# Two Variants of Transport Corridors for the New Silk Road through the Territory of Russia

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Abstract: In the past, for a millennium and a half, the main trade route in the world was the Great Silk Road. Great geographical discoveries led to the fact that commodity flows moved to the oceans. The modern development of land transport allows the main world flows of passengers and goods to return to land in the XXI century. We are talking about using a safe and extremely fast Hyperloop transport. So the Great Silk Road can be revived at a new level, but with the increase in the territory of the earth involved in world trade, it will include America. Its main part of the routes will pass through the territory of Russia, because it is geographically located between three world production centers and markets – North America, Europe, and East Asia. It is through Russia that the land connection of Eurasia with America is possible, through the tunnel under the Bering Strait. Potentially, the sea cargo traffic across the Pacific Ocean and a significant part of it following the Indian and Atlantic, will move to the fast direct Hyperloop transport corridors following through Russia.



## 1 INTRODUCTION

Since the II century BC, a system of caravan overland tracks began to take shape across Eurasia, from China to Europe. It is known in history as the "Great Silk Road".

Silk on these caravan tracks was not the only commodity. Caravans could go along this route without silk at all. Moreover, the main number of caravans did not move from the extreme point of the path to another extreme point, but only on some part of it.

At that time, luxury articles were goods - it made sense to carry on camels for years only goods that brought super-profits. These were precious metals, horses, spices, furs, dried fruits, tea, indigo, precious stones, porcelain. Religious and secular ideas, scientific discoveries, cultural values and achievements spread across Eurasia through this path.

China, for example, exported horses from Central Asia along this route – a military-strategic commodity for the country in the absence of its own horse breeding and constant military pressure from the Mongolian steppes.

During the journey, goods, especially silk and spices (because the most expensive goods were carried over particularly long distances) changed hands dozens of times. From Central Asia, part of the Chinese silk, spices from India, and the goods of their countries were transported by local merchants to the west. Merchants of Central and Minor Asia, Palestine, and the Volga region replaced each other. Therefore, it is appropriate to talk about the travel of goods and not people.

The Great Silk Road had one road only from China to Central Asia, and further west, it had several main routes. However, the route to Central Asia had a split in the area of the Taklamakan desert - it bypassed it from the north and from the south.

The main route went from Central Asia to the west through Iran and Mesopotamia, to Palestine and from there to Europe goods arrived by sea. Alternatively, from Iran it was possible to follow not to the shores of the Mediterranean Sea, but to the Southeastern coast of the Black Sea to the port of the city of Trebizond. There was also a northern route – from Central Asia through modern Kazakhstan and the southern Russian steppes, overland caravans went to the Italian ports on the coast of Crimea.



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Having multiple path options was important. In the Middle Ages, there were often wars, and caravans bypassed the most dangerous areas.

There were many branches from the main path. Through them, countries located to the north and south of the main transport corridors – India, Southern Iran, Egypt, Tibet, Arab tribes, etc. joined trade along this route.

After the Great Geographical Discoveries, the Great Silk Road lost much in importance and as a path along its entire length ceased to exist. Because the transportation of goods by sea was more profitable than by camel.

Nowadays, the world is approaching a new cold war – between China and the United States. China, having become a global factory, sells industrial products and buys energy resources by sea. The American navy dominates the sea. China needs to diversify its commodity flows at least within Eurasia, and it is actively building railways to other countries, including high-speed ones, in an effort to revive the idea of the ancient "Great Silk Road".

One of the routes of the "Great Silk Road" went through the territory of Kazakhstan and Russia. This is natural given their intermediate position between East Asia and Europe. With political instability in Afghanistan and the Middle East, in our time, the route of a new path through Russia or through Kazakhstan and Russia is the best.

But the new, modern "Silk Road" should not be limited to Eurasia. In ancient times, Eurasia was the whole world for its population. Today, in order to connect the whole world by trade routes, it is necessary to connect America to this route as well. Especially North America, given its importance as a huge sales market and a major producer of goods. This, again, can be done by land transport only through Russia – with the help of a tunnel under the Bering Strait.

The second feature of this path in order to become effective and actively used – it must be very fast and relatively inexpensive. This is possible only if it will function exclusively on the basis of Hyperloop technologies. The speed of Hyperloop capsules is about 1200 kilometers per hour. (Santageo, 2018) This will allow even bypassing the Pacific Ocean, along its northern land borders, to deliver goods ten times faster than crossing the Pacific Ocean directly by sea. The high cost of port infrastructure makes Hyperloop, after its creation, much cheaper to operate than sea transport. What is important in the perspective of decades and centuries.

