# A supplementary note demonstrating high speed transportation using gravity Power Modules.

( US Patent pending: Application 12184154 Inventors Rajaram Bojji and A.K. Bojji)

1 A nomenclature for classifying Gravity Power Towers:

1.1 As described earlier a Gravity Power Tower will comprise of a number of Power Mass Modules, each with a driving mass, the size of the mass chosen based on requirements of the size of the mass on wheels to be driven. If we make a standard module of 500T , 250T and depending on the requirement of rolling mass we may choose a number of the modules of 500T or 250T modules, which facilitates standardization.

1.2 It is proposed that Power mass Module be named as P/M/h where P indicates Power mass module and M is the value of mass and h is the maximum vertical drop from the position of rest. So P/500/10 indicates that the driving mass is 500T and can travel 10m which means it has 5000g as its potential energy.

1.3 A Gravity Power Tower will have a number of such modules as well as a gear-power transmission cable system. It is proposed to adopt Gr/aP/M/h where Gr qualifies the Gravity Power Tower, a is the number of Power Mass Modules, followed by elements of the same. So Gr/6P/500/10 means it is a tower housing 6 nos of Power Mass modules each with 500 T mass and a10m range for vertical motion.

1.4 The length of the Power Transmission cables will be decided based on the rate of acceleration and the desired velocity for the rolling mass to be launched.

2 Gravity powered 360 kmph high speed transportation :

2.1 Assume we use a 50T capsule which is basically a coach 3.5m wide and 20m long carrying about 115 seated passengers. The parameters we assume are:

2.1.1 acceleration and deceleration at 0.3g

2.1.2 assume generally level track- in case of gravity powered system we can handle grades easily as it does not depend on the rail-wheel adhesion

2.1.3 a short route of just 8.5 km – current systems cannot reach this speed but gravity powered system can

2.2 <u>The Gravity Power Tower:</u>

2.2.1 The work to be done is 50. 0.3g .(100/2) . (100/0.3g) excluding the rolling resistance value, for the first approximation, during acceleration phase to reach the 100m per sec. So Power Mass Modules P/500/10 , if chosen about 6 of them will be found to be adequate; this provides 3000T total mass for the track. Actually the KE of rolling mass at maximum speed is divided by the Mgh of one Power Module and to account for rolling resistance add one more module to the result.

2.2.2 The rolling resistance is approximated by an equation of the type q= a+bv+cv^2

2.2.3 It is easy to calculate second by second assuming piecewise linearisation and work out the velocity, and the distance traveled, working out the tractive force for each second, which is equal to f= (m.a+ q) at that speed.

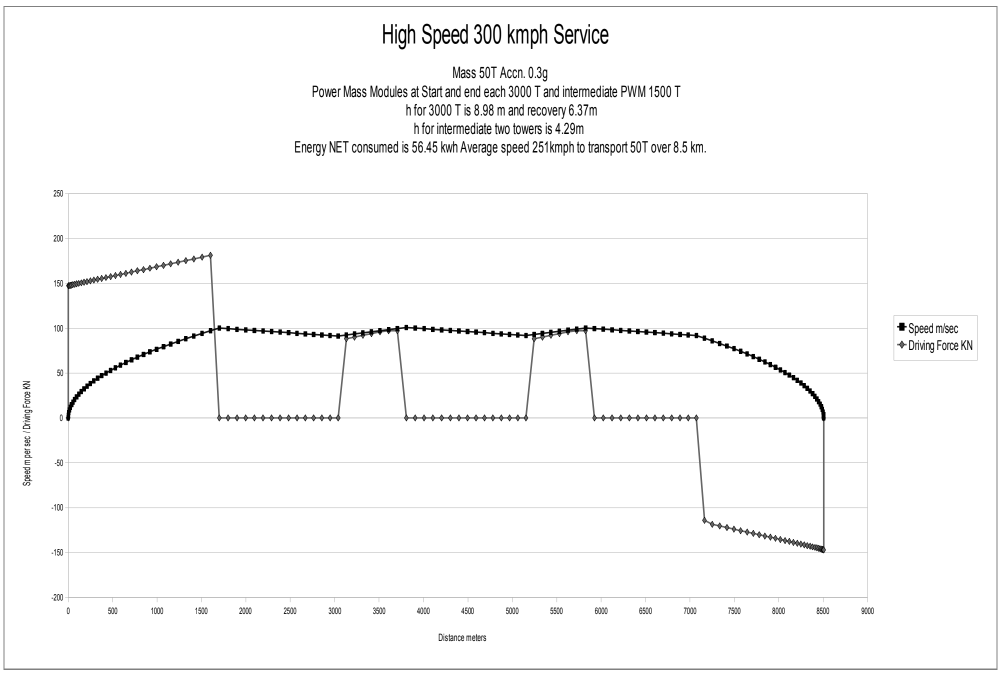
2.2.4 Knowing the tractive force, since set of M.g/n=f , we get for each of the second, the n value, and hence know the distance traveled by the M down vertically as the rolling mass gets accelerated.

2.2.5 Once the mass reaches the desired 100m per sec speed, the magnetic coupling from the power transmission cable gets disconnected and coasts and decelerates under the rolling resistance till it covers further 1.6 km , when another Gravity Power Tower takes over to give the boost in energy to bring back the speed to 100 m/sec. This is as per construct of this model. But the rate of acceleration is kept to 1.2m/ $sec^2$ Thus every 1.6

km a power boost is given- for which the Gravity Power Tower is having 3 x P/500/10 m power modules.

2.2.6 So we have at stations Gravity Power towers of higher capacity to launch, but at specified intervals, booster Gravity Power Towers along the route- which can be of any length. The intervals chosen on our design consideration, how much we can permit the speed to fall before we intervene to boost.

3 <u>The results</u>:




3.1 The model after taking into account the above said factors produced a plot of distance vs speed profile, the tractive force as shown for a case of 8.5 km route length. The basic advantage of gravity power is that we can provide enough power to sustain the acceleration of 0.3g with the result within 1.7 km and 34sec, we reach the 360kmph speed! If we deduct the acceleration and deceleration distances the rest of the distance is covered at speeds falling between 92m/sec to 100m/sec, or between 330 kmph to 360 kmph. So one can safely take 330 kmph as average speed, then add the 1 minute for terminal start and stop. A route length of 1000 km can be covered within 3 hours!

3.2 More importantly the electrical energy requirement is drastically brought down- it costs just o.13 kwh per tonne per km and as compared to current technology like TGV, saves close to 70% of energy. Gravity powers!

3.3 Further we may even launch every 30 seconds the capsules to raise the capacity to 28000 per hour! They will be separated by 2.7 km distance in between. The Power Tower will be augmented by increasing the h value to 20 and upgrading the static electrical motors to raise the mass.