



Review of the major factors influencing road development during the XXth century

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The written paper contains a detailed review of the major factors influencing road development during the XXth century.

In a 15 minute presentation, it is only possible to highlight the key points made in the paper.

The determining factors fall into two categories:

- *conditions existing at the end of the XIXth century, and*
- *influences during the XXth century.*

I will now discuss each in turn.

A. Conditions existing at the end of the XIXth century

A1. Many existing road systems had fallen into *disrepair* and few new roads were being built;

- Governments were devoting their transport resources to their local and regional rail networks.
- For 50 years rail had been seen as *the* land transport solution,
 - burgeoning operating deficits in the rail systems were only just beginning to alter that view.



A2. Horses

The use of horses had reached practical limits and changes were being demanded.

- Streets had become unpleasant places, with widespread horse excrement, occasional horse carcasses, and much associated dust, muck and stench.
- There was not enough farm-land to breed and feed all the animals needed to service the transport task.



A3. Growth

- Cities were continuing to grow disproportionately as the effects of industrialisation continued.
- Travel speeds had caused Marx' annihilation of space by time



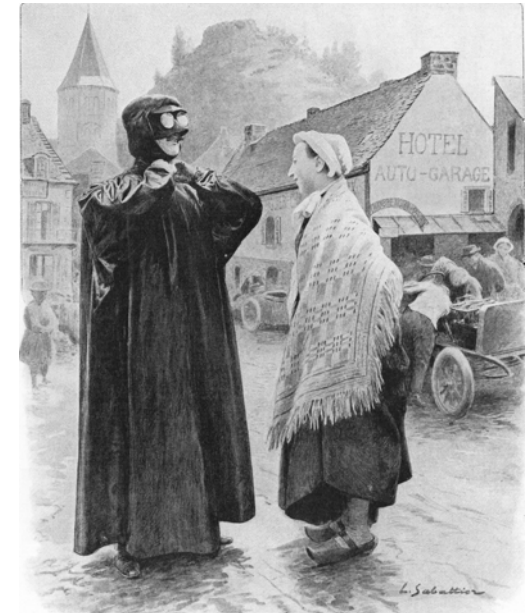
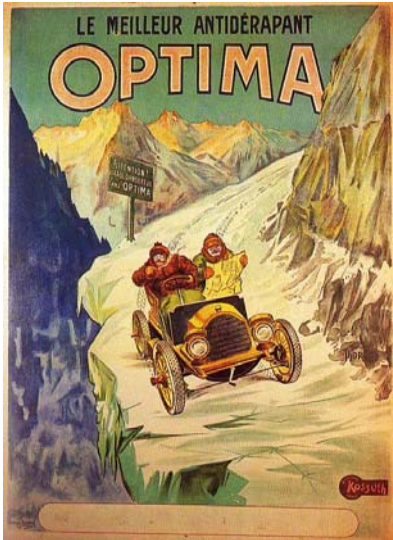
A4. The City Beautiful

- The XIXth century “City Beautiful” movement had given much strength to the view that a city’s transport problems were best solved by extensive demolition and rebuilding.
- This urban design charter was carried into the XXth century, particularly via the “parkway”.
- The concept was popularized by the development of Central Park, New York, in 1858.
- We’ll return to this factor later.

A5. Filling the vacuum

The newly invented internal-combustion cars and trucks were travelling at speeds far beyond the capabilities of:

- Road surfaces,
 - The new cars produced dust, and
 - The new trucks produced ruts.
- Road alignments, and
- Road regulations.



Vehicles powered by internal-combustion engines burst onto the scene like new puppies, with limitless energy and little care for the consequences of their leaps and bounds.



