Comparative analysis of STU and other transport systems

Indices	Relative size of indices	Justification of STU advantages
1. Average cost of the transportation system (route*, infrastructure** and the rolling stock***): • STU • motor transport • railway • mono-rail road • train on a magnet suspension	 100% 300—500% 150—200% 1,000—1,500% 1,500—2,000%	Reduced cost of STU is the result of the following factors: low material consumption of a string track structure, supports, rail cars and basic infrastructure components; use of traditional, low-cost and non-deficient materials and initial raw materials, machine-building nodes and aggregates; high production and building technologies of the route, infrastructure and rail cars; low cost and highly efficient operation (without traffic jams, and high-speed all-weather circulation without road accidents, etc.); rail cars (requiring reduced number of vehicles per 1 unit of transportation work); small land occupancy and small volume of earth works.
2. Average net cost of passenger and freight transportation: • STU • motor transport • railway • mono-rail road • train on a magnet suspension	 100% 300—400% 150—200% 500—800% 800—1,200%	STU has the lowest net cost of passenger and freight transportation among other known ground transportation systems which results from the low value of its constituting components: 1) low construction costs (low material consumption for the track structure, supports, infrastructure, rail cars and the use of the low-cost materials, nodes and aggregates; high construction and production technologies of all components; low volume of earth works and small land allocations; 2) low amortization costs (long service life of the track structure, supports, infrastructure, rail cars and their low cost; 3) low operation costs (small fuel consumption; high durability of the track structure, not requiring repair and restoration works; all-weather operation eliminating the need in the removal of ice and snow from the track in winter time; high operation efficiency of rail cars as a result of the high-speed movement, the lack of congestion and all-weather operation).
3. Area of land occupied by the transportation system (route and infrastructure): • STU • motor transport • railway • mono-rail road • train on a magnet	 100% 3,000—5,000% 4,000—6,000% 200—500%	Reduced area of land occupied by the STU is the result of the following factors: elimination of embankments, depressions, multi-level exchanges, bridges and overpasses that in highways or railways require the land-consuming high and long dams to access them; elimination of a wide continuous carriageway resting on a cushion and, consequently, on the earth embankment and ground surface; reduced (by 2—3 times) cross section of supports as compared, for example, with a mono-rail.

* the cost of routes includes the cost of land withdrawn from land-users for the distribution of the transportation system

** the infrastructure includes: stations, terminals, cargo terminals, depots, repair shops, garages, passages, bridges, overpasses, traffic exchanges, filling stations, power transmission lines, power sub-stations, etc. as well as the land they occupy

*** it includes the average cost of passenger and freight rolling stock per 1 km of roads (for highways — motorcycles, passenger cars, mini-buses, buses, trolley-buses, freight vehicles, etc.)

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suspension	400—600%	
4. Volume of soil removed in the course of the route and infrastructure construction: • STU • motor transport • railway • mono-rail road • train on a magnet suspension	 100% 3,000—5,000% 4,000—6,000% 200—500% 400—600%	Reduced volume of soil removed in the course of STU construction is the result of the following factors: elimination of depressions, embankments*; reduced size and depth of the foundations of supports thanks to the reduced loads on the supports as compared with a mono-rail road; elimination of a continuous carriage-way (or a rail-sleeper grid in railways) resting on a cushion and thickened soil; reduced (by 2—3 times) cross section of supports, for example as compared with a mono-rail.
5. Fuel consumption (electric energy) per 1 unit of the transportation work (by the rolling stock at the travel speed of 100 km/hour): • STU • motor transport • railway • mono-rail road • train on a magnet suspension	 100% 1,500—2,500% 200—400% 200—300% 800—1,200%	Reduced fuel (electric energy) consumption by STU for passenger and freight transportation is the result of the following factors: lower (by 20—30 times) rolling resistance of a steel wheel moving along the steel rail as compared with a rubber wheel; cylindrical shape of its bearing surface (in railways it has the form of a cone); two rims or derailment side rollers on each wheel (in railways there is one flange on a wheel) and lack of the wheel pairs (each wheel is provided with an independent suspension); improved aerodynamic qualities of the rolling stock eliminating screening effect (the lack of a continuous carriage-way); higher efficiency of a steel wheel as compared with an electro-magnetic suspension; reduced mass of the rolling stock per 1 unit of freight; improved evenness of the carriageway (due to the elimination of temperature deformation joints and preliminary tension of strings and the rail head).
6. Material consumption (except soil) for the route and infrastructure construction and manufacturing of the rolling stock: • STU • motor transport • railway • mono-rail road • train on a magnet suspension	 100% 2,000—3,000% 1,000—1,500% 1,000—1,500% 1,500—2,000%	Reduced material consumption for STU construction (reduced resource-intensity of a system) is the result of the following factors: elimination of a continuous material-consuming carriageway resting on a cushion and embankment (which is replaced by compact, low material-consuming and low-cost string-rails); reduced material consumption for a track structure due to the use of pre-stressed strings (so that a track structure operates rather as a rigid thread than as a bridge beam for deflection) without worsening the strength and rigidity of a track structure; reduced loads on the supports and their foundations (only 1% of supports is exposed to the increased load, i.e. anchor supports); reduced material consumption of a rail car (on conversion to 1 unit of freight) as compared with the traditional rolling stock.
7. Summary environmental pollution in the course of the		Reduced summary environmental pollution (by STU as compared with other transportation systems) is the result of the following factors: significant reduction in fuel (energy)

* the volume of earth works in the course of modern highway and railway construction reaches 100,000 cub. m/km which results in their increased cost and great damage to the natural environment.

