



Case Study 4 | “We’re Falling Behind” the Chinese National Highway System

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Introduction

Since 1988, China has been investing in the expansion of a globally competitive highway system. The National Trunk Highway System (NTHS) is essential to China's rapid Gross Domestic Product (GDP) growth. The highway network is forecasted to reach 52,000 miles (83,200km) and connect all provincial capitals with populations over 200,000. This network expansion is a part of a National policy to promote automobile usage and production. The system upgrades will be an incentive for wealthy and middle class Chinese to own an automobile as well as increase Chinese national mobility. Transportation infrastructure is an economic engine for growth. China's economy will continue to expand based on national investments in their transportation systems.

The research will explore the status of the NTHS and future forecasts of growth. The NTHS will make China more globally competitive and equal. The United States Interstate Highway system is currently the leader in total highway system network but is forecasted to relinquish its position to China. How will this change global policy and investments? Chinese policy issues in transportation efficiency, financing, safety, economic, environmental and social equity will be explored. China is becoming a world leader in highway development and continues to compete in the global market place.



Figure 1 | China Expressway Network as of 2006.



Figure 2 | China Expressway Network on the eastern side of the country as of 2006.

List of Actors

National Level

- Chinese Central Government
- Ministry of Communications (MOC) – which includes the following departments that are closely involved in highway infrastructure:

Public Security Departments,
Highway Administration,
Coordination Planning,
International Cooperation,
Institutional Reform and Legal Affairs,
Finance.

- Environmental Protection Department

Provincial and Local

- Provincial Communications Departments (PCD)

These provincial-level governments vary greatly from one province to the next, but in particular, the difference between the inland areas (west) and the coastal areas (east) play a large role in the level of equity between the regions in China.

Private Enterprises in joint ventures

- Foreign Investors, especially from Hong Kong

Citizens

- Rural Farmers, Agriculture
- East coast citizens
- Freight operators
- Taiwan

United States

- Federal Highway Administration
- Jim Oberstar – Chairman of the Committee on Transportation and Infrastructure

Timeline of Events

- 1913 | China builds first modern highway. (MacLeod, 2006)
- 1949 | Total road length open to traffic is 50,000 miles. (MacLeod, 2006)
- 1978 | Inflection point / major change - shift from rail to cars (Xue, et al 2002)
- 1979 | “Open Door” Policy – purely planned economy to semi-market economy
- 1988 | First expressway -- 11.5 miles long -- built near Shanghai. (MacLeod, 2006)
- 1996 | Land Administration Law – private organizations and individuals can lease and develop state-owned land
- 1997 | Highway Law (Wu, et al., 2007)
- 1998 | Major construction of expressways begins. (MacLeod, 2006)
- 1998 | Energy Conservation Law (MacLeod, 2006)
- 1999 | Highway Law Amendment (to include gas tax) – not approved
- 2000 | Number of private cars on the road is 6.25 million. (MacLeod, 2006)
- 2000 | Chinese Clean Air Act (MacLeod, 2006)
- 2001 | 10th 5-Year Plan
- 2003 | Road Traffic Safety Law
- 2004 | “7-9-18” Highway Plan “7-9-18 highway network” (Wu, et al., 2007)
- 2005 | Number of private cars on the road increases to 17million. (MacLeod, 2006)
- 2006 | World Bank Transportation Strategy Update (Wu, et al., 2007)
- 2006 | Expressways total 25,480 miles. (MacLeod, 2006)
- 2006 | 11th 5 Year Plan
- 2007 | NTHS Complete – total of 44,000 km of highway
- 2010 | Forecast that Chin will be the largest market for cars (Wu, et al., 2007)
- 2020 | Forecast that China likely to be world's leading carmaker (MacLeod, 2006)

Policy Issues by Type

Efficiency of System

“Open Door” policy shifted from an entirely planned economy to a semi-planned, semi-market economy. (Schipper, 2004)) This allowed people more freedom to choose where they lived, which increased congestion towards economic centers on the east coast.

The Beijing-Tongjiang Expressway, one of the highways of the National Trunk Highway System, had one of the most influential impacts on transport services. This highway decreased travel time significantly and lowered operating costs for vehicles because of the improved conditions of the roads and shorter distances. (Ojiro, et al., 2003) Similarly, other new expressway construction projects of the National Trunk Highway System also helped with connectivity to major cities, as well as to outlying inland cities.

