Centro de Sismologia
Universidade de São Paulo

HVSR Report: Station MCI8

Location: Montes Claros/MG

H/V Curve

The HVSR method was applied to 2h data of station MCI8 from 2013/02/19-06:00:00 to 2013/02/19-08:00:00. Figure 1 below shows the H/V curve obtained with *Geopsy*. Windows of 40s (with 5% overlap) were employed and 78 windows were selected.

The natural frequency calculated for MCI8 was $f0 = 15.37Hz$.

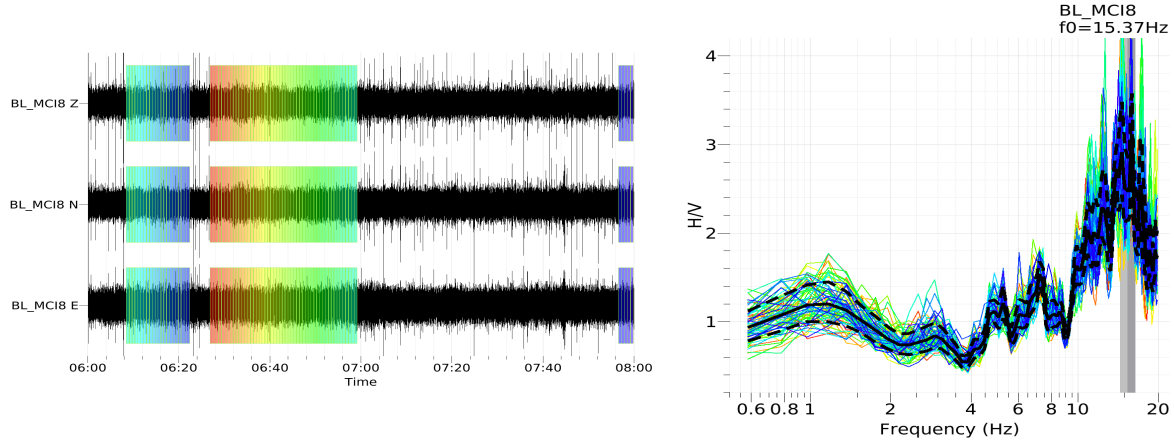

Figure 1 – (**left**) MCI8 waveform from 2013/02/19-06:00:00 to 2013/02/19-08:00:00 (2h data) and windows without spikes selected. (**right**) H/V curve obtained. Solid line: geometric mean, dashed lines: standard deviation. $f0 = 15.37Hz$.

Dispersion Curve (MASW)

In addition to the H/V curve, for the inversion step we also used the Rayleigh wave dispersion curve obtained from the MASW survey (carried out by the company AFC) around station MCI8 (Fig. 2).

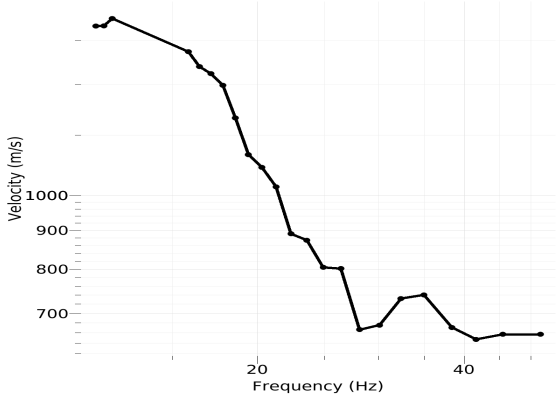

Figure 2 – Dispersion curve from MASW that was inverted in addition to the H/V Curve.

Data Inversion

For the data inversion, we used a model of 5 layers constrained not to have any velocity inversion. The search ranges are listed below in table 1. The model was inverted for layer thicknesses, Vs and Poisson ratio. Vp was constrained by Vs and Poisson. Density was fixed. All the results were obtained by using the *Dinver* tool from *Geopsy*.

Table 1 – Search intervals used in data inversion step.

