

Kinabalu AM.RA82A RShake 4D Seismic Vault Construction Log

No.	Event/Matter	Details
1	Equipment	RShake 4D (RS4D) Rpi 2B RShake all weather enclosure (IP67)
2	Man power	Mainly 1 person. Had help for day of pouring cement
3	Duration	Mid May - Sept (on -going) Done during weekends/public holiday/leave.
4	Date RShake 4D Online in vault	2018/09/02 (Sunday)
5	Status	Station online. Condensation issue - of no concern anymore. Tidy up work to do.
6	Location	Almost on the foot of a small hill/slope at the back of the house. Lightly used road 15-20 meters away on the hill. Trees around the vault toward
7	Issues	1) Monitoring CPU temp. Idle temp - 57C. Whilst heavy use can reach 60-61C. 2) Potential water ponding if persistent heavy rain near wooden enclosure.
8	Social Media	Twitter - @KRshake Please visit have a look at earthquake waveforms detected by my station.

Background

The project to construct the seismic vault started in mid May 2018 after some researching into seismic vault construction. It is heavily based on USGS Methods of Installing United States National Seismographic Network (USNSN) Stations -- A Construction Manual. Please see link: <https://pubs.usgs.gov/of/2002/ofr-02-0144/>

In mid May, the digging of earthwork begun. This continued to happen until end of June where the hole is being widen and deepen, roots being removed as much as possible et cetera. This would involve about 1 - 1.5 hours during a weekend. Electrical and ethernet wiring begun as well to the site of the hole. The location is at the back of the house which is a small hill/slope, a location I picked as far from trees as much as possible without 'crossing the boundary'.

As someone who does DIYs a bit, this is by far the longest and arduous project embarked. I have installed weather station, lightning detectors, various antennas & receivers around the house, but this is a different ball game!

Pictures starts from below.

Here are pictures along the progress. These are progress made slowly (months).



Hole being dug, note root of dead jackfruit tree on the right. Most of it was eventually removed. I found the soil at the bottom somehow getting softer. It is dark in colour, compost like.



Continued work to refine the hole, remove roots and dug access for piping work for cables. Hole dimension 60cm W x 60cm L x 60cm deep (estimate). 60cm is almost 2 feet.

Digging a 60cm deep hole is already hard work, I can't imagine those who had dug a metre deep! (which I initially planned, but decided not to in the end).



Trialing of pail positioning and also pipe for cables.



First design for pipe. Somehow I wasn't happy with this. PVC conduit has cables pulled on the right.



Eventual design of pipe work. I settled this to reduce any vibration from the pipe to the pail/RS4D. The bottom part will be embedded in cement. I have to say, there is no evidence to say this design is better than the simpler pipe connection. It is just something I chose in the end.

***Note:** A forum member has commented that with U bends, there is the possibility of condensation issue in the future. So for prospective builders, this is something to note. However from my observation as the pipe i used is quite thick, there isn't any noticeable condensation in side the pipe. So, decide which best suits your situation.



View of tent erected late July for the construction of the vault. Erected prior to starting cement pouring work. If not it will be too hot during the day, and also provide protection when it rains. You can see the trees nearby the vault's location.



Cables pulled through and into the pail that will hold the RS4D.



18/08/22 - Now, in this picture, it didn't show what actually happened. The base of the hole actually had cement poured in two weeks prior to this pouring. The first pouring wasn't completed due to poor weather, and also it was done by myself and it was hard work. This second pouring I got help from my father. It took the two of us almost 4.5 hours to complete, with breaks for lunch and rest as it was really back breaking work! Leveling of cement work wasn't done at this stage. In hindsight it should have been done to reduce corrective work afterwards. I was too tired from the mixing of cement and sand and was just glad it was done. Yup it is amateur-ish cement work there as you can see from the surface. In total 4 bags of 50kg cement was used. Ratio: 1 part cement : 1 part sand was used as per guide and rshake forum.

If you really want to make things easier, ensure the cement inside the pail is level. Check with spirit indicator. That would save you a lot of time. Furthermore, if you want, you can place the enclosure of the pail (lumber/cement board etc) into the cement before it sets. I didn't as when I get back the cement is already quite set. So do it perhaps after 20 minutes after you poured your cement.



18/08/31 - How the unfinished vault looks like...



Tile ensured centred.



18/09/02 - 2 days after tile placement, the AM.RA82A RS4D is inside the vault. Checking device position and leveling. It is in the all weather enclosure.