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transportation system construction and operation: • STU • motor transport • railway • mono-rail road • train on a magnet suspension	 100% 1,000—1,500% 300—400% 200—300% 200—300%	consumption for the transportation of passengers and freights within the whole range of travel speeds (under equal external conditions); no deterioration of rubber tires and asphalt and the lack of their smell in hot weather; elimination of dusty, easily destroyed earth embankments and depressions, gravel and other cushions; elimination of the use of anti-icing salts and snow-removing machines in winter; elimination of high electric voltages, currents and strong alternating electromagnetic fields; low resource-intensity of a system contributing to the increased environmental safety at the stage of construction (increased technological ecological purity results from the reduced environmental load on natural environment at the stage of raw materials extraction and processing and implementation of construction and assembly works in the construction site).
8. Summary operation costs (including consumption of fuel, electric energy, repair and maintenance costs of a track, the rolling stock and infrastructure, salary for the staff, etc.): • STU • motor transport • railway • mono-rail road • train on a magnet suspension	 100% 400—600% 200—300% 150—200% 200—300%	Low operation costs of STU are the result of the following factors: low fuel consumption per 1 unit of transportation work; increased service life of a string-rail, supports and rail cars (due to the lack of temperature joints and high evenness of the rail head STU is practically free from the dynamic shock loads of the moving wheels); all-weather operation of the rolling stock (including shower, hail, strong fog, hurricane wind, icing, heavy snow, flooding, etc.); no need to remove ice and snow from the track structure in winter time; under the extreme weather conditions (hurricane wind, shower, flooding, earthquake, tsunami, etc.) no need in the restoration of a track that is not damaged; reduced volume of repair and restoration works due to the increased durability of a system and its reduced material consumption.
9. Traffic accident rates (including injures and death of people, domestic and wild animals): • STU • motor transport • railway • mono-rail road • train on a magnet suspension	 100% > 10,000% 300—500% 100% 110%	High stability of rail cars on the string-rails (thanks to the provision of each unibus wheel with a derailment system and independent suspension and a more stable gage as compared with railways) and "the second level" of circulation eliminating collisions with ground vehicles, people, domestic and wild animals which makes STU the safest transportation system (accident rates including injures and deaths of people will be lower than in railways and aviation today, i.e. approximately by 100 times lower than in highways). Elimination of embankments and depressions does not hinder the flow of ground and surface waters, migration of people and animals, dislocation of agricultural and other technical devices which contributes to the reduced accident rates and increased safety of the system. Elimination of embankments unstable to the mechanical impacts contributes to the increased system resistance to various natural disasters such as floods, tsunami, earthquakes as well as to the terrorist acts (thanks to the high margin of safety of supports and a track

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		structure and difficult to access string-rail elevated to a considerable height).
10. Summary negative environmental impact (in the course of construction and operation of the route, infrastructure and the rolling stock): • STU • motor transport • railway • mono-rail road • train on a magnet suspension	 100% 1,500—2,000% 500—800% 200—300% 300—500%	Environmental impact of STU will be minimal at all stages of its life cycle which could be attributed to the following factors: suspension systems of the rolling stock relative to the track structure (i.e. a steel wheel) — are characterized by the highest efficiency coefficient among all known and future solutions (99,9%) which could be hardly over-passed in future (for example, electromagnetic suspension of a "Trans-rapid" train, Germany, has the efficiency of 40%), therefore, a rail car in the aggregate with its high aerodynamic qualities is the most economically efficient vehicle among all known vehicles with its minimal environmental impact; jointless rail track with a smooth rolling surface (the working surface of a rail is polished to eliminate micro-unevenness) makes the wheels to move noiseless within the whole range of speeds; improved aerodynamic qualities of rail cars (4—5 times better than of sports cars according to the experimental data) eliminate aerodynamic noises within the whole range of speeds; unlike other ground transportation systems construction of STU routes will not result in the destruction of natural landscapes and bio-cenoses and will contribute to the reduced numbers of people and animals killed in road accidents; small volume of earth works and small area of land allocated for STU construction will result in the minimal withdrawal of fertile soils with its valuable humus generated during millions of years implying land-use and oxygen-generation processes necessary to maintain its constant and continuous rehabilitation in the atmosphere of the planet.