Probably, this way, like the ancient Great Silk Road, will have branches to different countries and their groups. For example, to Central Asia, to India, to the Middle East.

For Russia, with its cold climate, snowfalls and blizzards, the Hyperloop transport system is convenient because the transport is, as it were, isolated from the external natural environment in a transport pipe, and that the pipe is suspended above the ground on pylons. The adverse effects of climate, weather, are reduced to zero here (Özbek, 2021), unlike all types of railway transport.

## 2 MATERIALS AND METHODS

In the article we have considered two variants of the transport corridor of the new "Silk Road" with the use of Hyperloop technologies in it.

The first option has advantages in that it passes through the territory of Russia in the north, where the density of settlements is not high. For this reason, it will be able to remain an almost perfectly straight route for thousands of kilometers, especially west of the Yenisei, where the territory is flat.

The huge speed of Hyperloop transport makes transport corridors not rational for it, in which, due to turns bypassing cities, terrain irregularities, it will be necessary to reduce speed. And also, in which there will be frequent stops on the way. Also, acceleration and deceleration will inevitably create physical discomfort for passengers. (Almujibah, 2020)

The second option is attractive because in the eastern part of the country, where there is a mountainous terrain, it runs along the route of already existing railway corridors. For this reason, the Hyperloop highway will be easier to carry out here, cheaper.

Strategically, for centuries, the first transport corridor is more attractive. In an ideal straight line, Hyperloop capsules in the distant future will probably be able to move much faster than the 1200 kilometers per hour announced today, perhaps even several times. The second corridor, due to the fact that it is cheaper and uses an existing route, can be built faster.

Probably, in the distant future, both of these corridors will be needed, as different branches of the new "Great Silk Road", and possibly one or more additional branches.

At the moment, new technical solutions in the field of Hyperloop and their patenting are rapidly developing. The next stage in the development of

Hyperloop transport, the embodiment of its capabilities, is the development of the advantages of high speed, long-distance transnational routes of this type of transport. The most promising options for these routes are proposed in the article. (Davydov, 2019)

# 3 RESULTS AND DISCUSSION

A section of the new "Silk Road" using Hyperloop technologies connecting Eurasia and North America.

The new Silk Road, like the old one, will cross Eurasia from west to east. The two path options have different routes in this direction.

But the New Silk Road should also connect Eurasia and North America. This segment of the path will be common to both options.

The connection of Eurasia and North America is possible only in the area of the Bering Strait. The tunnel under the strait was planned at the beginning of the XX century. Today it is not just possible, but very profitable, because the speed of Hyperloop transport dramatically reduces the inconvenience associated with its remoteness from the main transport routes, the locations of producers and consumers of goods.

In Russia, it is possible to lay two routes to the Bering Strait.

The first one is from Yakutsk. At the beginning of the XX century, this route was proposed by American transport companies in the event of an agreement on the construction of a tunnel. Today there is also a project of such a road from Yakutsk to Magadan and further past it to the Bering Strait. It is necessary to supplement the route by creating a transport link between BAM and Yakutsk, and thus with the Bering Strait. This could be the Hyperloop highway following the route of the modern Amur-Yakutsk highway.

The second is along the western shore of the Sea of Okhotsk, from Primorsky Krai to Magadan and Shelikhov Bay. The coastal area is mostly flat, convenient for laying a transport route. Then, from Shelikhov Bay, the highway will go to the Bering Strait, also through relatively flat territories. Along the western shore of the Shelikhov Bay to the northeast of Magadan, lowland areas are located, then this relief continues with a lowland between the Kolyma and Koryak highlands almost to the Bering Strait. This section of the route along flat sections will be almost straight, which is convenient for Hyperloop. Today there is a railway project on this route – "Postyshevo-Magadan".

Both options can be used for diversification, with their connection to the section of the path from west to east of Eurasia. But of the two, the second option is the most attractive. The reason is that in it, there will be a convenient exit of the highway to the countries of East Asia and to the ports of Russia on the Sea of Okhotsk. This is very important for the convenience of using the path by such industrial countries as China, Japan, North Korea.

Japan will be able to connect to this branch of the route, and through it to the branch going to Europe, by conducting its Hyperloop highway from the island of Hokkaido to Sakhalin by tunneling under the La Perouse Strait (43 kilometers) and then through the tunnel from Sakhalin to the Khabarovsk Territory under the Nevelsky Strait (8 kilometers).