Trying to find out how to arrange the cables. An unwanted stainless steel bin was used inside the pail. As it was too high in the pail, I had to bend the pail on both ends so that it is lower than the pail and the pail cover can be closed. That's why the shape looks weird. ~~Operating on a limited budget.~~ Being resourceful - reuse.



After securing the stainless steel bin with blu tac and placing in some insulating material inside the bin, a brick is placed on top of the RS4D to keep it in place.



Started to place PU foam to the pail. Due to limited space, I cannot place the nozzle of the can to the base properly. Then the weather took a turn and turned bad, so I had to proceed with haste.



18/09/07 - Another day, overall look of vault



Placed rubber seal. Foam was from previous attempt so still have voids.



Condensation issue which is obvious - I didn't finish off the PU foam work the other day. Furthermore, the wooden enclosure wasn't airtight yet.



Added more PU foam and also used some bubble wrap. Wooden enclosure also ensure airtight with PU foam.

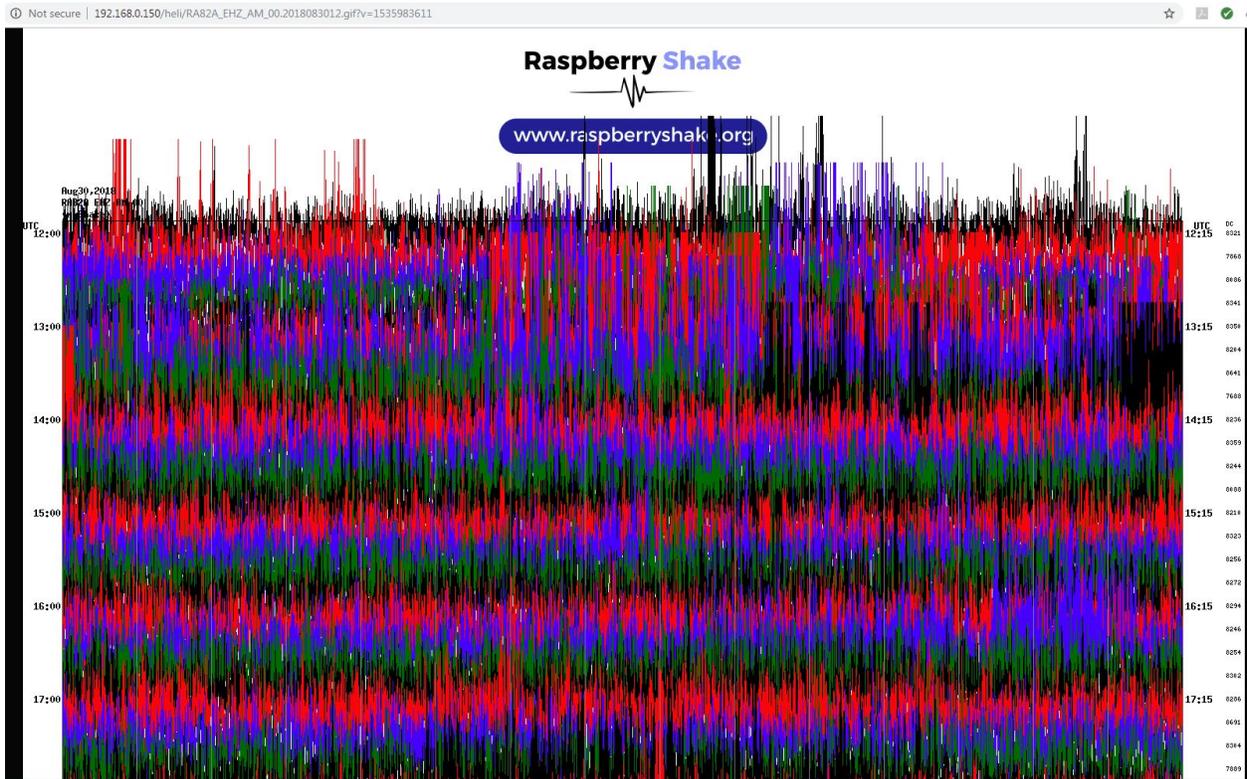


Sort of completed

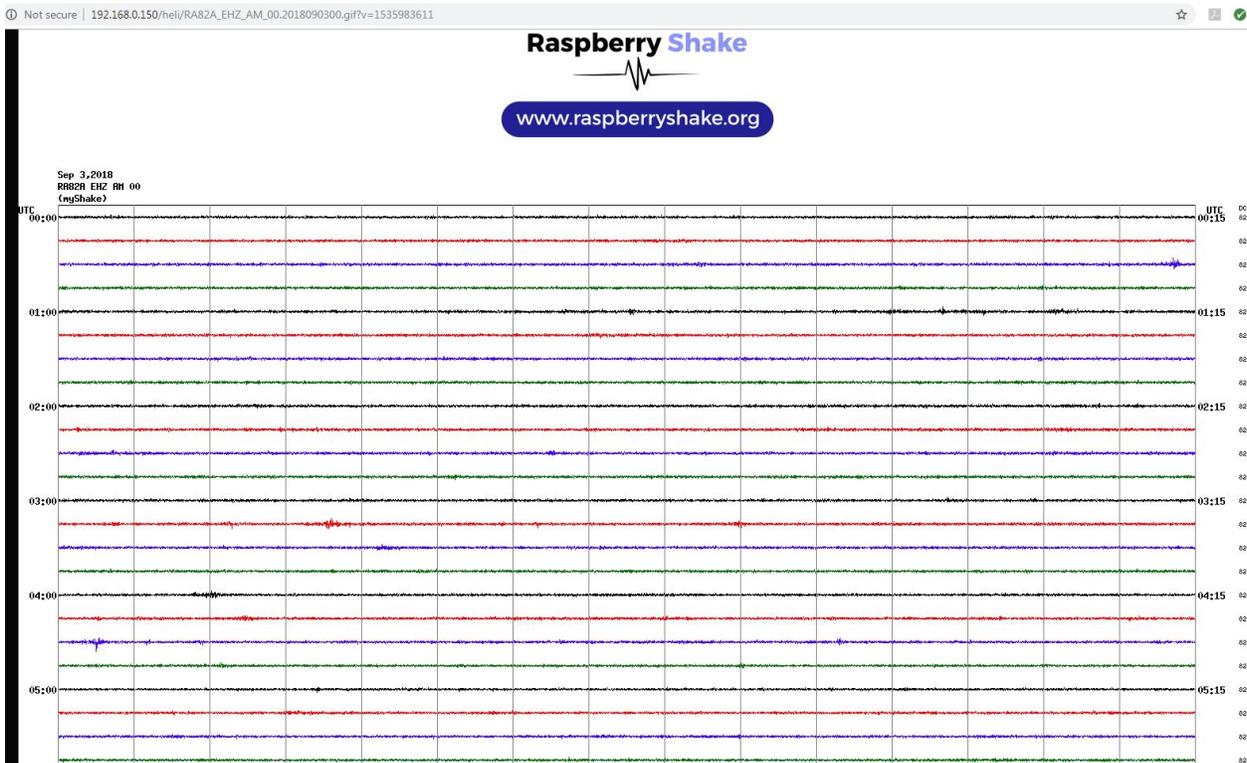


This was an old kitchen tabletop, so I 'recycled' this to be the cover for the vault. Placed a laminated shake logo on the tabletop just for fun.

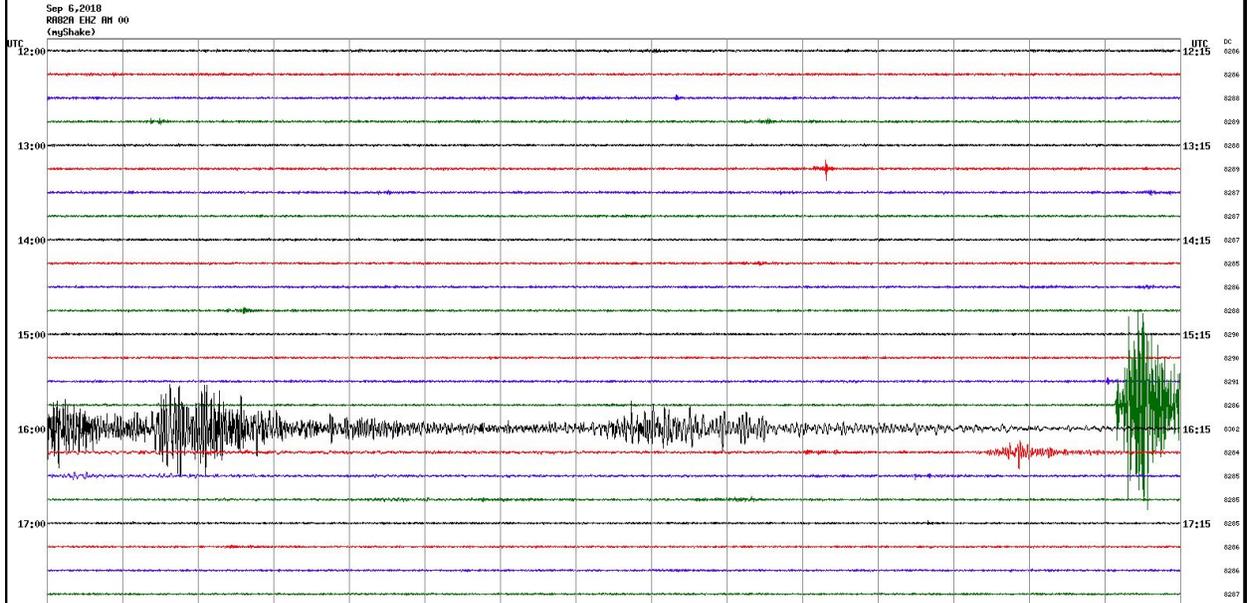
Now let's see how the RS4D helicorder before and after the vault



