

## Road construction in Eighteenth Century France

Anne Conchon

In eighteenth century France only a few streets in towns were cobbled, and the road system was in a poor state. The term “road” can encompass anything from a paved highway to a mere pathway surfaced with heaped-up earth. In the last fifty years the literature on road improvements in France during the eighteenth century has given prominence to the achievements of Pierre-Marie-Jérôme Trésaguet (1716-1796). The purpose of this paper is not to add a further contribution to previous research on improvements in road haulage and the roads themselves, but to discuss how technical improvements and a movement towards standardisation during the eighteenth century involved changes in the organisation of labour. This paper is divided into three sections. In the first section I want to underline the institutional and financial methods of building and repairing the roads during this period. Secondly, using a variety of sources (estimates, technical treatises, maps, deals etc.) I would like to build a reliable picture of road construction, showing the various techniques adopted, and finally I would like to suggest that improvements in road construction and maintenance involved only a few highways because the system of feudal tolls and statute labour prevented their widespread adoption.

### ROAD BUILDING POLICY

During the eighteenth century the growing volume of haulage required increases in infrastructure and the widening of bridges. Many roads could only be made suitable for wheeled traffic if the narrow packhorse bridges were replaced by bridges wide enough to carry carriages and carts. There were numerous complaints from contemporary road travellers and road users about the extensive gaps, roads that were impassable for coaches, the high costs of travelling, potholes that could snap the axles of wagons and the many bridges in ruins. If Arthur Young, who travelled in France between 1787 and 1789, was complimentary about the road system, it was because he travelled on main routes after the completion of spring work by statute labour, and in areas such as Languedoc and northern France, which had above average roads.

Because of the inadequacy of public finance and administration at this period, the maintenance of transport infrastructure was normally a local responsibility. Landowners bordering the road were responsible for maintenance, notably by raising the height of the middle of the road and pruning trees. Sometimes local nobility were also authorised to collect tolls on goods using repaired bridges or roads, but they had neither the means nor the desire to build roads, and in many cases the tolls collected were not spent on road repairs.

Generally, the eighteenth century witnessed serious efforts to create new roads and to improve existing roads. The extension of the road network during this period added the question of road maintenance to the problem of construction. If the government made considerable efforts to build new roads, these roads were repaired only when they had deteriorated badly and complaints were vociferous. The question of how best to maintain well-repaired roads centred less on the repair techniques to be used than on the type of restrictions, which should be imposed on road users. In order to prevent deterioration from the cutting and pounding action of carts, the state attempted to restrict weights and regulate wheel width. In the second half of the century, largely due to the interest shown by the government, more attention was given to the state of the roads and ways in which they could be improved. Road construction and maintenance were increasingly the responsibility of local *intendants* and the highways department. They fixed the details of new routes, decided which sections of road would be repaired, and stipulated how the work should be done. Jean-Rodolphe Perronet, director of the highways in the *généralité* of Paris, improved and built more than 600 *lieues* of roads (approximately 3,000 kilometres) over a period of thirty years. Civil engineers decided the location of bridges, and gradually stone bridges which could support heavy wagons, replaced the wooden bridges and numerous ferries. They were provided and maintained not by statute labour but at the expense of public funds, and their building was supervised by civil engineers. The highways department budget rose from two millions *livres* in 1726 to 25 millions on the eve of the French Revolution (about 4% of the royal budget). In a few cases, some provinces (the *pays d'états*) - for example Languedoc - constructed and maintained roads on their own initiative.

From 1738 onwards the monarchy resorted to statute labour. Whereas in England from the mid-seventeenth century onwards unwilling and inefficient statute labour was replaced by wage labour, and turnpike tolls financed road building, the French pattern was the complete opposite. The monarchy began to classify roads according to their economic or strategic importance. Priority was given to major thoroughfares used by the postmasters and to the main highways from Paris to the frontiers and the ports. Royal instructions defined the width of different kinds of roads: the widest were three lane roads with a paved road in the middle and two dirt tracks (*bermes*) on either side. Unpaid duty-service was generally used in France after 1738, in order to build toll-free main roads and to keep them in good repair. This continued until the French Revolution and during this period some 24,000 kilometres of paved roads were built.

The employment of pauper labour was also widespread for excavation works from 1775 onwards whenever special repairs or improvements were made to the highways. These workers were divided into groups according to physical strength and paid at a rate lower than the current wage.