	$Vp\ (m/s)$	$Vs\ (m/s)$	ν	$\rho\ (kg/m^3)$
soil	200 - 1000	100 - 1000	0.2 - 0.4	1700
layer 2	400 - 5000	100 - 2000		2000
layer 3		100 - 3000		2000
layer 4		100 - 3500		2200
half-space		300 - 3600	0.2 - 0.3	2700

Two joint inversion attempts were made, using data from H/V curve, H/V peak and the dispersion curve from MASW. Table 2 shows the weights of each element used in the inversion step.

Table 2 – Inversion attempts and weights of elements used. A weight of 0 means that it was not used in the inversion.

	Input	**Weight**
Run 1	H/V curve	1
	H/V Peak	1
	Disp Curve (MASW)	10
Run 2	H/V curve	1
	H/V Peak	1
	Disp Curve (MASW)	5

RUN1

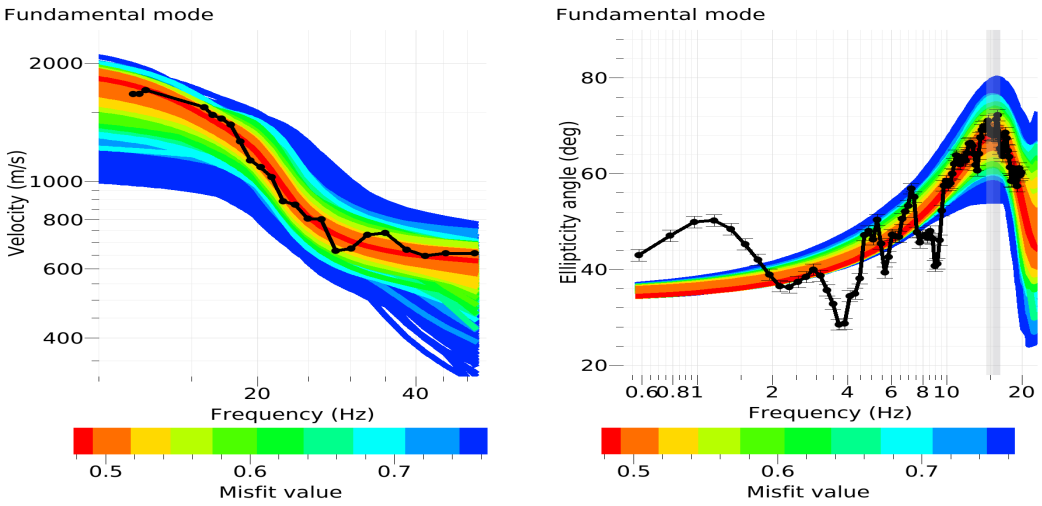

Figure 3 – (**left**) Dispersion curve inversion (MASW). (**right**) Inversion of the H/V curve, gray vertical line indicates the peak of natural frequency ($f0 = 15.37Hz$). Best fit ~ 0.49 (red line).

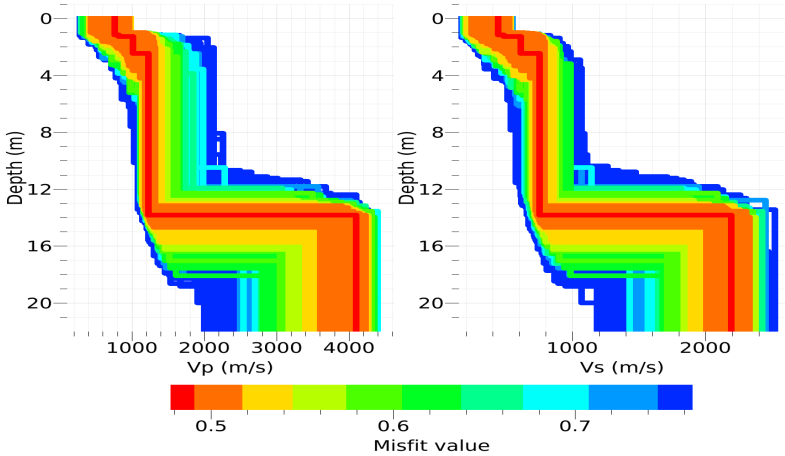

Figure 4 – Vp and Vs velocity profiles under MCI8 obtained by inverting the items shown in Table 2. Best fit ~ 0.49 (red line).

