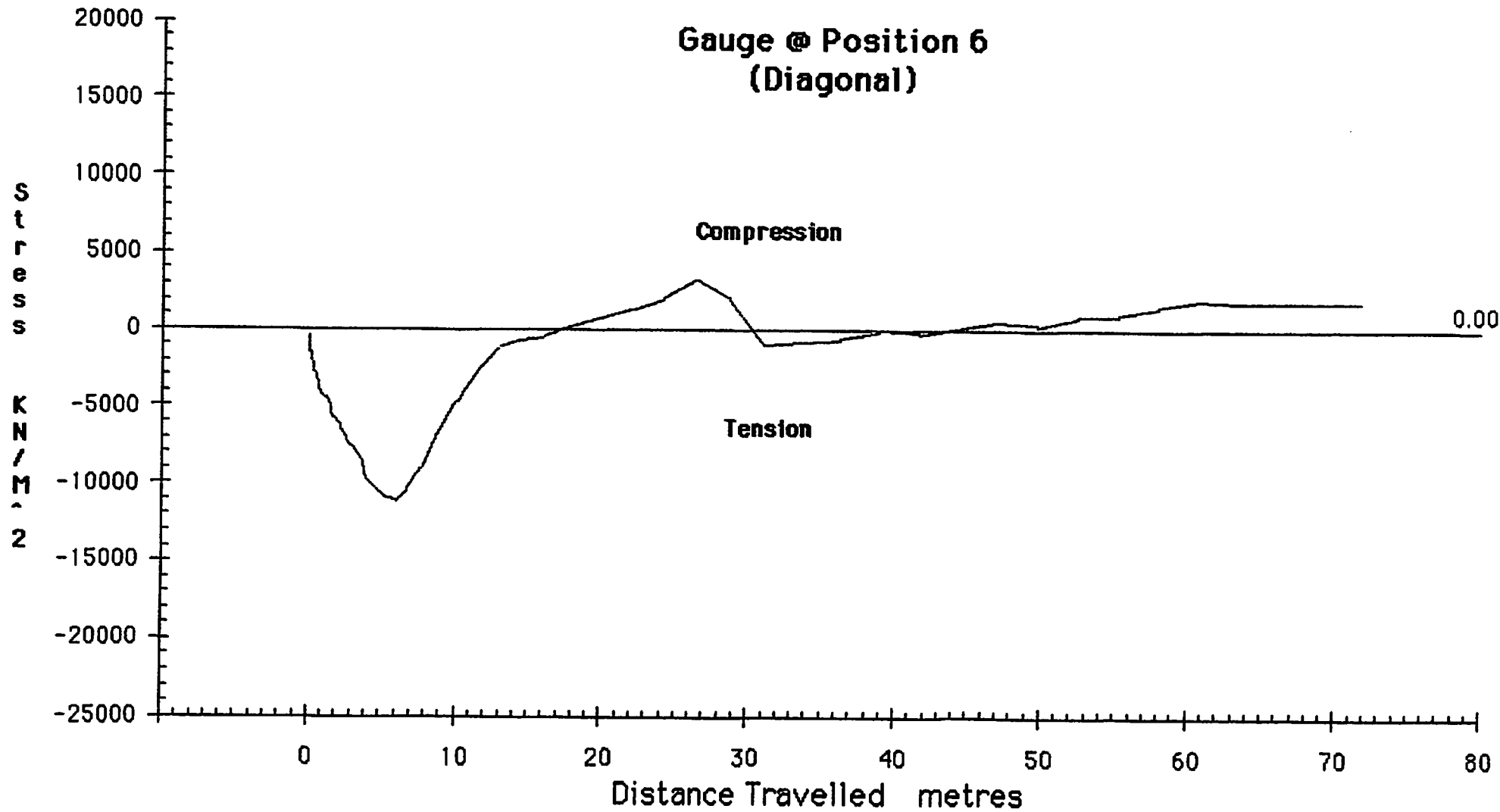


FIG. 5.6

MY BROMLEY PEARL

LAUNCHING STRESS PLOT  
Youngs Mod. 'E' =  $207 \times 10^6 \text{ KN/M}^2$

28th March 1990

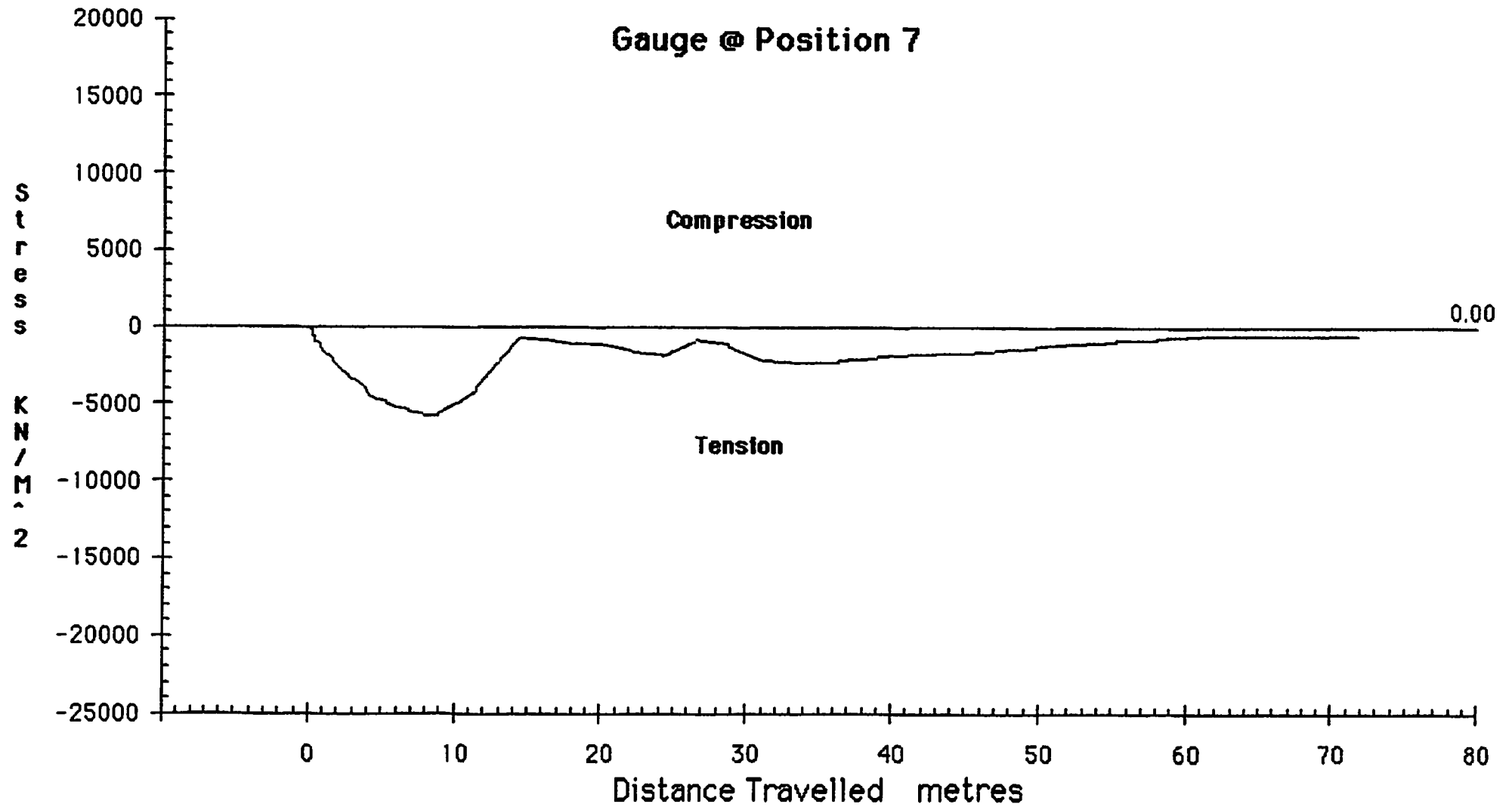


FIG. 5.7

MY BROMLEY PEARL

LAUNCHING STRESS PLOT  
Youngs Mod. 'E' =  $207 \times 10^6$  KN/M<sup>2</sup>

28th March 1990

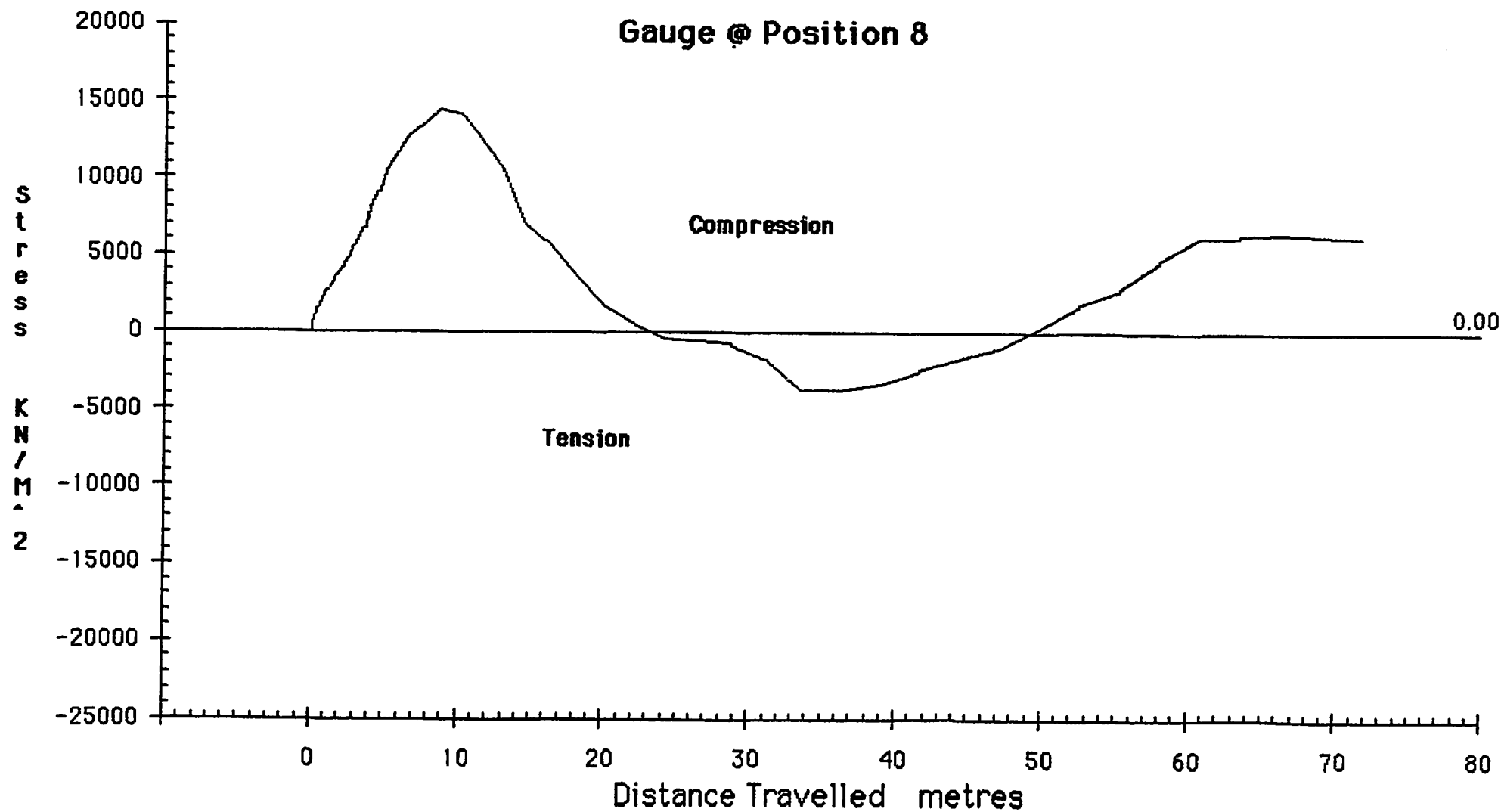


FIG. 5.8

MY BROMLEY PEARL

LAUNCHING STRESS PLOT  
Youngs Mod. 'E' =  $207 \times 10^6 \text{ KN/M}^2$

28th March 1990

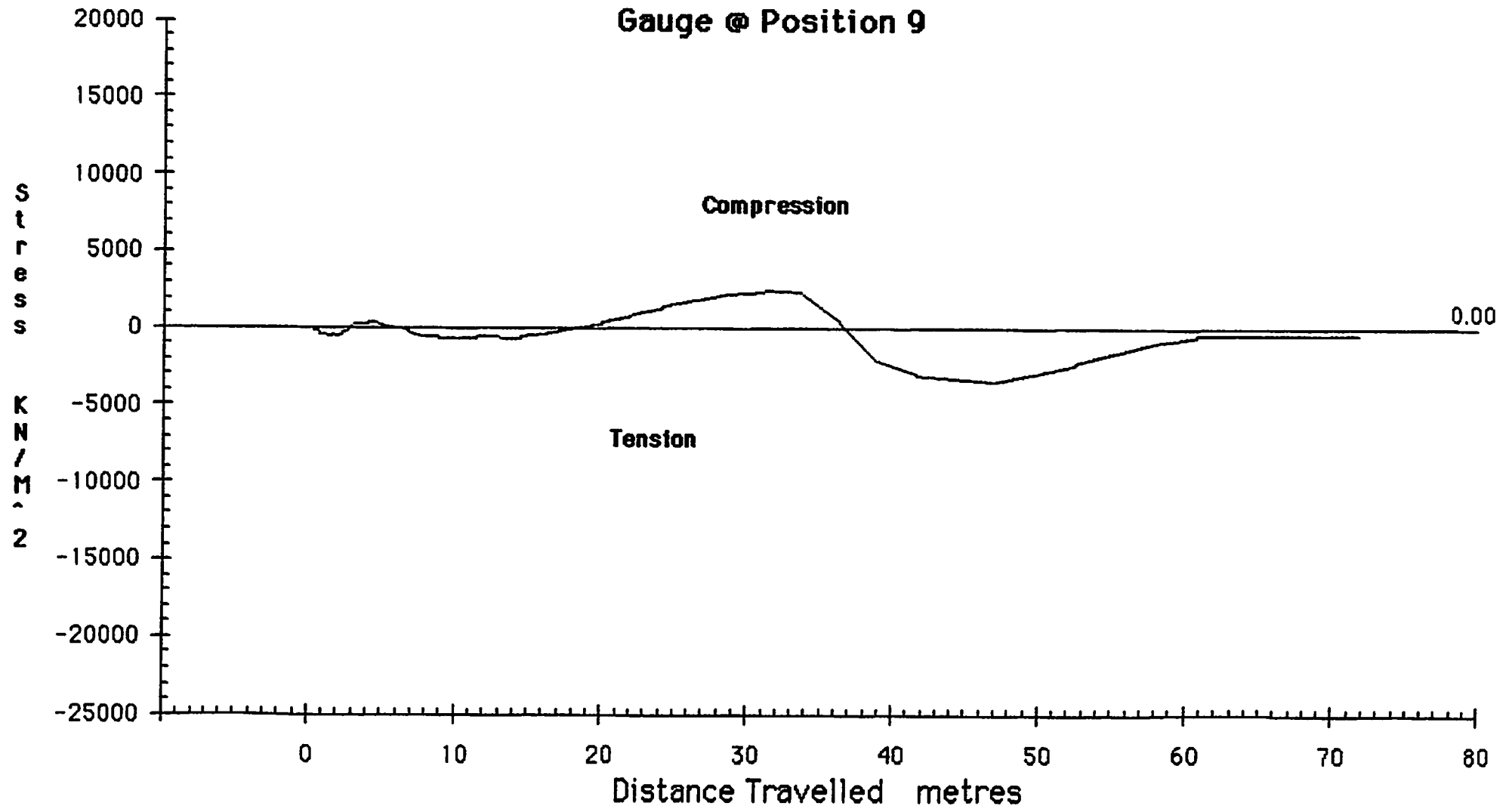


FIG. 5.9



MY BROMLEY PEARL

LAUNCHING TIME & TRAVEL

28th March 1990

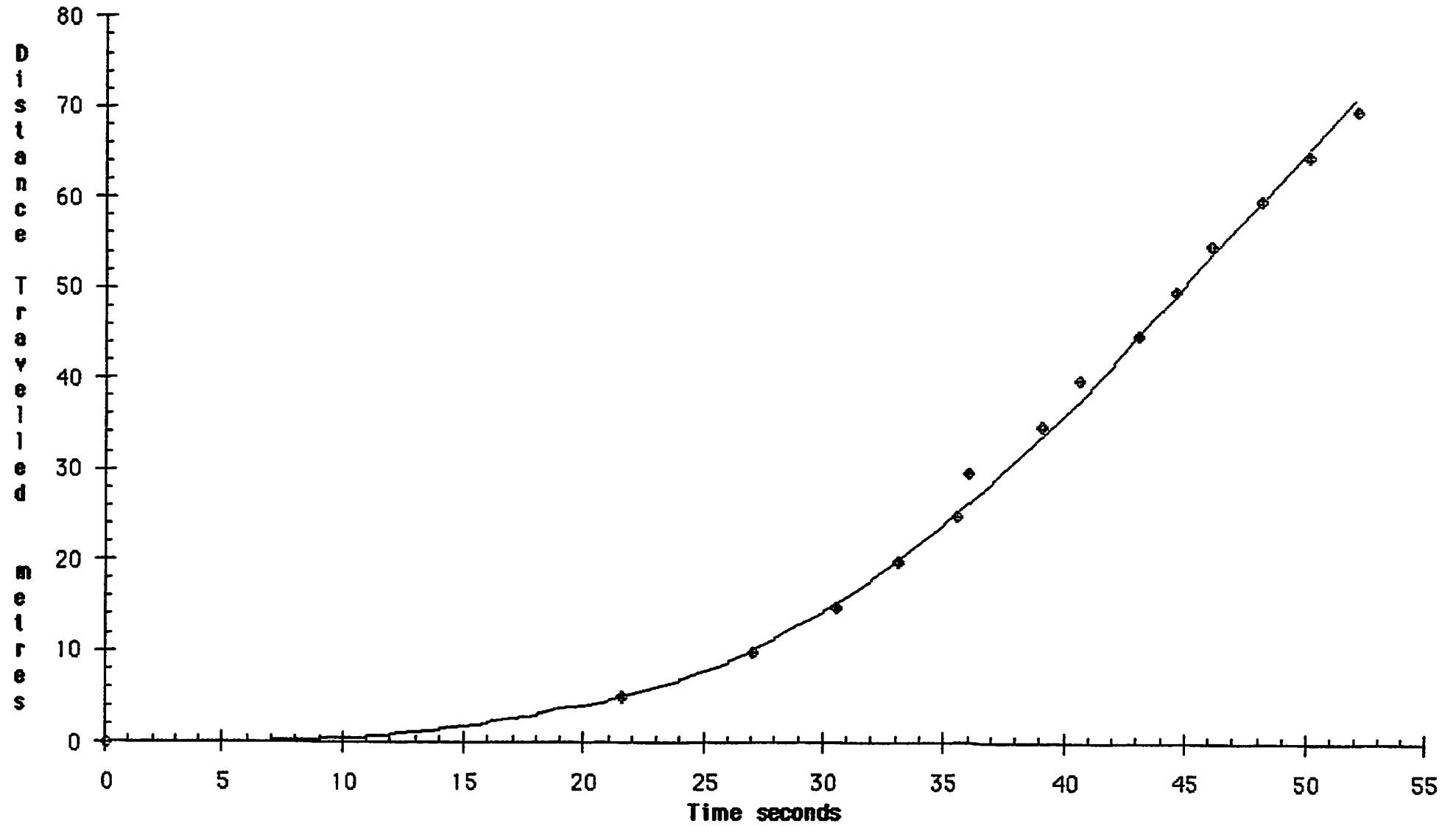


FIG 6

**LAUNCHING STRAIN VALUES**

TIME	DISTANCE Metres	GAUGE @ Pos'n 1	GAUGE @ Pos'n 2	GAUGE @ Pos'n 3	GAUGE @ Pos'n 4	GAUGE @ Pos'n 5	GAUGE @ Pos'n 6	GAUGE @ Pos'n 7	GAUGE @ Pos'n 8	GAUGE @ Pos'n 9