These new vehicles provided their XXth century users with historically unprecedented and unforeseen levels of:

- service, availability, timeliness, convenience, comfort, weather protection, security & safety**
- low perceived cost**
- all at speeds that people had never experienced in the days of the horse and carriage.**

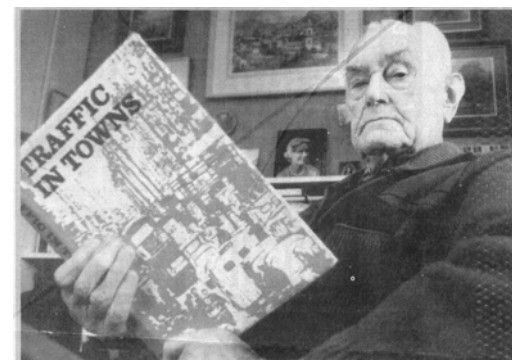
To this pragmatic list of car virtues, we can add the extra, exhilarating dimensions of

- independence, status, pride of ownership,**
- power, privacy, style,**
- love and danger.**

A major XXth century consequence is what I once proposed as the First Law of the Car:

→ *if you have a car, you will use it wherever and whenever possible.*

The proposition was first articulated by Buchanan in the 1960s.



■ Professor Sir Colin Buchanan

Influential planner who
cared about place
22-8-1907 — 6-12-2001

engineers who shaped so
much of the British empire.
Born the son of the water
engineer in Simla, he was

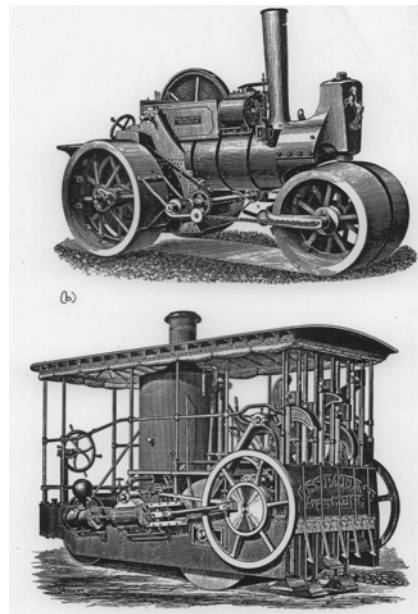
1959-64, Ernest Marples, ...
preparing for a trip to America
in 1960 — and anticipating a
debate triggered by increasin

A corollary of the Law is that:

→ *people who don't use a car are those who are physically unable to do so.*

A6. Roadmaking technology was well advanced with the:

- engineering work of McAdam, Telford and Malo,
- invention of asphalt and concrete roads, and
- availability of explosives, mechanical excavators, stone-crushers and steam-rollers



B. Influences during the XXth century



B1. The City Beautiful / Parkway / Motorway

- ➔ **The initial stages of the Long Island Motor Parkway in New York State were built on private land in 1906 as a single asphalt carriageway, 10 m in width and 10 km long.**
- ➔ **The rapidly changing market led to it being opened to the public in 1908 as a toll road for cars only.**
- ➔ **It was the first public road to eliminate intersections and bank its curves,**
 - **provisions that had not been needed in the low speed pre-car days.**



A core new concept introduced in the parkways and subsequent motorways was that adjoining land-owners had no rights of access to the road.

- Access was only possible at specially designed, grade-separated intersections.**
- Access restrictions had not been necessary along the pre-IC roads (except immediately adjacent to a toll-gate).**
- The concept was strongly resisted by influential sectors of the first generation of XXth century road engineers, although**
 - it could be justified by reference to rail systems which had protected rights-of-way.**

- ➔ In many ways these parkways were similar to today's motorways,
 - but were usually designed for lower speeds & thus had less generous alignments
- ➔ The first of the XXth century parkways was the 27 km Bronx River Parkway, curiously recommended primarily to clean up the banks of the Bronx River and protect animals in the Bronx Zoo from water pollution.



- ➔ The design speed was 60 km/h and no trucks were permitted.
- ➔ The Parkway was widely acclaimed by the local community and set road design standards for the next 30 years.

Between 1913 and 1921 a private German group called AVUS - Automobil Verkehrs und Uebungsstrasse - built a straight, dual carriageway, controlled-access road of about 10 km in Berlin.