The 8 point strategy to complement infrastructure was developed by the MOC to complement the massive increase in expressway construction. Included in this set of strategies were goals to improve the quality and speed of the roads and freight system, along with integration of other policies and various other maintenance and financial goals. (Wu, et al., 2007)

Financing of the highway system

Western Development Strategy attempts to balance the economic situation across China. It was oriented towards integrating the cities west and inland and bringing them up to the economic pace of the eastern cities. (Schipper & Wei-Shiuen, 2004))

The 1997 Highway Law decentralized the highway system administration. The central government of China, through the Ministry of Communications still regulates highway projects and maintenance; however, the provinces have a much larger role than before. Provincial Communications Departments plan, develop, and maintain the highway network within their provinces. Larger scaled projects that involve multiple provinces are planned by the MOC and approved by the PCDs. This results in the financing partially falling on the provinces. (Wu, et al., 2007)

China uses a beneficiary-pay system that balances out taxes to fairly distribute the cost of the highways. Fares, tolls, road maintenance fees are some of the means to tax or charge the direct beneficiaries of the highway system. The vehicle purchase fees go towards road maintenance. This fee is about 10% of the retail cost of vehicles purchased. Indirect beneficiaries are included via land-related taxes, such as charges on selling land-use rights, or land-use fees, and developer-paid fees, such as urban construction and completion fees. (Hayashi, et al, 1998)

These taxes and fees are similar to the US highway system for funding maintenance with the exception of a few policy items. The US uses a gas tax in addition to other highway usages fees. Further, developers in China have to pay fees twice. They must pay once as a developer, and again as a beneficiary of the highway system. (Hayashi, et al, 1998)

(ADB policy reform) The highways use the “Build-Operate-Transfer” method. Under this method, provinces must seek out private investors or loans to fund their road construction projects. Some provincial and lower-level governments run into challenges using this method because of the high-risk involved.

The “Open Door” policy (or Open Reform Policy) helped to bring in foreign investor partnerships. The policy in the late 1970s paved the way for the private sector to be involved in the financing of the National Highway System, and especially the Trunk Highway System. (Schipper & Wei-Shiuen, 2004)

Environmental Issues

World Bank Transportation Strategy in 2006-2007 stated that part of the goals of helping partner countries establish their transportation systems was that these systems are sustainably economically, environmentally, and socially. (Wu, et al., 2007)

Clean Air Act of 2000 requires vehicles to follow emissions standards and prohibits the import of vehicles that do not meet these requirements. (Schipper & Wei-Shiuen, 2004) These are based on the Euro II standards from the European Union.

Social Equity Issues

Toll pricing in China versus other countries indicate that the amount is (ADB) relatively comparable to toll costs in the US and not as significantly high as the tolls in Japan (see figure 7). However, comparing the toll costs in China to GDP per capita reveals that despite the relative low price, the cost is unaffordable for many Chinese citizens.

They do not have policies or regulations that protect non-motorized forms of transportation, such as bikes.

The Chinese government would compensate for land taken for the development of highways and infrastructure. (Ojira, et al., 2003) They would also provide monetary assistance for poorer households, people whose land was temporarily inhabited for construction and people who had assets on their land that would be lost.

From 1999 to 2003 about 4.5 million people were relocated due to highway construction, usually affecting the poor the most. The relocation tended to uproot

these communities and disturb lifestyle patterns and cultural resources. (Schipper & Wei-Shiuen, 2004).

Western provinces are at a disadvantage after the decentralization of highway and infrastructure administration. They have less ability to acquire funding through private sector partnerships and also generally have fewer resources to pay for the construction and maintenance of highways and roads. (Li, Shum, 2001)

Economic Development

Road Transportation Ordinance in July of 2004 included goals of fair market competition, vehicle and operator permits, conditions for international cross-border operations. (Duncan, 2006)