South Korea can connect to the described transport route, bypassing North Korea, through Japan. An underwater tunnel between these countries has been discussed since 1917. Its length along the shortest route (via the islands of Iki and Tsushima) is 182 km. What was possible a hundred years ago is both possible and rational today. Especially if it ensures the connection of South Korea to the Hyperloop high-speed route to Europe and North America.

Thanks to the continuation of the transport route from China to Southeast Asia, and further from Indochina to India, the entire eastern part of Asia will be "connected" to the new Silk Road. With the ability to connect to the track, the ability to reload from sea transport to Hyperloop using Chinese, Japanese and Korean ports will be further enhanced. Cargo will only travel to Europe and North America via the new Great Silk Road, transiting through Russia.

A section of the new "Silk Road" using Hyperloop technology connecting Europe and East Asia. The northern branch.

Hyperloop technologies exhibit all their high-speed qualities with an ideally direct transport corridor that preserves this quality over long distances. There is an opportunity to lay such a direct route through the northern part of Russia. Along the entire length of the country from east to west. To do this, you need to make a corridor approximately 59.3 degrees north latitude.

This is the latitude of Magadan, Okhotsk in the east and in the west just south of St. Petersburg (its latitude is 59.57) and the port of Ust-Luga (59.4).

At latitude 59-60, there are relatively few settlements that the highways would have to go around, or disrupt the infrastructure by passing

through them. There are no large lakes, reservoirs. In the west, the highway would pass under Lake Peipsi.

From the east and from the west along this route, the highway relies on seaports – in the east Magadan and Okhotsk, in the west Ust-Luga and in general the system of the port agglomeration of St. Petersburg. This is important for connecting cargo and passengers arriving by sea to the highway. But it is especially important as the possibility of continuing the Hyperloop transport pipelines to Europe under the Baltic Sea.

The landscape along this route is favorable for the construction of the highway. Basically, it will pass through flat areas. Only in the eastern part from the Aldan River to the city of Okhotsk will it be necessary to punch tunnels in the Prilensky plateau. The route from the point of view of the landscape is easier than the BAM route. But modern technologies are much ahead of those that were half a century ago when the Baikal-Amur highway was built.

Currently, in the Russian Federation there is a project of the "Lensko-Kamchatskaya railway line". In it, from the village of Nepa on the Lower Tunguska to Shelikhov Bay, a section is planned along approximately the same route that is proposed here as the eastern part of the highway across the country at 59-60 degrees north latitude. This indicates that the specified transport corridor in its mountainous eastern part is possible and real.

Probably, it will be possible to make a highway close to a perfectly straight line only from the Yenisei and to the Baltic Sea coast. Across the West Siberian and East European plains. It is more than six thousand kilometers.

A section of the new "Silk Road" using Hyperloop technology connecting Europe and East Asia. The southern branch.

The southern section of the route could use the existing Transsib and BAM transport corridors. On these tracks, railways could be replaced by Hyperloop pipeline transport systems.

But in the east, the Trans-Siberian Railway follows along the border of Russia with Mongolia and China, to Vladivostok. BAM from the transport hub in the city of Tynda, follows parallel to the Trans-Siberian Railway to Novy Urgal, and then, through Postyshevo and Komsomolsk-on-Amur, follows to the ports of the Tatar Strait of the Sea of Japan - Vanino and Sovetskaya Gavan-Gorod. This route leaves aside the very important Nevelsky Strait, through a tunnel under which goods from Japan and South Korea and countries that have reloaded goods from ships to Hyperloop capsules in Japanese ports would go to Russia and transit through Russia. And also, this route is not connected to the highway to the Bering Strait, which is the main feature of the new Silk Road, given the importance of the US economy for the world as a whole. Therefore, it is important to connect the highway running along the BAM route with the Nevelsky Strait area and with the highway following the Bering Strait and further to the USA. For example, from Postyshevo, the highway could follow not only to Komsomolsk-on-Amur, but also to the Nevelsky Strait and to the city of Tugur in order to connect with the highway along the coast of the Sea of Okhotsk in the USA and become a single system with it. The connection of transport hubs in the cities of Verkhnezeisk (on the BAM) and Chumikan (on the coast of the Sea of Okhotsk) could also shorten and make the connection between highways along the coast of the Sea of Okhotsk and along the BAM route more direct.