		<b>Strain*10<sup>6</sup></b>								
20:00:57		-0.18	0.92	-0.89	-0.03	-0.32	0.56	-0.36	0.01	0.16
20:00:58	Start of	-0.08	0.79	-0.56	0.00	-0.09	0.56	-0.22	-0.04	0.22
20:00:59	Travel	-0.05	1.38	-0.75	0.06	-0.28	0.49	-0.19	0.04	0.39
20:01:00	0.00	0.36	-1.27	-0.02	0.13	0.18	0.14	0.02	-0.12	-0.16
20:01:01	0.00	0.09	0.04	-0.39	0.18	0.31	-0.62	0.10	-0.05	-0.01
20:01:02	0.00	0.38	-1.35	-0.23	0.10	-0.03	0.17	-0.02	-0.13	0.16
20:01:03	0.00	0.57	-1.29	0.08	0.23	0.64	-0.65	0.29	-0.21	-0.46
20:01:04	0.00	-0.64	0.58	1.38	0.30	0.39	-0.69	0.27	0.07	-0.23
20:01:05	0.00	-0.45	0.21	1.38	-0.96	-0.80	0.03	0.10	0.43	-0.06
20:01:06	0.10	0.18	1.25	1.61	0.17	-0.05	0.17	0.34	-0.69	0.10
20:01:07	0.18	0.41	2.03	1.44	0.30	0.29	-0.65	0.51	-0.68	-0.18