China is spending 5% of their annual GDP on funding highway transportation while most countries spend 2%. The large investment is intended to help economic growth by connecting large cities to each other, helping increase markets. In the first phase of the Trunk Highway System development, construction was focused on the east coast, which actually exacerbated the divide between economic equity between the east and the west. It wasn't until the second phase that the southwest was more equally accessible and thus gained potential economic benefit. But, for the cost of the western highways, they did not provide as much success in a cost-benefit analysis as much as the eastern highways cost-benefit analysis showed. (Li, Shum, 2001) Despite the highway system connectivity, the west may not find their portions of the highway economically viable. A large investment that helps to transfer resources inland would also be necessary to make the west competitive or a "Grand development of China's west"

In 1994, the central government prioritized the auto industry as a pillar industry. In 2004, the vehicle production rate in China was 4.5 million a year, the fourth largest rate in production. It was also the third largest consumer of cars in the world. (Schipper & Wei-Shiuen, 2004)

Compared to the US, China uses a riskier method for paying for the growth of their highway infrastructure. To finance their projects, China has their provinces undertake large loans, which borrow against the potential toll revenue of their province's section of the highway. In addition, other portions come from various methods of funding established by the provinces or by the central government. The loans paid back by tolls make up about 70% of the cost of the highway construction project. (Duncan, 2007) This is particularly risky because of the differences in economies between provinces. This method may not be economically viable for some western provinces, which may never be able to pay back their loans through their toll revenues. (Li, Shum, 2001)

The US, on the other hand uses a "pay-as-you-go" development plan for highways. Using predominantly gas taxes, 90% funded by these surcharges, the US limits their

highway development projects by the amount of revenue raised. This method is less risky. China has recognized the comparative risk in their model, and plans to impose higher or additional taxes on more profitable sections of the national highway system. These additional charges would go to subsidize the less profitable portions and help them pay back their loans. (Duncan, 2007)



Figure 3 | Interchange in China. (McNichols)

Narrative of the Case Study

Origins

The Chinese highway system is a particularly interesting system due to the scale of the system and the time frame in which the system was implemented and deployed. The first motorway in 1984, the Shenyang Dalian Expressway, began the development of the National Trunk Highway System. This network includes 5 north-south routes and 7 east-west routes for a total of 35,000 km of road. (Li, Shum, 2001) Since the successful construction of this large highway network in 2007 (McNichol, 2007), China has established a new plan to build the “7-9-18” Highways, which would include 7 radial highways, 9 north-south routes, and 18 east-west routes. This includes 85,000 km of road and would be completed in 2020. (Wu, et al., 2007) The history and origins of this ambitious project helps to set the stage for such a large scaled infrastructure project.

In 1913, China built its first modern “highway”. (MacLeod, 2006) This highway system was not the type of highway we build today. In the 1930s, many other connecting roads were built while China was at war with Japan. By 1949, there was a total of 50,000 miles of road for a country of 9,640,821 km². Keeping in mind that the United States highway system began in about 1956, China did not begin its elaborate highway construction projects until the 1980s. After the 1979 Open Door, or Reform and Open Policy, which shifted the purely planned economy to a semi-planned, semi-market economy, the market became free. (Xue, Schmid, Smith, 2002) This partially contributed to changes in the structure that allowed consumer demand to be exhibited in the economic system. As such, a more competitive market incentivized migrations of people from the country-side to more urban areas with job opportunities. This shift led to rapid motorization as well as congestion of the existing road system. In the 1980s, 28 cities had populations of 1 million and above in China. Soon after, in 2005, 43 cities had 1 million and above and 24 or more of those had exceeded 2 million.

