



E-ASIA
university of oregon libraries

<http://e-asia.uoregon.edu>

ECONOMICS OF TRANSPORTATION FOR CHINA*

BY

DR. J. A. L. WADDELL

Transportation for China may be divided into four primary groups, listed in the order of their importance as follows :

- A. Water
- B. Railway
- C. Highway
- D. Aerial

Waterways are more important than either railways or highways in that they are Nature's means of communication and because they cost generally but little for upkeep. They have also the economic advantage that steamboats carry more freight than railroads per unit of fuel expended. On the other hand, the streams, lakes and harbours in the northern portions of the country freeze in winter and thus block entirely transportation over them by boats. For this reason in cold districts it would not do to rely upon them solely ; hence it would be necessary to supplement them by railways or highways or, preferably, both.

Railways and waterways should be made to supplement each other ; and they should not be considered as rivals, for the latter should carry the bulky freight in places where they compete, leaving for the railroads the transportation of most of the passengers, light and perishable freight, express and mail.

Where rivers freeze, the bulky freight, such as grain, with proper prevision can generally be shipped by water between harvest time and the date when the waterways become ice-bound ; and that date in many important locations can be postponed somewhat by the employment of ice-breakers for keeping the channels and harbours open.

In America, where people are always in a hurry for everything, river and canal navigation has not received the attention that its importance deserves ; but the government there is beginning to awaken to a knowledge of the economic value of water carriage, for the construction of several great waterways is now being seriously contemplated.

In China, on the contrary, the waterways have always been the principal means of travel and freight transportation ; and immense sums of money have, very properly, been spent on bank protection and the building of canals.

I said at the outset that railways and waterways should not be considered as rivals ; but there is one place where they cannot help being such, namely, where they cross each other without tunnelling. In

* No. 2, of A Series of Memoirs entitled "Some Thoughts Concerning Economics in the Development of China."

America the river transportation interests often either oppose strenuously any proposed crossing of an important waterway by a bridge, or make such demands concerning its layout as to render its construction almost prohibitory. The railroads, on the other hand, feel that they, too, have some rights; and they fight for them vigorously. The arbiter in such disputes is the U. S. Engineer Corps, an organization of the War Department. It apparently has a tendency to favour the waterways side of disputes, perhaps because the maintenance of waterways is one of its regular duties. The consequence is that the railway companies and the promoters of toll-bridges, or the communities where highway bridges are needed, are forced to pay for their structures more than they can well afford—sometimes they are even prevented entirely from building. There is a happy mean, of course, and it should invariably be adopted by the arbiter when settling disputes concerning such river or harbour crossings. The bridge should not be allowed to interfere seriously with navigation, block prejudicially the passage of the water or affect adversely the regimen of the stream by causing scour of banks or shifting of the navigable channel. But arbitrary or unjust demands on the part of the shipping interests should be ignored, not only in the interests of justice but also because they militate against national progress.

This question of river crossings by railways and highways will arise some day in China, hence it is pertinent to discuss here the possible pros and cons of both sides of the controversy. The navigation interests may demand tunnelling, as that method of crossing does not interfere with them at all; but as tunnelling is almost always more expensive than bridging, the railway people would object strenuously and the highway authorities even more vigorously. Not only is a tunnel expensive to build, but sometimes it is costly to maintain; and it is always disagreeable to its users, who do not care to go below ground any sooner than Nature compels them to.

If the navigation interests do not demand a tunnel, they may insist upon a high-level bridge and one with an unreasonably long span or long spans. Both the owners and the users of the structure would object to this, first, because of the large initial cost, and, second, because of the high climb, which would involve both loss of time and much expense.

The railway or highway people, as the case may be, will generally offer a low level bridge with as short spans as they think the deciding authority will accept; and the navigation interests will probably fight this proposal "from the word go"—possibly with good reason. They will say that the proposed structure would be a menace to navigation on account of the restricted channel and the danger of a vessel that is out of control running into a span and seriously damaging both itself and the structure. There is a good deal of sense in this claim, but it is not of enough importance to warrant compulsion of the railway or highway to climb to an abnormal height. The best compromise is to adhere to a low-level structure having its vertical clearance sufficiently great to permit small river craft to go beneath the fixed spans, and giving enough height at the movable span to pass, without any possibility of interference, the tallest-masted vessels that navigate the waters to be

traversed by the structure. The spans should be long enough to avoid undue interference with the current and injurious scouring of the river banks.

When the building of lorries (generally called motor-trucks in the U.S.A.) and motor-busses was started in North America there was conflict initiated between their owners and those of the railroads they paralleled. In self defence the latter sometimes inaugurated bus lines and motor-truck lines of their own. To-day, however, it is pretty generally recognized that such lines make good feeders for the railways; but they should run transversely to them and not parallel. For China it would be best to build a few long railroads as main arteries of travel with an occasional cross line of railroad where some distant place of importance is to be reached, and have a sufficient number of highway feeders on each side of the railway to carry the exports and imports of the entire district that the line is intended to serve. It must be remembered that in China railroads are expensive and that macadamized highways are comparatively cheap; hence the latter should be built as feeders to the former, instead of branch lines of railroad.

In respect to the economics of railway operation in China, much might be said as to details, but space will not permit, hence my following remarks will be confined to the major problems thereof.