Table 3 – Properties of the best fit profile shown above in Fig 4 (red line):

Thickness	$Vp\ (m/s)$	$Vs\ (m/s)$	$Vs30\ (m/s)$
1.2	766	440	
0.1	819	482	
1.2	1019	612	**1100**
11.3	1231	754	
0	4105	2195	

RUN2

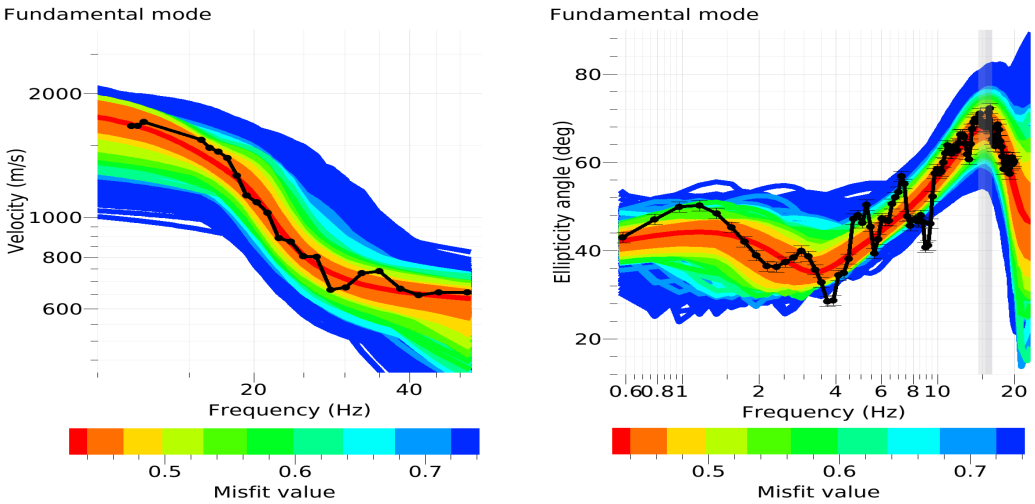

Figure 5 – (**left**) Dispersion curve inversion (MASW). (**right**) Inversion of the H/V curve, gray vertical line indicates the peak of natural frequency ($f0 = 15.37Hz$). Best fit ~ 0.44.

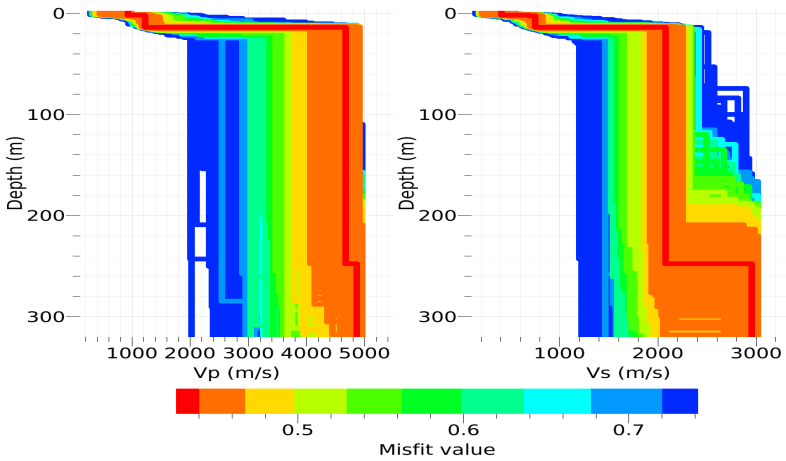

Figure 6 – Vp and Vs velocity profiles under MCI8 obtained by inverting the items shown in Table 2. Best fit ~ 0.44 (red line).

Table 4 – Properties of the best fit profile shown above in Fig 6 (red line):

Thickness	$Vp\ (m/s)$	$Vs\ (m/s)$	$Vs30\ (m/s)$
1.8	935	407	
0.8	1219	682	
11.2	1231	754	**1060**
234.1	4671	2080	
0	4861	2958	