20:01:08	0.26	0.74	2.22	0.44	0.07	0.00	-1.12	0.25	-0.46	-0.16
20:01:09	0.35	1.41	2.42	-0.24	0.29	0.18	-1.88	0.06	0.08	-0.18
20:01:10	0.55	1.90	2.83	-1.92	0.28	0.15	-2.75	-0.13	0.42	-0.21
20:01:11	0.75	2.33	4.96	-4.13	0.31	-0.25	-3.75	-0.26	0.92	-0.06
20:01:12	0.90	2.93	5.09	-5.84	0.42	0.35	-5.17	-0.29	1.34	-0.37
20:01:13	1.20	3.90	6.94	-9.02	0.64	0.22	-5.26	-0.50	1.71	-0.29
20:01:14	1.50	4.67	9.79	-12.17	0.68	-0.38	-6.08	-0.81	2.56	-0.13
20:01:15	1.76	5.80	10.32	-14.88	0.93	-0.41	-7.52	-0.98	3.46	-0.32
20:01:16	2.20	6.57	12.07	-18.64	1.31	-0.20	-9.13	-1.92	4.52	-0.29
20:01:17	2.65	7.61	14.28	-23.01	1.54	-0.48	-10.39	-2.77	5.34	-0.91
20:01:18	3.00	10.04	18.32	-29.99	2.02	-0.89	-12.91	-4.46	7.14	-0.73
20:01:19	3.68	10.93	18.39	-32.28	2.32	-0.91	-14.14	-4.92	8.01	-1.07
20:01:20	4.05	12.18	21.69	-36.71	2.10	-1.38	-17.22	-5.72	9.68	-1.90