## **BUILDING TECHNIQUES**

Even though methods of road repair did not change radically, attention was paid to them during the eighteenth century. The basic ideas on building and repair were put forward by civil engineers, who

began to produce theories about the practice of construction, advocated technical advances and applied general principles of good road building. However there are few technical treatises, as the process of road building was of less interest than the process of bridge building. Gradients were improved by cutting through hilltops and narrow and crooked roads were widened and straightened. Most writers and engineers agreed that roads should be built straight, as this allowed for simpler construction (Lecreulx 1782, p. 53). The common aim of eighteenth century innovations was to create roads that were cheaper to build and easier to maintain. The system of roadbeds proposed by civil engineers, such as the famous Trésaguet, allowed for a reduction in both the work force and building costs, which meant that more work could be completed.

There are three main features of road repair which must be considered: foundations, road shape and surfacing. First, roads require a solid base protected by a layer of loose stones. They should be constructed on a foundation of rammed-down soil bound with stones, and covered with gravel or sand. The main cause of bad roads was standing water on road surfaces, which soaked the base and caused it to shift or sag. Making the road surface convex ensured that drainage could take place. Experiments seem to have produced a consensus of opinion amongst civil engineers in favour of a moderately convex surface, artificially constructed of small pebbles and gravel. Wide ditches should carry the water away and be kept clean. The construction of drains and arches allowed watercourses to pass under the roads. Finally, the question of road surfacing was closely related to the strength of materials (flints, pebbles, sand, broken stone, cast gravel, ballast etc.). Hubert Gautier, a civil inspector, showed great concern about the kinds of materials suitable for road surfacing. He distinguished three kinds: cobble-sandstone used for the paved highways around Paris and for the streets in the capital city, pebble and metal. Because of the price of cobbles and paving, more and more civil engineers recommended broken stones for cruder surfaces.

As a result of his experience on the highways of Limousin, P.-M.-J. Trésaguet wrote a treatise in 1775 about road construction, as a blueprint for civil engineers. He dealt with different kinds of geographical constraints (hills, plains, boggy soils), recommended reducing the width of the road, removing ditches on one side of the road, and not exceeding a gradient of 7% incline (Yvon 1986, pp. 306-309, Arbellot 1973, pp. 770-771 and Goger 1988, pp. 67-72). In the middle decades of the eighteenth century another civil engineer, Saint-André, improved the building of mountains roads. Trésaguet's main innovation concerned gravelling techniques. He believed cobbles were more expensive than metalling (even paved surfaces made from setts were superior to those formed from broken stones) and that with a reduced thickness of a roadway it was possible to reduce construction costs. Foundations should not be more than 10 *pouces* (about 25 centimetres) deep. The road should be built on carefully constructed foundations with a domed surface of small rocks. First a base of large pointed stones should be carefully placed by hand on edge rather than flat; then a second layer of broken stones was laid with a sledgehammer, to ensure there were no gaps between the stones; finally these foundations would be covered with 3 *pouces* deep (about 8 centimetres) of small hard stones that had been broken with a hammer to the size of a walnut.

These new methods for building roads were relatively expensive and the new roads required regular maintenance. Trésaguet assumed that building contractors would be paid a lump sum to place materials at intervals along the roads, and to employ road menders to be in charge of the repairs and resurfacing of a given stretch of road. The costs of repairing roads made of broken stones were likely to be higher than those incurred with paved highways. This was probably the reason that this system was used primarily on main roads. For example, Trésaguet's techniques were adopted slowly, and only around Paris and in Limousin. There is a strong similarity to Thomas Telford's methods but after the French Revolution, MacAdam's technique was introduced in France. Perhaps the Scottish engineer had improved on Trésaguet's method. The two methods are similar, except that MacAdam thought that the foundation layer was unnecessary if the base on which the road to be built was sound.

Building practices generally reflected the lack of theoretical advance. Roads were constructed in various ways, not all of which were in accordance with the principles advocated by civil engineers. Haphazard methods of road construction and maintenance continued to prevail throughout the majority of the road network. At the national level the quality of the roads was also very varied: in the North, the highways were often paved and well-kept, whilst in the mountainous regions of the South they were tricky to build. The variations in technique were partly a result of the different characteristics of relief, soil and climate. Nevertheless a great part of the road network, such as the byeways, remained as hardpacked earth (Lepetit 1984, pp. 54-58).