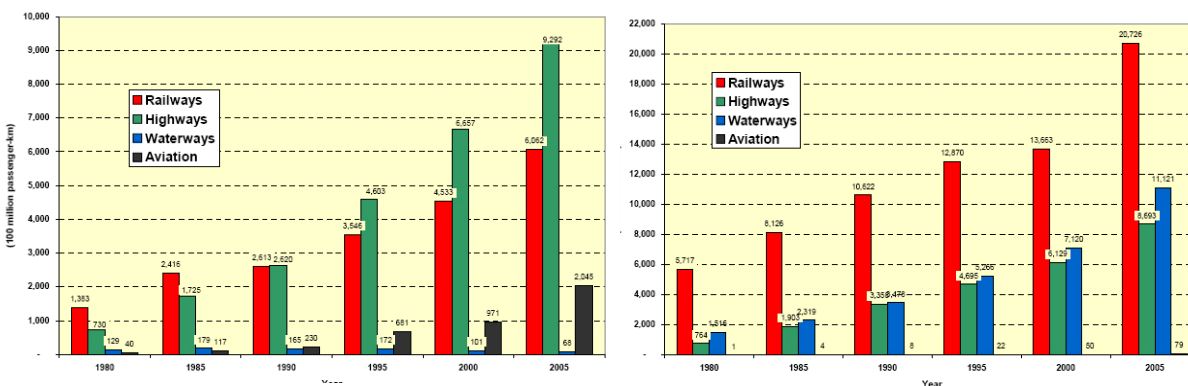


Figure 4 | China Passenger Travel by Mode 1980- 2005 (left) and Freight Ton Travel by Mode from 1980-2005. (Wu, 2007).

Part of the increase of competition and the migration of people towards large metropolises was the successful economic growth of China. This success, coupled with the strain on the existing road network, were some of the main factors in the large prioritizing of highway infrastructure construction projects.

Motorization Trends

Chinese motorization trends have been growing for two decades. Automobile ownership has risen by 15-20% per year and is heavily concentrated to the wealth in cities. Urban area populations have been increasing since the “open-door” policy of 1978. The result was an increase in populations in the cities and expanding wealth. In the 1980s there were 28 cities with 1 million residents. Migration from rural to urban areas increased the populations and in 2005 there were 43 cities that had 1 million residents and 24 cities have 2 million. (McNichol 2007) These population increases increased wealth and GDP. The growing economy of 8-10% GDP a year has increased the aggregate transport demand. (ADB 2005) An automobile culture is born from increasing incomes, which drives demand for road expansion as congestion and negative externalities reduce automotive benefits.

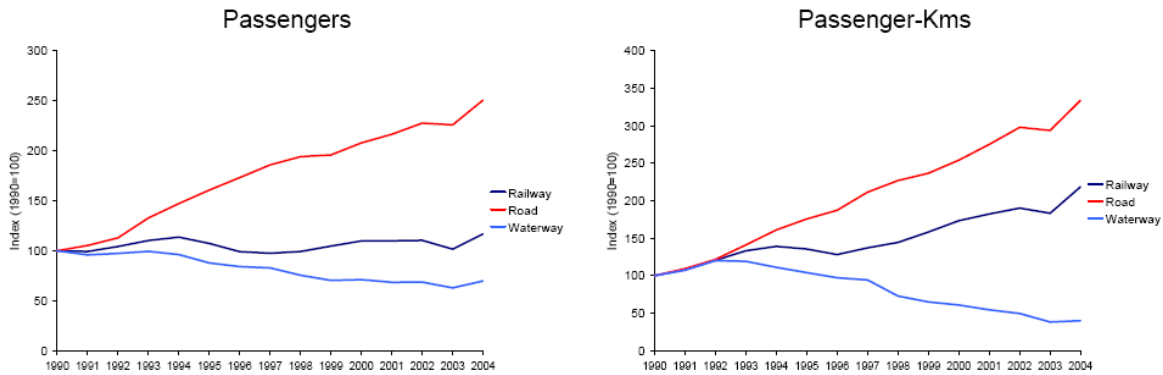


Figure 5 | Growth of passenger transport by mode from 1990-2004. (Asian Development Bank, 2005)

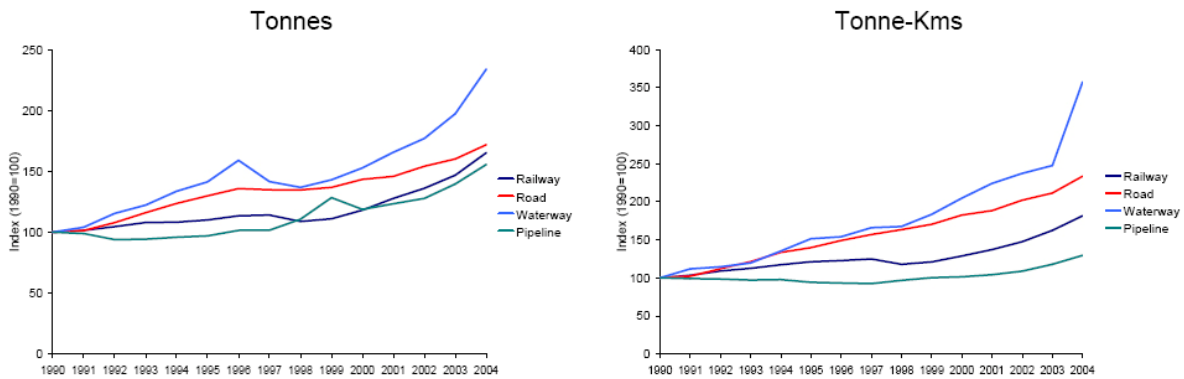


Figure 6 | Growth of freight transport by mode from 1990-2004. (Asian Development Bank, 2005)