20:01:21	4.63	13.68	25.71	-41.80	2.09	-1.39	-19.81	-7.13	12.09	-2.14
20:01:22	5.30	16.13	29.30	-47.30	2.39	-1.95	-21.46	-8.78	13.80	-2.54
20:01:23	6.05	18.83	34.51	-53.49	2.96	-1.85	-24.32	-10.33	15.73	-2.08
20:01:24	6.80	20.74	40.96	-59.95	4.77	-0.78	-27.85	-11.51	17.85	-2.72
20:01:25	7.80	22.63	44.70	-67.57	7.40	0.94	-30.98	-13.90	20.91	-1.74
20:01:26	8.83	23.56	46.49	-77.70	11.12	4.29	-34.58	-15.31	23.50	-0.86
20:01:27	10.12	24.10	51.78	-86.59	13.53	6.99	-36.96	-16.32	27.24	0.86
20:01:28	11.40	24.84	55.49	-93.27	16.02	10.38	-41.34	-18.50	32.42	1.40
20:01:29	13.00	23.87	61.63	-97.45	18.37	12.60	-47.07	-21.14	38.11	1.78
20:01:30	14.50	24.64	66.98	-100.91	19.26	12.48	-49.90	-22.62	43.84	1.36
20:01:31	16.13	22.28	70.10	-102.37	19.49	12.42	-52.48	-23.79	50.94	0.29