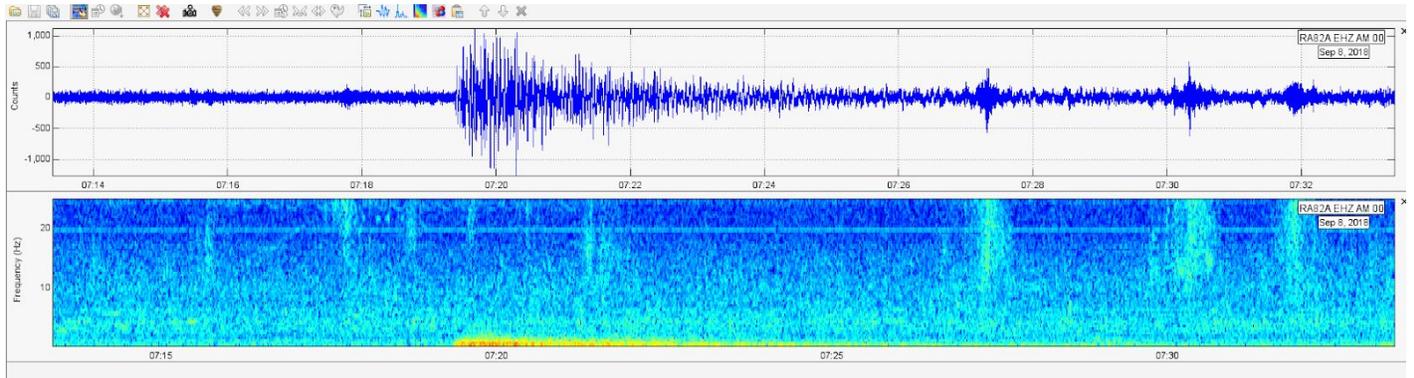
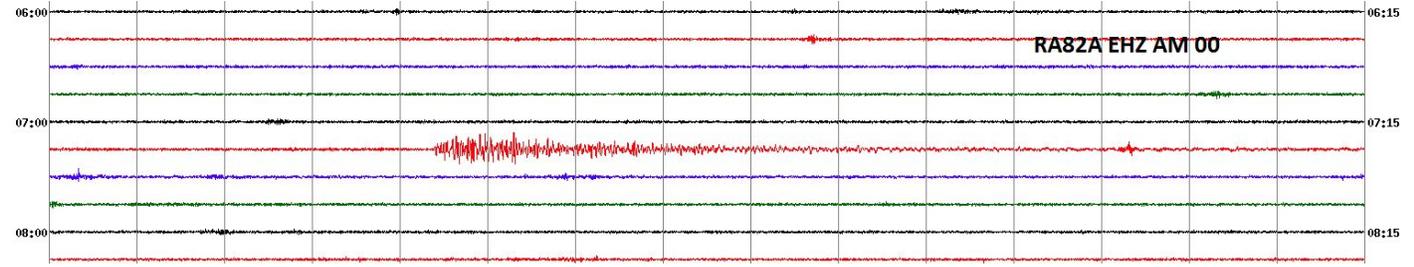
Helicorder above - Before - It was in my room. Noisy. (18/08/30)



Helicorder - After. Swarm shows reading around 200-300 counts or thereabouts.



M7.9 180906 1549UTC Suva, Fiji recorded by RA82A at Kota Kinabalu. Helicorder view.



Regional quake - M6.1 180908 -0716UTC Manay Philippines. Above helicorder; below, swarm used to visualize waveform.

Conclusion - Vault is providing a much quieter environment for the RS4D to detect EQs! As there are trees around so it will show up when it is windy, so not 100% quiet but it is satisfactory for myself. Still some bits and bobs to tidy up but it's functioning ok. Hopefully it lasts.