Congestion can push automotive users to less dense areas and expands the road distance. The continual building phase since the 1980's have emphasized raising standards of roads, building trunk roads and motorways, while continuously increasing the route length. (Xue, Schmid, Smith 2001) Infrastructure investments to expand the system relieve congestion but also increase incentives to own an automobile. Rising amounts of motorization and increased middle class in wealthier urban areas have a higher ownership of cars 80-100 per 1,000 people compared to 11 cars per 1,000 people nationally. (McNichol 2007) Urban areas are increasingly becoming more auto-orientated but still have to compete with traditional sources of transportation.

The market share of automobiles has to compete with "traditional" modes of transportation. Foot or bicycle still does make up a large share of "trips" in China, about 60%. (Xue, Schmid, Smith, 2001) The automobile culture must compete for safe travel on the urban roadways with bikes, pedestrians, motorcycles, and public transportation. Private transportation needs increase the pressures on the public system. Policies will need to protect individual through better regulations of traffic and safety concerns. Physical separations on the roadway exist but are difficult to enforce as auto-attitudes push other users off the roads. Congestion forces cars to park on sidewalks, drive in bike lanes, and enter pedestrian areas. (Schipper Wei-Shiuen, 2004) The automotive culture creates negative social externalities on other sources of transportation but is a focus of National economic development.

The car culture in China is also increasing due to strategic government policies. In 1994 the central government industrial policy promoted the auto industry as a "pillar industry". (Lee Schipper Wei-Shiuen 2004) These policies directives are driving domestic demand and production of automobiles. China is forecasted to surpass the USA in 2010 as the largest market for cars (McNichol 2007) and the largest carmaker in 2020 (MacLeod, 2006). People's desire for automobiles increases as the product improves to become more efficient, safer, and less fuel consumptive. China hopes to satisfy those needs and produce automobiles for their domestic market as well as compete globally.

Funding

In 1997, the Highway Law decentralized the highway administration of China and placed more power on the individual provinces. The provinces were now able to plan, develop, and maintain the highway network through the Provincial Communications Departments. The central government of China, through the Ministry of Communications still regulates highway projects and maintenance; however, the provinces have a much larger role than before. Larger scaled projects that involve multiple provinces are planned by the MOC and approved by the PCDs. This results in the financing partially falling on the provinces. (Wu, et al., 2007)

The highways are thus funded on a comparatively riskier model than US highway system. To finance their highway development, China has their provinces undertake large loans, which borrow against the potential toll revenue of their province's section

of the highway. In addition, other portions come from various methods of funding established by the provinces or by the central government. The loans paid back by tolls make up about 70% of the cost of the highway construction project.

Further, the previous opening of the Chinese economy to market influences also allowed the country to take advantage of joint ventures with private enterprises and international bank loans. Companies like the Cheung Kong Group and New World Group, which are Hong Kong-based conglomerates, set up subsidiaries to invest in highways in China. There were over 80 of these public-private joint ventures used in the National Trunk Highway System financing. Also, the Asian Development Bank and World Bank issued loans of 1.70 billion USD to China. (Li, Shum, 2001)

The dominant part of the funding comes from the loans, while only a small part comes from the joint ventures and other private sectors. In the expressway system, about 10% of the financing comes from foreign investment. Further, to prevent foreign investment from growing, China has established a 25% cap on the ratio of foreign investment in projects. (McNichol, 2007)