20:01:32	18.10	19.01	71.41	-97.06	18.32	12.00	-53.63	-25.16	56.56	-0.44
20:01:33	20.00	14.43	73.19	-91.35	15.00	9.80	-50.24	-26.32	61.95	-1.69
20:01:34	22.10	8.59	67.91	-85.47	10.86	7.75	-43.18	-27.42	65.45	-2.98
20:01:35	24.20	5.03	64.12	-77.24	5.87	5.65	-32.84	-26.87	69.79	-3.38
20:01:36	26.50	3.89	59.43	-65.94	1.27	4.14	-22.32	-23.57	68.25	-3.40
20:01:37	28.80	4.42	60.48	-49.82	-1.14	3.46	-13.31	-19.47	60.93	-3.00
20:01:38	31.25	5.47	56.34	-32.64	-4.81	2.32	-5.44	-10.68	50.80	-3.10
20:01:39	33.75	4.86	49.58	-9.82	-4.53	4.50	-3.31	-3.48	34.33	-2.65
20:01:40	36.35	4.38	48.93	-4.03	-4.76	4.65	-2.41	-4.20	28.51	-1.85
20:01:41	39.00	2.18	42.51	12.39	-6.48	4.80	0.84	-5.61	17.94	0.09
20:01:42	41.70	5.15	42.35	29.62	-11.77	3.62	3.83	-5.19	8.86	2.02
20:01:43	44.85	6.02	36.85	37.29	-16.86	1.15	6.46	-7.72	2.65	4.20

