# WHAT DO WE LEARN IN DISASTERS

——From a Rescuer's Point of View

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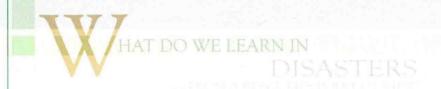
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# SECTION I

# THE NEGLECTED DETAILS IN EARTHQUAKES



# **QUESTION 1:**

# What kind of shake you will feel when earthquake hits?

I remember that when I was in college, my teacher always wrote "P" wave and "S" wave on the blackboard, which mean the two basic waveforms (longitudinal wave and transverse wave). Here, if I still use particle vibration direction and wave propagation to describe the concepts of these two kinds of waves, it is better to go to library or look up relevant information on the internet, since the information we can't remember clearly can be found out there, and we can go for them when we need. Till that day, when I was on the scene, countless aftershocks threatened me and my teammates who rescued survivors in the ruins. No matter what my title was at that time, security official or rescuer, I always became more nervous and vigilant when I felt a tiny shock, though it was only the resonance caused by generator or the thunder from a car passed by. In fact, I was being high-strung all the time on earthquake site.

It was the first time that I began to ponder and estimate the shocks I felt on the scene. This made me recollect the theoretical knowledge that learned from books. Thanks to the chance of the collision of theory and practice, I have so many questions resulted from the gap between them. "Is it really true that longitudinal toss comes before transverse rock?"

Core problem: For me, it is more meaningful to judge whether shall we escape or not depends on different kinds of shock; which kind of shock is more destructive; which kind of shock is more likely to cause ankle broken; which kind of running form is more appropriate for earthquake escape and so on rather than figure out the motion form of the ground during earthquake.

• The 1<sup>st</sup> View Point of Analysis: I would tell my feeling of the practice of P-wave (longitudinal wave). Because there is an objective existent truth in wave shock principle, which is that the propagation speed of longitudinal wave is faster than transverse wave. Usually the feeling of the shock of longitudinal wave comes to us first. But what is

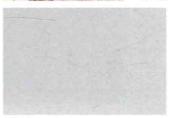






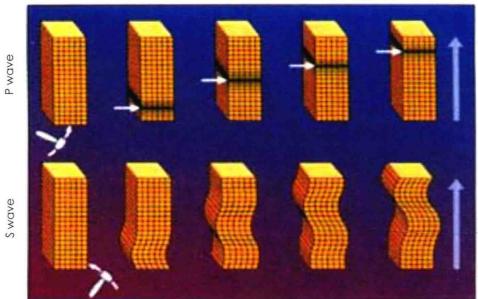




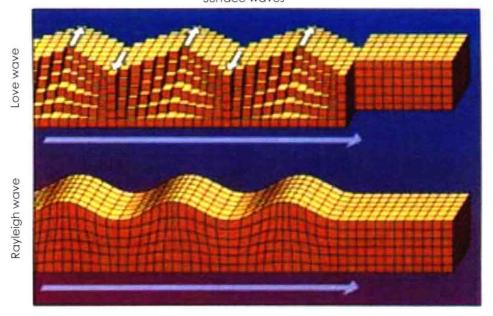




# Body waves



# Surface waves



the longitudinal wave like in the earthquake field?

- Practical Experience: In my opinion, it is really longitudinal shock, or rather longitudinal jolt. But the key point is that the jolt frequency is higher than I ever thought, and sometimes accompanies with earth sounds. For example, it is just like there is a gadder beside you (if you don't know what the gadder is, you can image that your upstairs neighbor is decorating, and the sound is like the noise cased by digging or drilling on tile or cement wall). And the gadder continually knocks the surrounding ground. This kind of shock frequency and sound are similar to the longitudinal wave in the earthquake. Therefore, I sometimes have to distinguish these two familiar effects, so that I can confirm it is shock or forcible entry (a kind of professional technology in international rescue).
- The 2<sup>nd</sup> View Point of Analysis: S-wave (transverse wave) is the main killer in building destruction. In other words, S-wave is what we have to elude! The main reason is that its wave form on the ground is from side to side. Transverse wave, which differs from longitudinal wave, is a kind of transverse shear force. For instance, when you are holding a 5-layer big cake on your hands, the cake will not be collapsed if you shake up and down. But if you wag from side to side, the cake is very easy to be fallen down. Similarly, in the earthquake, the higher the building is, the stronger the shake will be.
- **Practical Experience:** However, you should remember that all the explanations above are all on the theoretical level, because I can seldom feel only the transverse shake on the earthquake scene. Then after the pre-arrival longitudinal wave (shake up and down), it is a kind of quake in complex form, just like standing on a board that





floats in the sea — that's why we always say that it is hard for people to escape when the earthquake hits. Since people can hardly run when they are on the ship that rocks violently on the sea, indeed, it is always even hard to keep one's feet!

