8. Comparison of Earthquake Motion at Hitotsubashi and at Hongo.

The Seismological Institute (Hongo) is situated on the higher part of the town where the ground is of hard clay. On the other hand, the Hitotsubashi Observatory stands on low and very soft soil, which is seismically one of the most sensitive places in Tokyo. From the comparison of the seismograms obtained at Hitotsubashi with those obtained at Tsukiji,* it was found that the seismic movements at the former place is even greater than that at the latter.

Table XIV gives the comparison of the earthquake motion in the 26 cases observed simultaneously at Hitotsubashi and Hongo. (In each of the three cases, namely, earthquakes Nos. 135,61 and 84, the motion at Hongo consisted simply, of ripples of quick period, while that at Hitotsubashi consisted of vibrations of the usual period. Consequently these three earthquakes have been excluded in deducing the mean values of the quantities T_0, V and A.) The mean results of the comparison is as follows.

	Hitotsubashi.	Hongo.	Ratio, $\frac{\text{Hitotsubashi}}{\text{Hongo}}$.
Duration.	1.19 sec.	0.72 sec.	1.7
Max. 2a.	1.07 mm.	0.56 mm.	1.9
T_0	0.87 sec.	0.63 sec.	1.4
V	3.5 mm/s	1.9 mm/s	1.8
A	24.9 mm/s^2	20.4 mm/s^2	1.2

Thus the duration at Hitotsubashi is 1.7 times longer than that at Hongo. Further the maximum motion and the period at the

* Tsukiji or *Made Ground* is the name of the portion of the city along the sea coast, to the right-hand side of the mouth of the Sumida, which was formerly under the sea.

former place are greater than those at the latter respectively in the ratios of 1.9 and 1.4. Consequently the maximum velocity and maximum acceleration at Hitotsubashi are greater than those at Hongo respectively in the ratios of 1.8 and 1.2. These results are nearly the same as those obtained by the late Professor Sekiya.*

The above comparison relates to non-destructive earthquakes. In destructive earthquakes, the period of principal vibrations will *not* be very quick and consequently will not much differ at Hitotsubashi and Hongo. In these cases, therefore, the V and A at Hitotsubashi will differ from the corresponding quantities at Hongo in a greater ratio than those here indicated.

Remark. Loose soft soil and hard compact ground considerably differ in their elastic qualities, but their specific gravities do not much differ from each other. Consequently the earthquake movements in a loose soft soil will, in general, be slower in period and greater in amplitude than those in a hard compact ground or rocky district.

The dependence of the intensity of earthquake motion on the nature of soil is very striking indeed. Thus, for example, on the occasion of the great Mino-Owari earthquake of Oct. 28th, 1891, the shock was very strong in the city of Hikone (province of Ōmi), where several houses and temples were entirely overthrown ; while on a neighboring hill the shock was much weaker, even *stone lanterns* (Japanese lamp posts for girdens) not being overturned.

The effect of earthquake motion will similarly be felt very severely in a valley district, where loose soil is superposed on a hard formation ; just as sand particles placed on a sounding plate are caused to jump up by the vibration of the latter.

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* Jour. Sc. Coll. Imp. Univ., Tokyo, Vol. II.

TABLE XIV.—COMPARISON OF EARTHQUAKE MOVEMENTS AT HITOTSUBASHI AND HONGO.

(HORIZONTAL COMPONENT.)

Group.	No.	Duration. (s).		Max. 2a (mm).		T_0 (sec).		V. $\left(\frac{mm}{s.}\right)$		A. $\left(\frac{mm}{s^2.}\right)$	
		Hit.	Hongo.	Hit.	Hongo.	Hit.	Hongo.	Hit.	Hongo.	Hit.	Hongo.
I	25	60	70	0.2	0.2	0.8	0.5	0.8	1.3	6.2	15.8
,,	31	85	45	0.2	0.2	0.8	0.4	0.8	1.6	6.2	24.7
,,	58	120	25	0.4	0.12	0.84	0.52	1.5	0.7	11.0	8.7
,,	135	45	15	0.5	0.08	0.92	0.26	1.7	1.0	12.0	23.3
,,	167	80	20	0.25	—	0.65	—	1.2	—	11.6	—
II	21	180	57	—	0.26	—	—	—	—	—	—
,,	28	—	100	2.8	2.4	—	0.8	—	9.4	—	74.0
,,	29	—	40	0.3	0.2	—	0.7	—	0.9	—	8.1
,,	50	30	35	0.25	0.15	0.62	0.5	1.3	0.94	12.9	12.0
,,	61	—	30	0.32	0.32	0.86	0.3	1.2	3.4	9.0	72.0
,,	65	105	110	2.0	1.4	0.77	0.71	8.2	6.2	67.0	55.0
,,	78	240	140	2.2	0.74	0.97	0.78	7.1	3.0	46.1	25.0
,,	123	160	40	1.2	0.54	0.77	—	4.9	—	40.0	—
III	5	100	50	0.2	—	0.8	—	0.8	—	6.2	—
IV	10	50	—	0.21	0.2	0.54	0.45	1.2	1.4	14.2	19.5
,,	62	100	70	0.4	—	0.74	—	1.7	—	15.0	—
,,	84	100	60	0.3	0.16	0.88	0.22	1.1	2.3	8.1	66.0
,,	86	120	70	1.0	0.2	0.70	0.6	4.5	0.52	41.0	2.7
V	4	100	80	—	—	—	—	—	—	—	—
,,	19	180	116	1.7	0.5	0.84	0.5	6.3	3.1	47.6	39.5
,,	23	100	90	0.64	0.6	0.96	1.3	2.1	1.4	13.7	7.0
,,	39	120	65	0.6	0.32	0.79	0.48	2.4	2.1	19.0	28.0
,,	43	—	130	5.0	2.0	—	1.3	—	4.8	—	23.0
,,	122	120	70	0.7	0.6	0.66	—	3.3	—	31.0	—
VI	56	120	100	0.45	0.24	0.78	0.79	1.8	0.95	14.0	7.5
,,	103	180	180	1.1	0.5	0.81	—	4.3	—	34.0	—
Mean.		**119**	**72**	**1.07**	**0.56**	**0.87**	**0.63**	**3.5**	**1.9**	**24.9**	**20.4**