**LAUNCHING STRAIN VALUES**

TIME	DISTANCE	GAUGE @ Pos'n 1	GAUGE @ Pos'n 2	GAUGE @ Pos'n 3	GAUGE @ Pos'n 4	GAUGE @ Pos'n 5	GAUGE @ Pos'n 6	GAUGE @ Pos'n 7	GAUGE @ Pos'n 8	GAUGE @ Pos'n 9
20:01:44	47.78	2.50	26.31	36.57	-16.91	2.30	9.84	-8.90	-2.13	6.57
20:01:45	50.71	0.67	12.08	21.56	-13.71	4.53	15.63	-4.13	-3.03	8.57
20:01:46	53.64	1.03	2.75	9.19	-2.74	9.17	9.53	-5.62	-4.13	10.95
20:01:47	56.57	-0.99	0.50	10.96	18.43	18.57	-4.70	-10.36	-8.66	11.97
20:01:48	59.50	0.08	10.54	40.18	22.58	15.92	-3.79	-11.02	-18.24	10.84
20:01:49	62.43	0.44	9.10	51.64	31.04	9.11	-2.91	-10.47	-18.33	1.90
20:01:50	65.35	-1.59	6.20	48.25	49.92	3.90	-0.42	-9.24	-16.21	-10.64
20:01:51	68.28	-3.90	-3.19	35.69	65.32	5.95	-1.64	-8.17	-11.79	-14.86
20:01:52	<i>71.21</i>	-4.71	-11.63	20.10	59.20	0.56	2.58	-7.14	-5.43	-16.78
20:01:53		-8.05	-24.70	-1.56	63.96	6.29	1.35	-6.04	1.07	-14.04
20:01:54		-8.66	-33.24	-22.59	50.29	3.10	4.49	-5.28	8.66	-11.04
20:01:55		-10.03	-40.76	-39.17	39.71	4.25	5.14	-4.34	13.73	-7.72
20:01:56		-10.42	-48.48	-60.87	17.54	1.78	7.46	-3.72	22.63	-4.39
20:01:57		-12.46	-59.92	-84.00	1.56	0.10	9.53	-2.94	29.99	-1.89
20:01:58	For'd Draft	-12.49	-61.73	-85.54	-6.96	-1.81	8.53	-2.58	30.31	-2.06
20:01:59	Marks	-13.13	-60.75	-85.79	-6.85	-2.03	8.50	-2.78	31.13	-2.41
20:02:00	Pass	-12.50	-60.16	-83.83	-5.28	-1.62	8.74	-2.85	30.25	-1.85
20:02:01	Sight Point	-12.09	-60.24	-82.67	-4.65	-1.07	8.14	-2.71	29.52	-1.94