The financing system then uses the “build-operate-transfer” method. For the first 25-50 years, the provinces would operate the tolls. The toll revenue, collected by the provinces would go to pay back the loans. After this time frame, the highway would then be transferred over to the public and no longer have tolls imposed on them. (McNichol, 2007) In that period of tolling, the revenues may also be used for operating expenses as well as debt repayment. The Ministry of Communications would be regulating these tolls, but they would primarily be operated by the provinces. Thus, there may be varying rates for tolls of different provinces. Provinces would generally set the rate using factors such as the return on funds invested, rates of neighboring tolls, user ability to pay, and expected traffic flows. (Wu, et al., 2007)

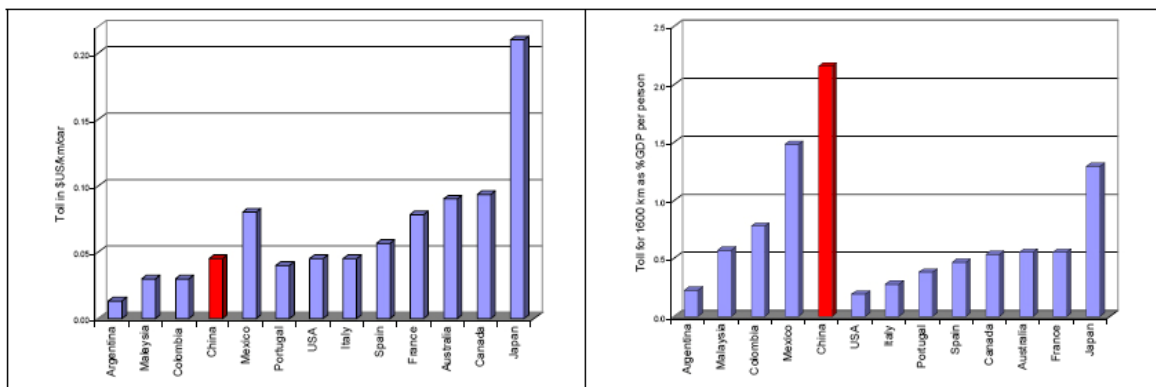


Figure 7 | Toll rate in China compared to other countries and the affordability of the tolls versus per capita GDP (Duncan, 2006)

made divides worse before they got better. After phase two implemented highway construction in the south-west, the travel times were shortened much more equitably across the country. However, the west was always at a disadvantage given geographical barriers. In the end, phase 2 cost was much more difficult and costly to implement, and produced less economic return than the eastern phase 1 portion. (Li, Shum, 2001)

Given the success of the NTHS system in connecting major cities and providing mobility more equitably across the country, more highway plans were made. The National Expressway Network (NEN), also called the “7-9-18” Highway Network called for even more highway construction. This plan proposes 7 radial highways from provincial capitals, 9 north-south routes, and 18 east-west routes. The goal is to reach more than 1 billion people, especially towards the more disadvantages areas of the west and smaller populated cities throughout the country. While the NTHS connected cities of populations of 500,000 or more (Li, Shum, 2001), this plan proposes to connect smaller cities with a population of 200,000 or more. It would also continue to enhance connectivity and travel times on the east coast, giving them access to expressways within 30 minutes of travel time. The new NEN plan would add 85,000 km of highway and would be schedule to be complete in 2020 (Wu, et al., 2007), which is the year that forecasters estimate that China likely to become world's leading carmaker. (MacLeod, 2006)

On a broader scale, there are many other national and global policies that have supported the expansion o the Chinese highway system. (MacLeod, 2006) Shortly before the completion of the NTHS, the World Bank Transportation Strategy Update stated the goal of helping partner countries establish transportation policies and services that are sustainable in terms of economics, environment, and social equity. (Wu, et al., 2007) Further, China’s own 5 year plans, especially the 10th and the 11th 5 Year Plans, indicate the strong desire to further enhance road transportation. In an 8-point strategy to complement this desired infrastructure, China established the following goals:

- Consolidate road transport industry, better regulatory framework;
- Improve quality and speed of passenger services;
- Raise quality and speed of freight services;
- Improve planning and management of freight terminals;
- Tighten safety management;
- Balance between tolls and other fees;
- Increase technology for efficiency and reduction of pollution;
- Better way of integrating policy, formation, regulation, planning, ops, and enforcement. (Wu, et al., 2007)

While it is not clear that they are going to successfully implement these goals, it is clear that they have these issues in mind.



Figure 10 | Interchange in Shanghai.