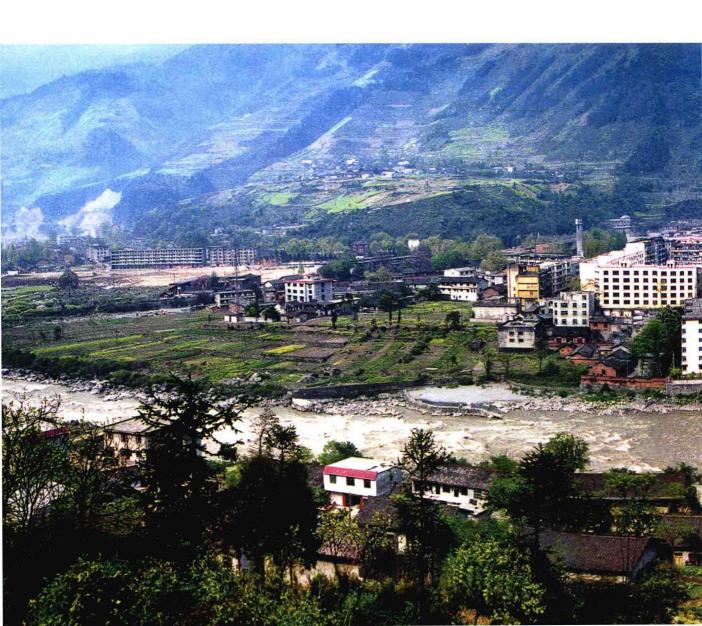
- The 3<sup>rd</sup> View Point of Analysis: There is a question that every time I mentioned when I gave a lesson or talked with students from rescue team. The question is what is the relationship between body wave, longitudinal wave and transverse wave? Then why should we have to figure out these complicated nouns? There are nothing but two purposes to understand these waves' practical significance: the first one is to ease fears when we face earthquake; the second one is to know when is the best opportunity to escape and when is the best occasion to hide ourselves.
- Practical Experience: The reason for fear is that people don't know what the things are. The most direct feeling in earthquake is shock, so we have to overcome this kind of fear. I also feared when I first time felt the shock on the earthquake scene (the gap between theory and practice must be filled by personal experiences), on the fear of this kind of severe shock would collapse the surroundings and hit me, or a crack appeared on the ground then I fell off. However, after being familiar and grasping the practical

experience, we even begin to forecast the magnitude of every aftershock. Back to the question above, both the longitudinal wave and the transverse wave belong to body wave, that is to say they propagate in the earth inner. But if they come to the ground, the shock form will become different. Because of the differences of mediums waves will change to surface waves (if you want to know some more in detail, I suggest you to look up relevant profession data. And I will not go into detail). Surface wave always means the most destructive wave that we can feel it directly. To remember it more easily, I divide the waves into two categories: S-shap wave and spherical wave. S-shap wave is that the wave swing parallel to the ground in "S" shape on the ground; and spherical wave is that the wave swing vertical to the ground

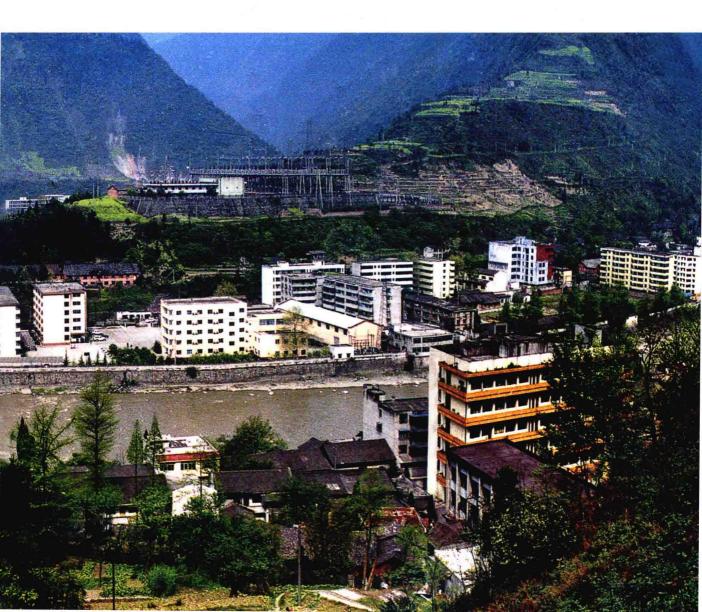




in spherical shape. The feeling of reeling and swaggering just like standing on the water in earthquake is the effect of spherical wave. In other words, we can't escape from this kind of wave. We are apt to break our angle in this occasion. However a case in the Wenchuan earthquake gives me some new ideas. That was a short video recorded by a bank camera. A middle-aged woman suddenly stood up and began to run out of bank when she felt the shock caused by