LAUNCHING STRESS VALUES KN/M<sup>2</sup>

YOUNG'S MODULOUS 'E' = 206.91\*10<sup>6</sup> KN/M<sup>2</sup>

TIME	DISTANCE Metres	GAUGE @ Pos'n 1	GAUGE @ Pos'n 2	GAUGE @ Pos'n 3	GAUGE @ Pos'n 4	GAUGE @ Pos'n 5	GAUGE @ Pos'n 6	GAUGE @ Pos'n 7	GAUGE @ Pos'n 8	GAUGE @ Pos'n 9
20:00:57		-38	189	-184	-7	-66	116	-75	2	33
20:00:58	Start of	-17	163	-116	0	-19	116	-45	-8	46
20:00:59	Travel	-10	286	-156	13	-59	101	-38	8	80
20:01:00	0.00	75	-263	-4	26	36	29	5	-25	-33
20:01:01	0.00	19	8	-81	38	65	-128	21	-11	-3
20:01:02	0.00	78	-279	-47	20	-7	36	-5	-28	33
20:01:03	0.00	119	-266	16	48	133	-134	60	-43	-96
20:01:04	0.00	-133	119	286	61	82	-144	56	15	-48
20:01:05	0.00	-94	42	286	-199	-166	7	21	89	-13
20:01:06	0.10	38	260	334	35	-10	36	71	-143	21
20:01:07	0.18	85	420	297	61	59	-134	106	-140	-36
20:01:08	0.26	152	459	92	15	0	-232	52	-95	-33
20:01:09	0.35	291	501	-50	60	36	-389	11	17	-36
20:01:10	0.55	392	585	-398	58	31	-570	-27	88	-43
20:01:11	0.75	482	1027	-854	65	-52	-776	-54	191	-13
20:01:12	0.90	606	1053	-1208	86	72	-1070	-61	277	-77
20:01:13	1.20	807	1435	-1866	133	46	-1089	-104	354	-60
20:01:14	1.50	967	2025	-2518	142	-79	-1259	-168	529	-26
20:01:15	1.76	1200	2134	-3078	192	-86	-1555	-202	715	-67
20:01:16	2.20	1360	2497	-3856	270	-42	-1890	-396	935	-60
20:01:17	2.65	1574	2954	-4761	318	-99	-2149	-573	1104	-189
20:01:18	3.00	2077	3790	-6206	419	-184	-2671	-923	1478	-152
20:01:19	3.68	2262	3805	-6678	480	-189	-2926	-1018	1658	-221
20:01:20	4.05	2520	4488	-7596	435	-285	-3564	-1183	2002	-394
20:01:21	4.63	2831	5320	-8649	432	-288	-4099	-1475	2502	-443
20:01:22	5.30	3338	6063	-9788	494	-403	-4440	-1817	2856	-526
20:01:23	6.05	3896	7141	-11068	612	-383	-5031	-2137	3255	-431
20:01:24	6.80	4290	8475	-12404	986	-161	-5763	-2381	3693	-563
20:01:25	7.80	4683	9249	-13981	1530	195	-6410	-2877	4326	-360
20:01:26	8.83	4875	9620	-16076	2300	888	-7155	-3169	4861	-179
20:01:27	10.12	4987	10714	-17917	2799	1446	-7647	-3376	5636	179
20:01:28	11.40	5139	11482	-19297	3315	2148	-8554	-3827	6709	290
20:01:29	13.00	4939	12752	-20164	3801	2606	-9739	-4374	7885	368
20:01:30	14.50	5098	13859	-20879	3984	2583	-10324	-4681	9072	282
20:01:31	16.13	4611	14505	-21182	4033	2570	-10859	-4923	10540	60
20:01:32	18.10	3933	14776	-20082	3791	2483	-11098	-5206	11702	-91
20:01:33	20.00	2987	15145	-18900	3103	2028	-10396	-5447	12818	-350
20:01:34	22.10	1776	14051	-17684	2247	1603	-8935	-5673	13543	-617
20:01:35	24.20	1041	13267	-15981	1215	1168	-6795	-5559	14441	-700
20:01:36	26.50	804	12297	-13643	263	856	-4618	-4877	14121	-704
20:01:37	28.80	914	12514	-10308	-236	715	-2753	-4029	12607	-621
20:01:38	31.25	1131	11658	-6753	-995	480	-1126	-2210	10510	-641
20:01:39	33.75	1005	10259	-2032	-937	931	-685	-719	7103	-548
20:01:40	36.35	906	10125	-834	-985	963	-499	-870	5898	-384
20:01:41	39.00	452	8795	2563	-1341	993	174	-1160	3713	18
20:01:42	41.70	1065	8763	6128	-2436	749	792	-1074	1833	417
20:01:43	44.85	1245	7625	7717	-3489	239	1337	-1597	549	869

