Proceedings of Ninth World Conference on Earthquake Engineering
August 2-9, 1988, Tokyo-Kyoto, JAPAN (Vol.VIII)

**SB-6**

# FATHABAD-GHIR, IRAN EARTHQUAKE STUDY OF THE STRONG MOTION RECORDS

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## SUMMARY

In this paper the storg motion accelerograms recorded during the damaging earthquake of February 2,1985 in Fathabad-Ghir, Iran are introduced and some of the results obtained from the analysis of these records are discussed.

## INTRODUCTION

On February 2,1985 a damaging earthquake with an estimated $M_s$5.3 ($m_b$5.2) occurred in Fars province, Southern Iran and killed 5 persons, injured more than 80 inhabitants and caused some damages to the town of Fathabad where the highest intensity of VII MM was felt (Ref 1). The reported epicenter of 28.4 N, 52.99E(CSEM) is nearby the epicentral area of the devastating earthquake, $M_s$7.1 of April 10,1972 (Ref. 2).The area is in the tightly folded NW-SE trending mountains in the Zagros Range which extends the length of the country on its southwest border near the Persian Gulf.Zagros suture zone is generally accepted as a major plate boundary, where the Arabian Plate has been in collision with Eurasia since the late Miocene (Ref 3,4).Seismically, this zone is ranked as the most active zone in Iran (Ref.4).

At the time of this earthquake,there were six strong motion Accelerographic stations within a radius of 120 Km from the epicenter.They were equipped with SMA-1 instruments. Among these stations only one station at Ghir, located about 8 Km from the epicenter, registered the earthquake and its several aftershocks with magnitues ranging from $m_b$3.4 to $m_b$4.7. The teleseismically reported main shock has been recorded at this station as two distinctly separated events(herewith called event 1 and 2 ) with almost the same epicenteral location and 30 seconds of original time difference.

In this paper the strong motion records of this earthquake are presented,and some of the results obtained from analysis of the records are discussed.

## Analysis Of The Strong Motion Data

The strong motion stations in the region are a part of the Iranian accelerographic network which is presently operated by the Building and Housing Research Center. Digitization of the recorded accelerograms has been performed by means of SMAC Reader SM-03 at a rate of 50 samples/sec. After removing all obvious glitches and sharp discountinuities,Cal-Tech Procedures (Ref.6) have been applied for processing the data and calculating the time histories,fourier and response spectra.

The noises caused by poor quality of digitization seemed to impose serious limitation on the useable frequency band. To eliminate the noise effects, the band width of 0.4-15 HZ has been selected in filtering the records. Pages 4., 5 and 6 show acceleration, velocity and displacement time histories, acceleration response, pseudo-velocity and fourier amplitude spectra of horizontal and vertical components of the events 1 and 2 respectively. Peak values of the events are listed in Table 1.

| Event | Acceleration ($cm/sec^2$) | | | Velocity (cm/sec) | | | Displacement (cm) | | |
|---|---|---|---|---|---|---|---|---|---|
| | S comp | U-D | E comp | S comp | U-D | E comp | S comp | U-D | E comp |
| 1 | 240 | 51 | 49 | 8.8 | 2.5 | 2.4 | 0.6 | 0.3 | 0.3 |
| 2 | 208 | 107 | 218 | 7 | 4.1 | 11.5 | 0.8 | 0.5 | 1.3 |

Table 1 Peak Valued of the Events

Accelerograms and spectra of the events show that the energy release during event 2 is greater than that of event 1. The estimated local magnitudes, $M_L$, following the procedure of Kanamori and Jenning (Ref.7), for the events 1 and 2 are 5.4 and 5.7 respectively. In event 1 the peak values and the energy registered at south component are greater than those at east component. This is reversed in event 2.

There are some differences noticed between the two events. Event 1 seems to be a multiple shock consisting of at least 3 smaller earthquakes of about the same size. Event 2 appears as one larger earthquake associated, perhaps, with larger stress drop but with the same source dimensions as that of event 1. This is because the energy release is distributed more widely during event 1 than that of event 2. Spectral differences between the two events reflect the variations of source properties of the events and also the effect of azimuthal and ray path variations.

To estimate the effective dynamic stress $\sigma = \sigma_0 - \sigma_F$ ($\sigma_0$ is initial stress and $\sigma_F$ is frictional stress) for Brune Model (Ref.8), Mc Garr etal (Ref.9) used

$$\dot{U}_0 = 0.57 \left(\frac{r}{R}\right)\left(\frac{\sigma}{\mu}\right)\beta$$

where $\dot{U}_0$ is the particle velocity else to the fault, $\beta$ is shear velocity, r is the radius of the source or asperity, R is the distance between the source and station, and $\mu$ is the shear modulus. We shall use $\beta$ =3.3 Km/sec $\mu$=3.0x10" dyne/cm2, R=8 Km, r=2 Km (considering durations of small shocks in event 1) Applying average of the peak value velocities for the horizontal components given in table 1, the effective dynamic stress for the two events would be 18 bar and 28 bar.