longitudinal wave. Since the ground was shaking in waveform, she ran on tiptoe, like a TV program "Just Go" (a program that peoples who volunteer to participate in have to overcome obstacles that the program sets up and then reach the finishing point, and all the obstacle facilities are on the water) before the Beijing Olympic Games. One of the sections is that people have to step on the balls, which are floating on the water, one by one to reach the other side of





the pool. Every time, people who only focus on speed while neglect balance all fall into the water. The only effective way to get through is to step on the core of the ball. This method has been verified in the test that it can reduce the tumble risk effectively.

- The 4<sup>th</sup> View Point of Analysis: I saw people the first time feel the shock and judge the magnitude based on their experiences was in a TV series. Since earthquakes accompany with Japanese throughout the year, some people can estimate the magnitude of the earthquake every time it hits on the basis of their feelings, and compare their forecast with the magnitude in the official report. They tell people that they get used to earthquakes based on this. At first, I was skeptical about this, but later after experience several earthquakes, I found out some simple and interesting skills to estimate the magnitude.
- Practical Experience: Firstly, I want to declare that the behavior like in Japan some people don't take any action in the earthquake when their houses shake can't be popularized in domestic recently. That is because they have confidence in their buildings and they trust the quality of their houses. Do you still remember the "3·11" great earthquake in Japan in 2011? The camera recorded the scene in Tokyo: buildings were shaking and sometimes objects fell down from the upper air, but most of the buildings were still firm without collapsed like other "jerry-built projects". Maybe this is where Japan's confidence comes from. Sorry, I digress from my theme. Let's keep on track to talk about the description of different magnitudes in our text books. Here I quote some content that can be easily found on internet or in books (what need to be point out is the form is

completely selected from internet, and this book can't judge whether the data is true or not. The following form is only used to compare with real cases!)

Intensity	Description
1	No feeling — can only be detected by instrument
2	A little feeling — people who are extreme sensitive can feel it when they are in the state of rest
3	Less-feeling — a few people who are indoors can feel it when they are in the state of rest, hangings swing slightly
4	Multi-feeling — most people who are indoors and a few people who are outdoors can feel it, hangings swing, house containers knock against each other and make sounds
5	Wake up — most people who are outdoors can feel it, livestock are in turmoil, doors and windows make sounds, and fissures come onto walls
6	Alarm — people can't stand firmly, livestock run away, house containers fall down, weak houses are damaged, slope is abrupt and landslides appear
7	Houses are damaged — houses are damaged slightly, signboards and chimneys are destroyed, ground cracks, water sprays and sand emits
8	Buildings are damaged — many houses are damaged, a few roadbeds collapse and underground pipelines are broke
9	Many buildings are damaged — most houses are damaged, several collapse, signboards and chimneys collapse, railroads are bent
10	Most buildings are damaged — houses collapse, roads are damaged, an amount of hill stones crumble, billows rush towards shore
- 11	Destroy — a mass of buildings collapse, massive roadbeds and embankments collapse, the earth surface changes greatly
12	Mountains and rivers move and shift — almost all the buildings collapse, landform changes, animals and plants are ruined

To tell you the truth, I don't like the things mentioned above.





From a pupil in the primary school to a Ph.D., I have read countless forms and data, also learned many definitions and concepts. But the practical problem is that I often forget them after a period of time; moreover, the knowledge learned from books can't be used in practical applications. Since the concepts are too abstract, colorless and difficult to remember. The other point is that the purpose of creating this form is to describe the feelings in different intensities. However in deep disaster areas, for the people who are likely to face earthquake at all times, to know which kind of feeling means hiding and which kind feeling implies escaping are more meaningful. Emphasize the key point and re-recognize these feelings based on the means of emergency escape. In my opinion, to learn the escape skills is more important than to know what the intensity of the earthquake. The reason for me to show the form above is to set an example that the aftershocks in disaster areas would make us lose our trains of thoughts. Who can remember the content in the form at first time and then estimate the intensity and magnitude? Most cases that I have seen are people are scared, escape in a hurry and select shelters in haste.