In the western part of the country, the Hyperloop highway running along the Transsib route, from Omsk, should follow the historical Transsib route to Samara. Or, follow the Samara region and past it a little from the south, focusing on 52.5-52.6 degrees north latitude in a straight line, if possible, with access here to a convenient place for crossing the Volga, consisting of wide reservoirs. Let me remind you that a straight line is the most favorable route for Hyperloop transport, which in such conditions will be able to maintain a constant speed of more than 1200 kilometers per hour without slowing down on turns. The meaning and advantages of this type of transport, first of all, is in speed.

From Samara to the west, the highway should move as straight as possible, approximately 52,2-52,6 degrees north latitude. Beyond the territory of Russia, it will pass through the cities of southern Belarus Gomel, Kalinkovichi, Luninets and Brest, along the route of the railway that exists today, to Poland, and then to Germany.

A section of the continuation of the new Silk Road in Europe, Asia and North America.

If we are talking about the Northern branch of the highway crossing the territory of Russia, then from the Ust-Luga area and St. Petersburg, the Hyperloop pipeline transport highway could follow to Germany under the waters of the Baltic Sea, like the Nord Stream gas transmission system. In order to diversify the route, as well as to exclude the use of a dangerous underwater section for passenger transportation, there should be a second route – through the Baltic States to Poland and Germany. Also, the third direction of the continuation of the route outside of Russia is promising – the highway

under water follows from the southern shore of the Gulf of Finland to the northern shore, then to Finland, and then to Sweden, Denmark and Germany. Such a transport corridor already exists in land transport projects. (Kupriyanovsky, 2020)

From Europe, the route could follow through the Strait of Gibraltar to Africa. And through the territory of Turkey to the Middle East and through Egypt, as well as to Africa.

In Asia, the route from China should go south to Indochina, Indonesia, Malaysia, Burma and India. Also, in the areas of the borders of Russia and Kazakhstan, there will be branches from this route to Central Asia and further to Iran and through Iran to Pakistan and India, as well as through Iran to Arab countries. Just as there were branches of the historical Silk Road.

In North America, the route from Alaska should follow eastward across the entire continent, drawing the entire territory of Canada and the United States into the sphere of transport coverage of the new Silk Road. We also need a way from the USA to the south, to the countries of Latin America.

But the main highway in the entire Hyperloop world system will be the one that connects two of the world's largest markets and manufacturers – East Asia and North America through the territory of Russia. The second and third routes in importance are a connection through the territory of Russia, Europe with North America and Europe with East Asia.

Unprecedented capacity of the Hyperloop intercontinental highway through Russia.

The described Hyperloop highway system, connecting the main world markets through the territory of Russia, is of great importance for any highway capacity. But it has a real opportunity to create a revolution in international transportation, reducing the other modes of transport in quiet transportation, almost to zero. Even sea transport can practically disappear.

Hyperloop pipeline transport with long-term use of constructed highways is relatively inexpensive. This transport is quite safe, if you do not take into account the terrorist attacks. It is eco-friendly, which is important in the XXI century - this system uses electricity as energy, and not hydrocarbons as sea transport. But the main thing is that it is very fast. Delivery of goods and passengers from China to Europe will be carried out in transit without stops, within 8-10 hours. From China to the USA and from Europe to the USA – within a day.

Special studies were conducted on the comparative effectiveness of modern modes of transport for the Parliament of Canada (Loprespub, 2019) and for the NASA Research Center (Taylor, 2016). The conclusion turned out to be that Hyperloop transport is the most efficient both in terms of individual characteristics of transport systems and in their sum.

Such a large-scale transport revolution, with the transition to a new type of transport, was only in the era of Great Geographical Discoveries, and this put an end to the Great Silk Road overland. Now everything can happen the other way around – the new Silk Road will put an end to mass sea freight and passenger traffic by sea, and at the same time by air.

It will be possible to realize the transport super revolution if the Hyperloop international highways passing through the territory are powerful enough, with a large capacity. These are dozens or even more than a hundred transport pipes. They will not be built in such numbers at once, but examples of the benefits of transferring cargo flows via Hyperloop on these routes will lead to the constant modernization of transport corridors and the increase of pipeline capacity on them.

It is assumed that the capacity of the Hyperloop path is 840 passengers per hour, departing every 2 minutes. The potential to increase to 3,360 passengers per hour by increasing the frequency of departure of capsules to every 30 seconds. According to NASA estimates, such a capsule launch frequency is possible, since technology allows you to instantly stop in case of an emergency stop in front of a moving capsule. (Taylor, 2016) Accordingly, the capacity of the Hyperloop transport pipe at the peak of the development and application of technologies will allow 2,889 passenger capsules to be sent per day for 28 passengers, and a total of 80,640 passengers per day. It should also be taken into account that at night the number of capsules sent will be less and the actual passenger traffic of one passenger tube should be taken less in calculations per day.