Acknowledgement

The authors are greatfull to Mr. A. Naderzadeh of Building and Housing Research Center for his sincere assistance, providing the data and processing of the accelerograms.

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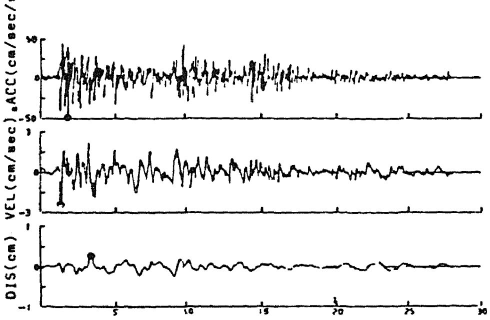
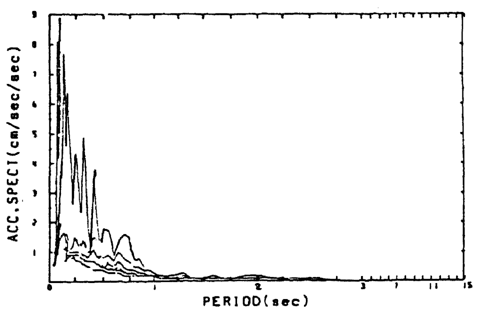
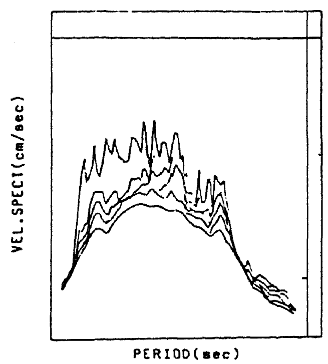
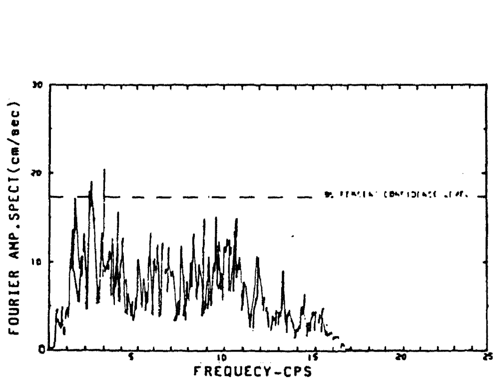
## EVENT 1- COMP.EAST