- ➔ If it had not been for the narrow unprotected median between the two carriageways, it would have been the world's first motorway.
- ➔ The expanded road remains in operation today as part of the E51 into Berlin

- ➔ **The AVUS idea captured the German imagination, particularly as it had the potential to alleviate massive local unemployment.**
- ➔ **A team travelled to America to inspect its new parkways, returning to Germany intent on building Germany's new roads to a grander, straighter scale.**
 - **For example, autobahn design speeds were set at 165 km/h, about double the values by then in use on the US parkways.**
- ➔ **Other aspects of the alignment - such as ramp geometries - were below modern motorway standards. These standards were later raised by US engineers, on the basis of the shortcomings of the first autobahns.**

The first autobahn was a 20 km stretch from Bonn to Cologne which was built in 1929-32.

- The road had two lanes in each direction separated by a coloured line and probably just qualifies as the world's first motorway.**
- The autobahnen and the associated motorization rapidly became major items in the Nazi PR campaign and a key part of the infrastructure of the German war machine.**

- ➔ Idealistically, autobahn construction was viewed as a trial mobilization and as embodying Nazi ideals of national character, spirit, strength, and beauty.
- ➔ More pragmatically, it was seen as relieving unemployment, encouraging the car industry, and promoting tourism.



America had been planning a national road system prior to the out-break of the Second World War. With post-war reconstruction in mind, President Roosevelt appointed a National Interregional Highway Committee in 1941.

- In 1944 it recommended a National System of Interstate and Defense Highways. The concept first appeared formally in the 1944 Federal Aid Highway Act and had a strong military basis.**
- In 1954 President Eisenhower appointed a committee under General Lucius Clay to study American highway needs.**
- The Interstate System was signed into law by President Eisenhower in 1956.**

B2. Urban road building

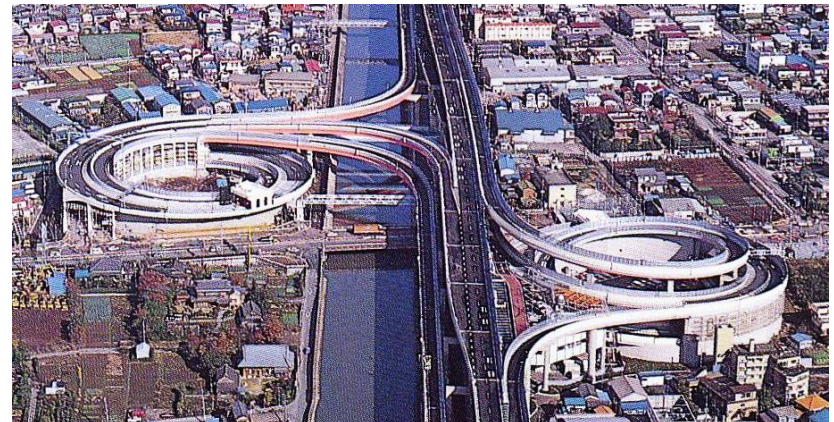
- **Somewhere between 1944 and 1962 a new urban direction was subtly added to the Interstate philosophy . The urban extension had strong congressional support as it was seen as a major job creation measure.**
- **The first mention of urban routes was in 1947. By 1956 about twenty percent of the IS system length was in urban areas.**
- **It is said that Eisenhower, seeing a motorway being built to enter Washington, telephoned officials expressing disbelief that this could be part of his Interstate System.**

- The urban motorway was introduced at the same time as the Urban Renewal Act permitted the demolition of urban “slums”.
- The process had much in common with the XIXth century City Beautiful movement.
- The dimensions of the urban motorway took it beyond the human scale and dramatically altered urban environments – often to their detriment.
- In a memorable quote Robert Moses stated that *“when you operate in an overbuilt metropolis, you have to hack your way through with a meat axe.”*

- One of the inherent problems with the initial approach to urban road development was that it transferred rural design standards to urban areas,

→ as if there was some virtue in being able to travel uninterrupted at 100 km/h through inner city areas.