**LAUNCHING STRESS VALUES KN/M<sup>2</sup>**

**YOUNG'S MODULOUS 'E' = 206.91\*10<sup>6</sup> KN/M<sup>2</sup>**

TIME	DISTANCE	GAUGE @ Pos'n 1	GAUGE @ Pos'n 2	GAUGE @ Pos'n 3	GAUGE @ Pos'n 4	GAUGE @ Pos'n 5	GAUGE @ Pos'n 6	GAUGE @ Pos'n 7	GAUGE @ Pos'n 8	GAUGE @ Pos'n 9
20:01:44	47.78	518	5443	7567	-3499	476	2037	-1841	-440	1360
20:01:45	50.71	138	2499	4461	-2837	938	3233	-854	-626	1773
20:01:46	53.64	214	568	1901	-568	1897	1971	-1164	-855	2266
20:01:47	56.57	-205	103	2268	3814	3842	-972	-2145	-1791	2478
20:01:48	59.50	16	2180	8313	4672	3294	-784	-2279	-3774	2242
20:01:49	62.43	91	1883	10684	6423	1884	-602	-2167	-3793	394
20:01:50	65.35	-329	1284	9984	10330	807	-86	-1912	-3355	-2202
20:01:51	68.28	-807	-660	7384	13515	1232	-339	-1690	-2440	-3075
20:01:52	<i>71.21</i>	-974	-2407	4159	12249	115	534	-1477	-1124	-3472
20:01:53		-1666	-5110	-322	13234	1301	279	-1250	221	-2904
20:01:54		-1792	-6877	-4673	10405	642	928	-1091	1791	-2285
20:01:55		-2075	-8433	-8104	8216	879	1063	-897	2841	-1597
20:01:56		-2156	-10030	-12595	3629	369	1543	-769	4682	-908
20:01:57		-2577	-12398	-17380	323	20	1973	-608	6205	-392
20:01:58	For'd Draft	-2584	-12774	-17699	-1441	-375	1766	-533	6272	-426
20:01:59	Marks	-2716	-12569	-17750	-1418	-420	1759	-576	6440	-499
20:02:00	Pass	-2587	-12449	-17345	-1092	-335	1809	-589	6259	-382
20:02:01	Sight Point	-2502	-12465	-17105	-962	-221	1684	-562	6109	-402

## APPENDIX 1

On the day following the launching trial the opportunity was taken to record the stress levels experienced over a period from the vessel being in a floating mode to when it actually settled into the mud bottom of the Haven.

These results are tabulated in Table 3 and are represented graphically in Figure 7, against a nominal reference of zero in the floating mode.

### Comments

Note that at zero time on this graph i.e. 10.41 hrs the vessel was floating and at 12.15 (94 minutes) the Haven was completely dry.

It will be noted that strain change values on grounding exceeded those during launching at gauge locations on the main deck.

Bromley Pear1 - Strain on Grounding in Haven 29/3/90.

Actual Time	Elapsed Time	MicroStrn. Gauge No	MicroStrn. Gauge No	MicroStrn. Gauge No	MicroStrn. Gauge No	MicroStrn. Gauge No	MicroStrn. Gauge No	MicroStrn. Gauge No	MicroStrn. Gauge No	MicroStrn. Gauge No	MicroStrn. Gauge No	MicroStrn. Gauge No	MicroStrn. Gauge No	MicroStrn. Gauge No
10:41	0	2	3	4	5	6	7	8	9					
10:42	1	0	0	0	0	0	0	0	0					
10:46	5	0	0	0	-2	-1	0	0	0					
10:51	10	10	12	9	4	-1	0	0	0					
10:56	15	7	16	14	5	-6	3	3	4					
11:01	20	2	17	13	1	-15	-1	-2	5					
11:06	25	10	28	21	8	-16	2	0	2					
11:11	30	2	26	21	9	-20	2	0	5					
11:16	35	-6	23	23	7	-23	4	-27	4					
11:21	40	-9	14	23	3	-18	4	-2	4					
11:26	45	-30	3	23	7	-20	9	0	5					
11:31	50	-40	-13	20	7	-15	11	2	3					
11:36	55	-54	-35	17	4	-13	13	4	2					
11:41	60	-64	-56	15	3	-6	16	10	1					
11:46	65	-74	-79	8	-2	0	18	15	0					
11:51	70	-77	-98	0	-7	6	20	25	-1					
11:56	75	-94	-114	-6	-11	6	24	38	-6					
12:01	80	-96	-134	-13	-20	11	25	50	-6					
12:06	85	-94	-148	-19	-26	12	25	63	-7					
12:11	90	-94	-162	-26	-33	13	26	74	-7					
12:16	95	-83	-169	-29	-39	17	24	82	-2					
12:21	100	-67	-173	-29	-42	19	23	88	3					
12:26	105	-102	-167	-28	-33	3	29	91	-4					
12:31	110	-69	-173	-27	-39	15	26	91	2					
12:34	113	-114	-189	-28	-41	18	18	99	10					
		-70	-174	-26	-43	17	19	94	7					

TABLE 3