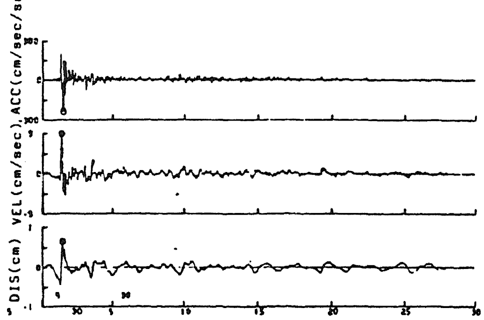


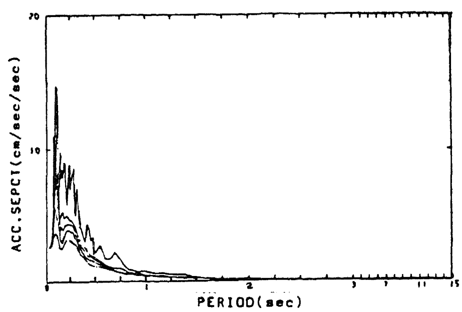



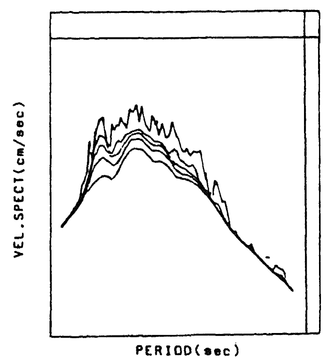



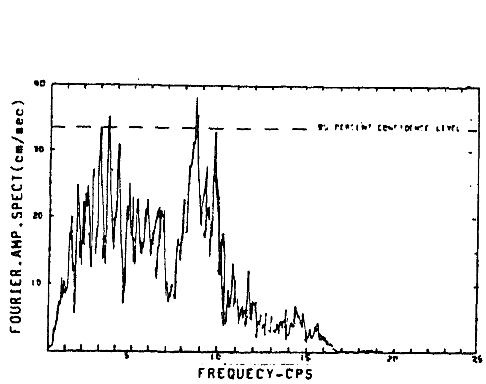




## EVENT 1- COMP.SOUTH

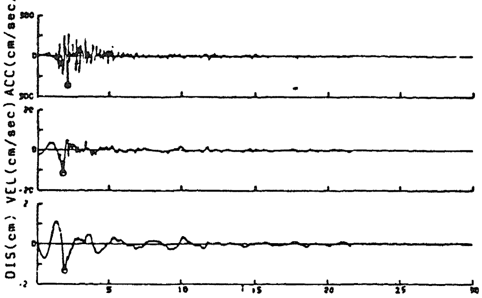


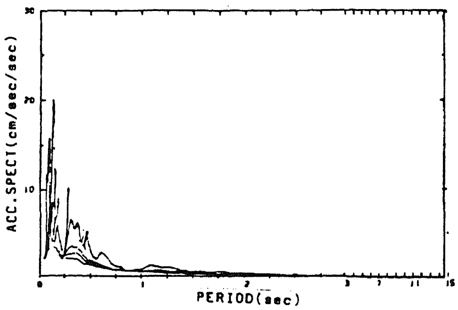



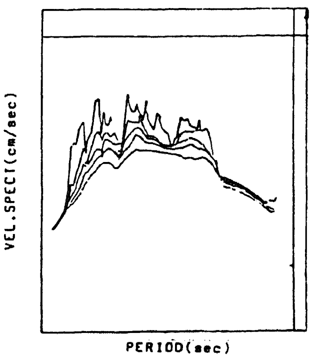



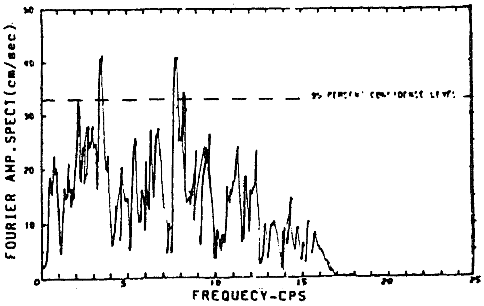



## EVENT 2- COMP EAST

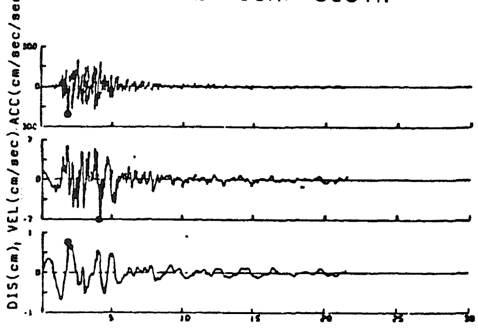


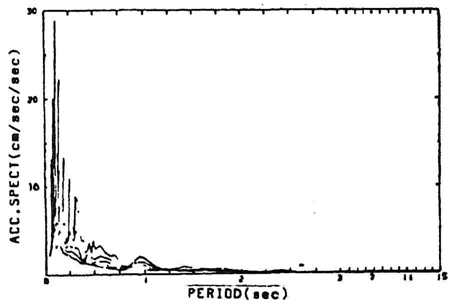



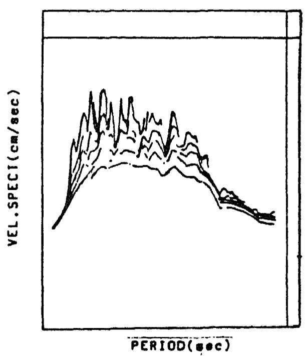



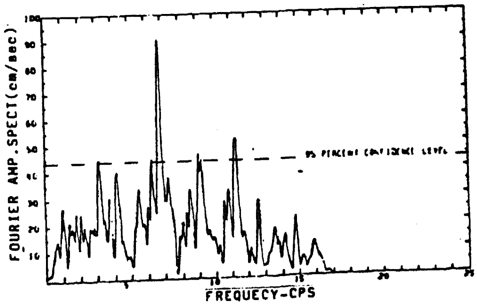




## EVENT 2- COMP SOUTH

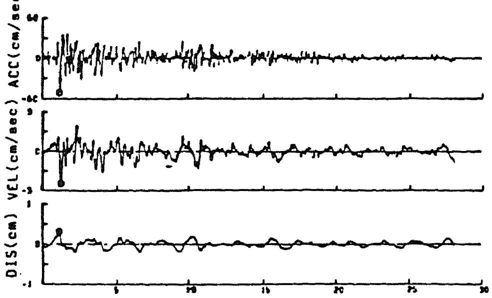


## EVENT 1- VERTICAL COMP.




## EVENT 2- VERTICAL COMP.