- A. Shipping in bulk instead of in small parcels or packages is truly economic; and the railroad management should teach its patrons this axiom. Charges on car-load lots can be made considerably lower than those on small-bulk shipments and still leave a good margin of profit.
- B. Return freight should be sought so as to avoid the hauling of empty cars, which practice, on the face of it, is uneconomic.
- C. To as great an extent as feasible, trains should be made up of cars destined for the same station, so as to avoid loss of time and money in switching. When coal or ore is shipped over the line there should be trains of cars loaded solely with these freights.
- D. High speed of trains, although augmenting the fuel consumption and the wear and tear of rolling stock, will save so much in time as to make it economic; but, of course, for each kind of train there is one rate of speed that is more economic than any other, and the management should endeavour to adopt it on all occasions. The economic speed is a function of the quality of the fuel; and an investigation should be made on the economics of the various kinds of coal available.
- E. A weak bridge, imperfect track, or any other condition that necessitates the placing of a slow order for trains is uneconomic, in that it increases the time of travel between termini. The cost of operating trains is an inverse function of their average speed (including stops); consequently anything that tends to reduce the number or to shorten the lengths of stops, or to prevent the slowing up of trains is conducive to economy.

- F. A well maintained track is economic, because it not only permits of high speed but also reduces the wear and tear on the rolling stock.
- G. Proper up-keep of locomotives and cars is economic, for the reason that breakdowns thereof cause delays—and delays cost money.
- H. A good *esprit de corps* and a fine spirit of loyalty among the railroad employees are conducive to economy, because they militate for increased efficiency and effort, and, consequently, for augmented output and reduced expense.
- I. Idleness of employees or any waste of their time is uneconomic. Whenever they run short of useful occupation, the management is at fault and should be brought to task.

As for the economics of the building, operation and maintenance of highways in China, it may be said that, for the present, it would not be economic to adopt any road surfacing that is more expensive than macadam. Of course, concrete or bitulithic pavement would be better, but just now it is beyond the means of this country. The grading can be done inexpensively on account of the cheapness of Chinese labour. Cuts should be avoided, unless so doing would increase the grade beyond the desired limit. The roadbed should be thoroughly rolled with a heavy road roller operated by mechanical power, and the layers of earth when placed in embankments should be limited to about six inches in thickness. The macadam surfacing should be not less than ten (preferably twelve) inches thick, and it should be constructed according to first class specifications—such as those given on page 1837 of my “Bridge Engineering.” The width of the macadamized surface should be twenty feet for two lines of vehicles, with ten feet more for each extra line provided for. The drainage, which is the most important feature of either road or railroad building, should receive the utmost consideration and care. This matter is of such extreme importance that one of the memoirs of this series will be devoted entirely to its discussion.

The limiting load for any truck, including its own weight, for a macadamized road in China should be five, or at the very most, six American short tons. No narrow-tired vehicle, excepting only jinrikishas for carrying passengers, should be allowed on the finished road. Of course, up to a certain reasonable limit, the greater the carrying capacity of a motor-truck the greater the economy of operation; but this presupposes a truly hard-surfaced road. When the wheel load becomes so heavy as to break up the macadam surface or to force it into the supporting soil, the damage done will over-balance the economy of the greater capacity of vehicles.

The same remark applies also, but in a lesser degree, to auto-busses. If these are provided with amply wide tires, the question of their load being too great for the road surface is not likely to arise.

As for the economics of the different kinds of power for highways, I would list them thus:

- A. Mechanical power B. Animal power C. Man power

For other places than modern highways, I would list the methods of carriage, from the economic viewpoint, as follows :

- | | |
|---------------------|--------------------------------------|
| A. Horse-drawn | F. Wheelbarrows |
| B. Camels | G. Sedan chairs and dandies |
| C. Pack horses | H. Freight-poles for two or more men |
| D. Jinrikishas | I. Back loads for men |
| E. Man-pulled carts | |

On waterways the methods of carriage, arranged in the order of their economics, will generally be found to be as follows :

- | | |
|-------------------|--|
| A. Large steamers | D. Sailing junks |
| B. Small steamers | E. Small boats operated by rowing, poling, or dragging |
| C. Motor launches | |

There is some doubt about the correctness of the position on this list of item C; for it is conceivable that under unfavourable conditions, sailing junks or small boats operated by man power might be more economic in freight carrying than motor launches; but when the latter are large and when there is an ample depth of water to float them, they certainly are superior.

There is a feature of economics in both construction and operation that must not be forgotten, namely, that what may be cheapest for the contractor or the operator may not be best for the nation, because the great mass of the people must be kept employed and fed, even if figures show that such employment is uneconomic. But this point will be treated in a future memoir entitled "Economics of Labour for China."

At first it is probable that the newly constructed highways would be used by horse-drawn wagons and carts, pack animals, jinrikishas, man-pulled carts, sedan chairs, dandies, pole-carriers, and pedestrians; but the slow-moving wheelbarrows with their heavy loads and comparatively narrow tires should not be allowed upon it, nor should any other narrow-tired vehicles except passenger-carrying jinrikishas. Sooner or later the pack animals and pedestrians (including those carrying sedan chairs, dandies, and poles) would be compelled to use paths adjacent to the road, built along the berms, and the slow-moving carts and, eventually, even the jinrikishas would be displaced by lorries and motor-busses, either for economic reasons or by governmental edict. The proper place for these, and some of the other crude conveyances of freight, to function is the cheap side roads of the country districts that would be needed as feeders for the main highways and their branches.

As for aerial transportation, the time when it will be most needed is the next decade, so as to carry mail, express and occasional passengers to distant points all over the country. After the railroads and highways in any district are in full operation, there will be no such crying need for airplane transportation as there is to-day, hence most of the planes could be moved to more remote districts, leaving only a few for extra-rapid travel of mail and for policing the country.

A well thought out system of aerial transportation should be installed without delay; for not only would it serve the purposes just mentioned, but also it would enable the Government to quell uprisings and to preserve peace and order throughout the Republic.