It is difficult to reconstruct an accurate picture of repair methods because the instructions to statute labour were often vague. A few directives stipulated how the materials were to be used, but detailed procedural directives were seldom made. The mayor was simply instructed to provide teams of workers. This suggests that on many roads the types of material and their use may have been ill-considered. The ballast bed of stones was sometimes so soft that they were immediately crushed and flattened.

Private contracts for the building or the maintenance of paved roads were numerous. It was difficult to put this type of work up for tender, as it required mobile teams which were hard to monitor and which generally gave a rather modest return. Both in the estimates and in the agreements the organisation of labour was very carefully defined. The quality of the materials, the re-use of existing material, the location of quarries, the number of workers to be employed, and the numbers of the masters, journeymen and apprentices with their precise qualifications were all specified in the agreements. The greatest expenses incurred in repairs were those for materials and carting. With statute labour, the poorest countrymen had to be employed to extract and prepare the materials, and carters had to be hired to haul the materials to where they were required. The areas in which quarrying was permitted were strictly controlled and it was forbidden in enclosed properties. The kind of materials used for a road depended primarily on what was locally available. Although gravel seems to have been commonly employed, pebbles, flints and broken stones were also used, but generally road materials were of poor quality.

## LABOUR AND ROADWORKS

The organisation of labour has been widely studied. The engineer drew up a detailed estimate of the length, width and gradient of the road, the nature and the quantity of works to be done by statute labour, or the number of parishes along the roads which would be involved and the length of the roadworks. There were a number of tasks involved in the construction of the thoroughfares such as excavation, embanking and paving. The parishes along the road were obliged to provide carts, horses, tools and men. An edict announced the date on which the works would begin and the nature and the quantity of work required of the inhabitants. On the day the works commenced, the engineer with the *subdélégué* assigned different tasks to the assembled labourers. Those liable for statute labour were required to form teams of eight or ten persons. The *picqueurs* were in charge of superintending the works and the workers were employed to fill ruts, to excavate, to quarry stone or gravel, or to transport the material necessary for the construction of the roads. If the road works were unfinished because a large number of labourers failed to appear, the work was given to a building contractor at the parish's expense.

Work on bridges involved the employment of masons and carpenters, and paved roads were constructed by skilled pavers. For the sake of safety, stakes were placed around the stretch of road under construction or maintenance. Workers were forbidden to leave the roadworks in order to keep to the deadline for the completion of the work. Although most of the labourers were men, there were some teams of women making the mortar on the roadways in Brittany (Vignols 1931, p. 362).

The main objection to employing peasants or paupers was that they did as little work as possible, and what work they did do was often done badly. Statute labour used for mending roads was both unwilling and unskilled in the art of road making. The system presented other problems such as the seasonal character of the work: the *corvéables* could be called upon only once or twice a year for few days. Most road repair work was undertaken in the springtime and the autumn. Paid workers were not only better motivated but could repair the road whenever needed. Many administrators suggested replacing statute labour with a tax that could finance professional labourers.

The practice of commuting statute labour was progressively introduced in the second half of the eighteenth century. Contemporary enlightened opinion seems to show that professional contractors were better able to construct and repair the roads than were the peasants. A few reforming *intendants* – Orceau de Fontette in Normandy (1758) and Turgot in Limousin (1762) agreed a lump sum with parishes in place of statute work. With wage labour replacing inefficient and unwilling statute labour, it became possible to have unified control over long stretches of road formerly repaired by many parishes. The rise of a professional workforce was generally associated with the growing awareness of the need for greater technical competence. But were the areas which replaced statute labour with a tax more likely to adopt better methods of road making? The fact remains that until the French Revolution the *intendants* and the civil engineers employed pauper labour, statute labour or paid labour as available.

In conclusion, we note that despite new principles of road construction and maintenance being adopted in the second half of the eighteenth century, the evolution of the techniques themselves and improvement of the road surface was very slow. Even though the main radial highways were built, much of the 40,000 kilometres of road network planned in 1738 existed only on paper. Road building experienced a serious crisis during the French Revolution, when military transport caused considerable damage to main roads. Slowness of construction and subsequent neglect meant that as late as 1820 important parts of the road network were still incomplete. It was not until the 1830s that French road building techniques underwent a pronounced change under engineers such as Navier, Schwilgué and Coriolis.

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