The major move towards rational design standards for urban areas came from Japan where projects in Tokyo and elsewhere demonstrated how design for lower operating speeds permitted quality motorways to be tightly fitted into existing urban areas.



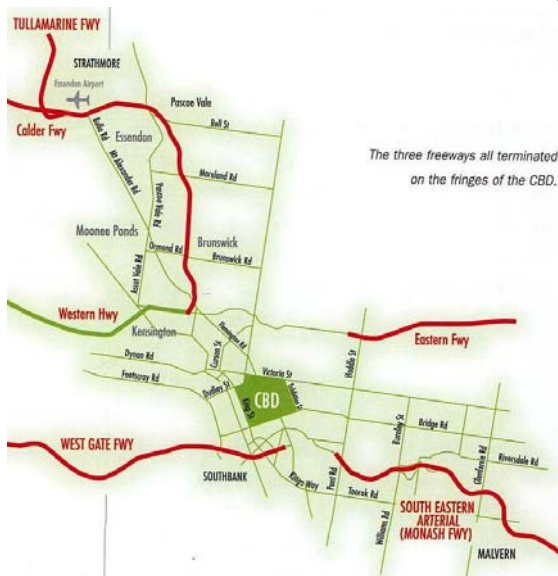
Cities throughout the world watched the aftermath of America's new urban freeways, noting both the good and bad points.

- One key lesson was that the land-take associated with freeway nodes, particularly if serving a set of radial routes, was so enormous that such nodes would eliminate an entire down-town area.**
- A turning point occurred in 1959 when citizens of San Francisco halted construction of the Embarcadero (I 480) Freeway – an elevated structure along the San Francisco waterfront. Their actions were successful and the last remnants of the motorway were removed in 1991.**



It was not until the large-diameter urban road tunnel became feasible that cities once again began to have some confidence in urban road-building. For example:

- when the CityLink motorway opened in Melbourne in 2000 with 5 km of urban tunnel it was arguably the first urban motorway in the world to alleviate existing traffic problems without creating any new traffic concerns.



Similarly, the Central Artery/Tunnel Project in Boston removed the elevated structure which had dominated the Boston streetscape and created huge traffic problems.

The tunnel plan eliminated the eyesore, improved traffic flow, opened up the city's waterfront and riverside, reduced community severance and provided citizens with new parks and open space.



B3. First World War

IC trucks had first been used in the Boer War late in the XIXth century.

→ The years preceding the First World War had been a time of military preparation. France began equipping its army with trucks in 1907.



- ➔ **A major impact of the First World War was the acceptance of the IC engine as a practical, useful operating device.**
 - **This particularly applied to the truck which by then was carrying freight at costs per tonne-km which were a quarter below those of rail.**
- ➔ **After the War, Marshall Ludendorff of the German Army declared "victory in 1918 was the victory of French trucks over German railways."**

There was little road development during the decade of the War, but at its end the world had a surfeit of trucks and of young men whose only peacetime skill was to operate and maintain trucks.

- As one consequence, the US gave 24 500 trucks to its State highway agencies for use in road construction.**
- Further, to demonstrate the peacetime effectiveness of the truck, in 1919 US General Pershing organised a convoy of 79 trucks and 300 soldiers including Dwight Eisenhower to undertake a demonstration drive across the USA.**

B4. Between the Wars

When the First World War was over, the initial surge in development was in the US, by then the world's industrial and rural powerhouse.

Car manufacture,

- which had begun in Germany,**
- then transferred to France with its better roads,**
- was now centred in Detroit where Henry Ford's cheap, mass-produced T models were providing cars for all. Their price bottomed at \$260 in the mid-1920s.**



- ➔ **From being a transport mode for the elite and the dilettante,**
 - **the car and truck were now available to all and were an essential tool on every farm.**

- ➔ **Ordinary voting citizens were converted from car-haters to car-lovers.**

- ➔ **There was thus a widespread emphasis on applying a hard and wide pavement surface to the existing two-way road network.**
 - **Before long, most of the USA was linked by an all-weather road system.**

The Depression had a major impact on XXth century roads.