In cargo transportation, it is assumed that the capsule will carry a sea container. Accordingly, it is 20-22 tons. With a speed of 2 capsules per minute, and 2,889 capsules per day, this will allow 57,780 tons to be moved per day, or 20-21 million tons per year. If it is not possible to load capsules at this speed, then the speed will be lower.

The world container volume of cargo transportation for export exceeds 200 million tons, non-container cargo transportation is approximately equal to 50 million tons. (Department of Transport and Infrastructure of the EEC,

http://www.eurasiancommission.org) The global cargo transportation market will inevitably grow. These figures are somewhat underestimated due to the decline in business activity due to the pandemic. Cargo transportation will also grow continuously from year to year due to the global growth of production and its globalization, orientation to world sales markets. For each of the proposed directions of Hyperloop super highways – Europe-Asia, America-Asia, America-Europe – you need to have more than ten parallel transport pipes. In order for the system using the transport corridor to have a margin of safety and ensure uninterrupted transportation of goods even during the repair of some pipes. The same applies to Hyperloop passenger systems.

Geographical movement of cities and enterprises, on the "shores" of Hyperloop intercontinental highways.

Cities located on highways traditionally have the best prospects for growth and development, for attracting investments, the population, and for placing enterprises here. These highways provide the supply of raw materials, and the movement of finished products to the sales markets. The more significant the transport highway on which the enterprise is located, the better the conditions for its growth, success, and competitiveness.

For example, in Russia, cities located on the Trans-Siberian Railway successfully grew at the beginning of the XX century. But the highway provided weak opportunities for world trade, it was important only to attract investment and resources within the country. Full-fledged access to world markets before the advent of Hyperloop technologies was possible only for production facilities located on the ocean non-freezing coast with convenient deep-water harbors, a modern port. This has never happened in Russia. Therefore, really large investments in the country were impossible. The country could not become a "second China".

But after the advent of Hyperloop technologies and the passage of the main Hyperloop transport routes through Russia, such an opportunity appears. But enterprises in which large investments can be made should be located on the "shores" of Hyperloop transport corridors, which will give them quick access to any of the world's main markets.

Probably, new industrial cities will appear "on the shores" of the new "Silk Road", and financial centers will appear next to industry. The geography of the placement of labor and enterprises in the country will change, as well as new enterprises will be the most modern. They will also be very large, because they will be focused on the sale of products in the largest markets.

The architectural plan of the new cities will probably also be new-looking, different from modern cities. Logically, if located on the "shores" of the transport highway, they will be "linear" along this highway, with a linear technopark between the linear city and the highway.

# 4 CONCLUSIONS

The emergence of new Hyperloop transport technologies creates unprecedented opportunities for Russia to enrich cargo transit and to develop its own transport and production. The advantage of Russia is geographical. It is Russia that has territories located on the border of America and Eurasia. Secondly, which is somewhat less important, there is a land connection between Europe and Asia through Russia. Russia is not unique in this, but having access to the Bering Strait makes communication through Asia and Europe through Russia more attractive than through other countries, since at the same time it is possible to carry out this transport connection, and exit from Europe and Asia to North America. The speed of Hyperloop capsules is so great that Russia's long distances cease to be an obstacle in order for its territory to become a connecting element between the world's largest markets – East Asia, North America, Europe. Hyperloop highways through Russia will replace sea and air transport.

Transit through Russia via Hyperloop highways in the future promises to reorient almost the entire world cargo and passenger traffic, and this will enrich the country. Moreover, the "shores" of Hyperloop transcontinental highways will incorporate the advantages and functions of sea coasts with ports. For world trade, large enterprises will need to be located not on the seashores, but on the "shores" of intercontinental Hyperloop. First of all, in Russia. This can create an investment boom in the country.

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Russia is a country with vast territories and without convenient access to the sea. It needs high-speed ground transport like no other state. The article shows that such transport is capable of revolutionizing the entire development of the

country. The projects outlined in the article will be implemented, it's only a matter of time. In this context, it is necessary to express gratitude to the creators of the Hyperloop transport system, the unwitting creators of one of the conditions for the future strength and success of Russia.

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