Safety

Road safety is a concern as the system expands and incorporates new users. Expansion of a new highway system requires a learning curve. Negative externalities of learning a new system are the fatalities and accidents. There was a 243% increase in traffic fatalities between 1975-1998. (Schipper Wei-Shiuen, 2004) Increasing motor vehicle use in urban areas where land use was designed for non-motorized transportation puts pedestrians and bicycle riders at risk. 45% of traffic deaths in China are bikers and pedestrians. (Schipper Wei-Shiuen, 2004) The Road Traffic Safety Law created in 2004 was a policy designed to provide basic safety rights for non-motorized users. This law intended to solve an issue of social inequality due to the high fatality rate. If a pedestrian is hit by a motorized vehicle, the motorized vehicle bears all responsibility unless the pedestrian deliberately caused the incident. Drunk Driving, driving without license, and speeding 50% over the post speed limit are also faced with harsher penalties. These issues are common to highway transportation systems. However, the regulations are only as productive as the enforcement that maintains them.

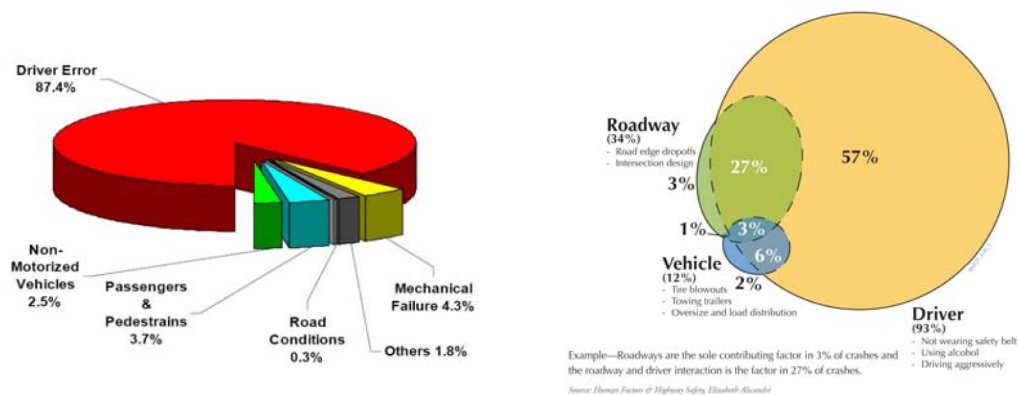


Figure 11 | Relative Road Fatality Causes for China (left) and the US (right). (Wu, 2007 & US DOT 2007)

Significance and Conclusions

China's highway transportation system developed similar to the Interstate in the United States except at a greater scale and speed. The United States and China constructed their systems as investments for economic development, public expansion, and military support. China's system began in the northeast and was created to benefit the industry in the area. The system was originally state owned as investment to help fuel industry and development. However, policies have changed with increased costs of maintaining the system. The NTHS uses tolls to make the system more market competitive.

The United States interstate system is the largest in the world, but is built out. The cost of building new links to the system has reached marginal diminishing returns. According to US House Rep. Jim Oberstar, Chairman of the Transportation Committee believes the nation has reached a transportation crisis and competition with China:

"Other nations recognize the importance of a strong public sector leadership and commitment to infrastructure, and are not being complacent in developing their transportation networks. Acknowledging the advantages our nation has enjoyed because of our transportation systems, they are taking steps to develop and expand their networks to compete with us in the global marketplace."

(Oberstar Forum, 2007)

The Chinese NTHS will expand expressway construction initiative sets a goal of reaching over 52,000 total expressway miles by 2020, connecting all provincial capitals and cities with a population of over 200,000. That would exceed America's now 46,000 miles of interstates. (Oberstar Forum, 2007) This is an issue of global competitiveness.

Discussion Questions

1. If and when China's NTHS surpasses the US, how will the US compete?
2. Is the United States "falling" behind in Highway expansion?
3. Should the United States attempt to out build China? Why or Why not?
4. How will increased Chinese auto use change their land use and environment?
5. What kind of incentives does the investment in the NTHS provide the Chinese auto industry?
6. What other industries benefit from NTHS investments?
7. How will China be able to afford the continual maintenance of this system without a current gas tax?
8. How does this investment create more social inequity or create an auto mobility division within Chinese society?

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