- Road-making has always been a source of work for the otherwise-unemployed and so the Depression saw increased road construction throughout the world.**



Traffic regulation mainly developed in the between-Wars period.

- Speed regulations were inherited from the horse-drawn era'**
 - They were one of the first tools used to attempt to control the car.**
- The concept of design speeds for roads was formalised during the 1930s with the realisation that the new cars could easily “out-drive” existing road alignments.**



- As a consequence, minimum curve radii on new roads gradually increased from
- the 50 m endorsed at the first PIARC Congress
 - to 150 m in the 1920s
 - to 500 m or more at the end of the century.
- This one change meant that, at a grand scale, the new XXth century roads bore little visual similarity to their predecessors.



B5. After the Second World War

- Formal transport planning began in the XIXth century railway era.**
- Between the Wars, there was a steady increase in traffic counting and censuses. Aided by improved computers, predictions were applied to planning inter-city roads.**
- The application of such numerate planning to cities began in the 1960s but was thwarted by some key problems.**

- **The initial software took no account of capacity constraints, leading to optimistic designs.**
- **The data used was far from adequate. For example, the key variable set in the first models was future population prediction and these predictions were often grossly in error.**
- **The models were over-calibrated and tended to enhance, rather than manage, any profligate current trends.**
- **The models inadequately allowed for traffic generated by the proposed new roads.**

By the late 1970s the models were beginning to deliver more credible outputs

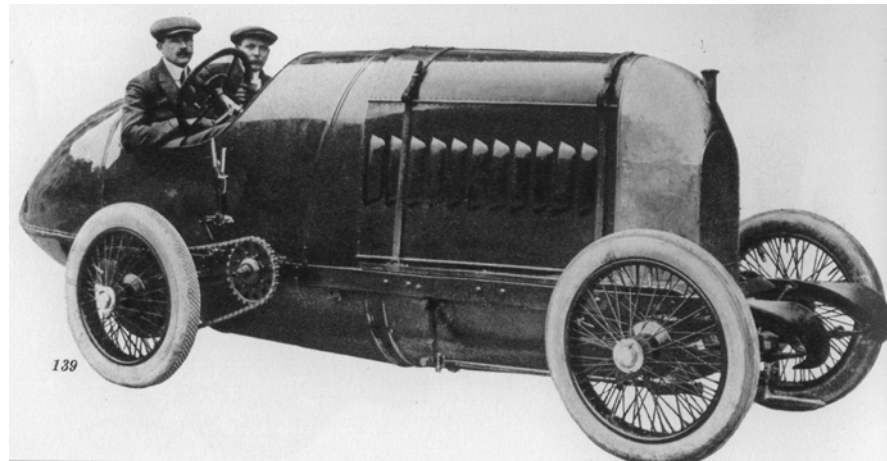
B.6 End of the century

The last part of the XXth century was marked by:

- *continued growth in road use,*
- *spectacular road building, and*
- *some strident resistance to new road building.*



- Whilst citizens have always resisted losing their land to road building and objected to “outside” traffic, the more recent complaints have had a broader, more philosophical basis.
- The objectors gained strength through Lewis Mumford’s articulate criticism of the American urban motorways in 1957 and the issues were more recently compounded by widespread concerns about pollution and sustainability.



And when more transport has been provided, the community has used it to improve accessibility rather than to satisfy demand.

Thus a significant consequence of the provision of radial urban motorways has been to increase the length of daily commuting trips.

