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www.interstatetraveler.us
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The Hydrogen Super Highway in an Earthquake Environment

When an earth quake sends out the various forms of seismic waves through soft soils and bed rock, there is an opportunity to create the direct resonance of the seismic waves along the length of the Hydrogen Super Highway (HSH) directly affected by the local soil/bedrock displacement. These waves could ripple along the length of the rail and set up strain forces on the main structural components.

There are several ways that the HSH is quipped counteract the potential damaging effects of resonance caused by an earth quake. These inherent qualities of the HSH go far beyond the resilience of our plate-steel rail when compared to brittle concrete that last only a few decades in harsh climates and can be turned to dust by seismic harmonics.

Conduit Cluster Geometry - The plane geometry of the central support beam (Conduit Cluster) where in the intersecting planes of plate steal stiffen the rail to such a degree that the necessary elasticity of the metal is counteracted it a high degree. Case in point; picture a sheet of plate steel 80 feet long, 4 feet wide and 1 inch thick. Natural resonance in a wave form perpendicular plane that is 80x4 would make it ring like a bell and sustain for quite some time as the elasticity of the plate has it's least resistance perpendicular to the 1 inch thickness. Turn ninety degrees out of phase and the elasticity vanishes as the plane is now trying to displace the entire thickness of 4 feet of steel. In the central support there are seven plates of steel welded at specific angles other than 90 degrees that enable greater stiffness and an increases resistance to resonance.

Stanchion Poles - The geometry of the Stanchion poles for the HSH which are specified as 3 feet outer diameter with a 1 inch sidewall. As the HSH will be normalized in grade to keep the top level of the rail as flat as possible while the terrain beneath it undulates and changes from place to place such that the length of each Stanchion pole will be unique. This variation in length of Stanchion pole helps prevent resonance. Further the insertion of a triangular tube made of three plates of steel that fits directly inside the inner diameter of the Stanchion provides three planes of 120 degrees out of phase that not only add tensile strength, they help dampen resonance. So the Stanchions have a two-fold protection against resonance, in their random length, and in the internal triangular structure.

Segment Breaker Switches - The HSH can be equipped with sections of rail that can be completely opened thus physically terminating the segment with the shockwave acting upon it. These segment breaks in the HSH are already established every three miles as a part of the conduit cluster interface with the Utility Substations. While segment break may not be required in most places in the world, they would be a standard in areas where earth quakes are expected.

Suspension System – They application of small independent slotted linear motors connected to the main vehicle body with a ball joint cantilever suspension system that enables conical motion with extension, contraction and rotation enabling three dimensional position control of the

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vehicle body. In the application of counter acting the forces of an earth quake upon the HSH, specifically it's effect on a Transport when a wave form harmonic is resonating in the rail, the suspension system can absorb the movement such that the passengers do not feel the seismic waves passing through.

Counter Harmonic – Seismographs may be installed at regular intervals along the rail, linked with the global seismographic network as an early warning system. The HSH may also employ a series mechanism help dampen the oscillations that will be set up in the rail by an earth quake. One counter harmonic method would be to employ electromagnetic resonators of adequate mass to quickly set up a destructive wave form to dampen any resonance that was set up by an earth quake. Although my favorite idea is the application of a mass counter-balance dampener like they use is sky scrapers and cruise ships. Specifically, the HSH can employ a redundant series of high-mass pendulum mechanically linked and geared to a direct current generator that can absorb the seismic waves reducing their effect on the rail segment while generating electrical current. The use of a pendulum enables the mechanical translation of force from the seismic wave regardless of which direction waves.

Geologic Effects

In the extreme cases of soil condition change from earth quakes such as shear displacement, liquefaction and land slides we have the following considerations:

Displacement - The taller the Stanchion poles the greater amount of flexibility. Should a later sheer displace the ground 10 feet, the stanchions would divide the displacement such that the deflection would be as if five feet of displacement acted upon each stanchion pole individually setting up a torsion stress at the top of the Stanchion where is it connected to the Conduit Cluster of the HSH. In areas where there are known shear faults specialized capitals will be installed on top of the Stanchions to connect to the HSH that enable a specific amount of movement to absorb the tension without transmitting the strain into structure components of the HSH or how it is safely connected to the Capital on top of the stanchion pole.

Liquefaction - As many researchers have already quantized the various viscosities of soils subject to resonance. When the HSH is being installed into soil conditions that are subject to a high degree of liquefaction, oversized 'feet' as depicted in the HSH Installation Crane Diagram can be dropped over the Stanchion pole and buried in the soil to increase the surface area and volumetric displacement to increase buoyancy of the stanchion poles in the affected soil.

Land Slide – Depending on severity, the HSH will perform quite well as the hydrodynamic drag of a mud slide may easily wash around the Stanchion pole without ripping out of the ground. In the case of massive land slides there is not much that can be done. The HSH advantage is the immediate delivery of replacement parts from inventory and the sections that were swept away in the land slide could be placed very quickly.

We hereby state that it is our belief that our HSH technology exceeds all safety, comfort and efficiency for the Traveler than all existing rail transportation technologies in the world.

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