Nevertheless, as cities around the world observed the worst excesses of the early urban motorway programs,

- a new level of design sophistication and environmental awareness arose and as a result many more recent projects have been sensitive and compatible parts of the urban environment.**

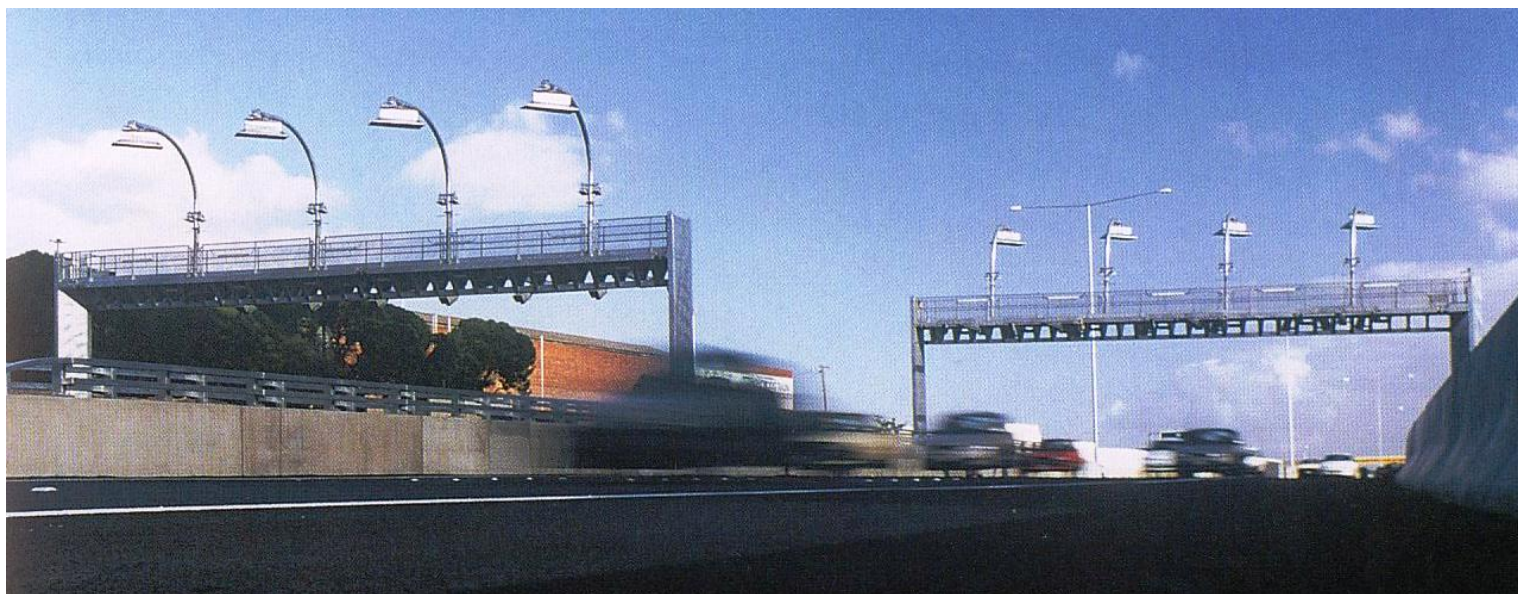


Toll roads were widespread in pre-rail portion of the XIXth century.

- There was a resurging growth in the second half of the XXth century, particularly in France, Spain, Italy and parts of the USA.**
- Initially, a major drawback was the fact that toll-collecting plazas required about five times the normal width of the toll road, making them inappropriate in many locations.**

However, the development of electronic tolling in the last decade of the century removed that impediment and has particularly made urban toll roads feasible.

Electronic toll collection began in the 1990s, commencing on a large-scale with City Link in Melbourne and Route 407 in Toronto.



The key topics of:

- 1. interurban roads,**
- 2. traffic control and**
- 3. road safety**

are covered in the published paper but I have no time to discuss them in this verbal presentation.



C. Conclusions:

The new cars & trucks with their rapidly changing and ever-improving technologies, encountered a road system which was old, ponderous and difficult to change, even with the best of intentions.

The story of roads in the XXth century has thus been based on the dichotomy between:

- the enormous advantages of the car and the truck on the one hand, and on the other hand**
- their peripheral - yet often overwhelming - effects on all other aspects of XXth century society.**

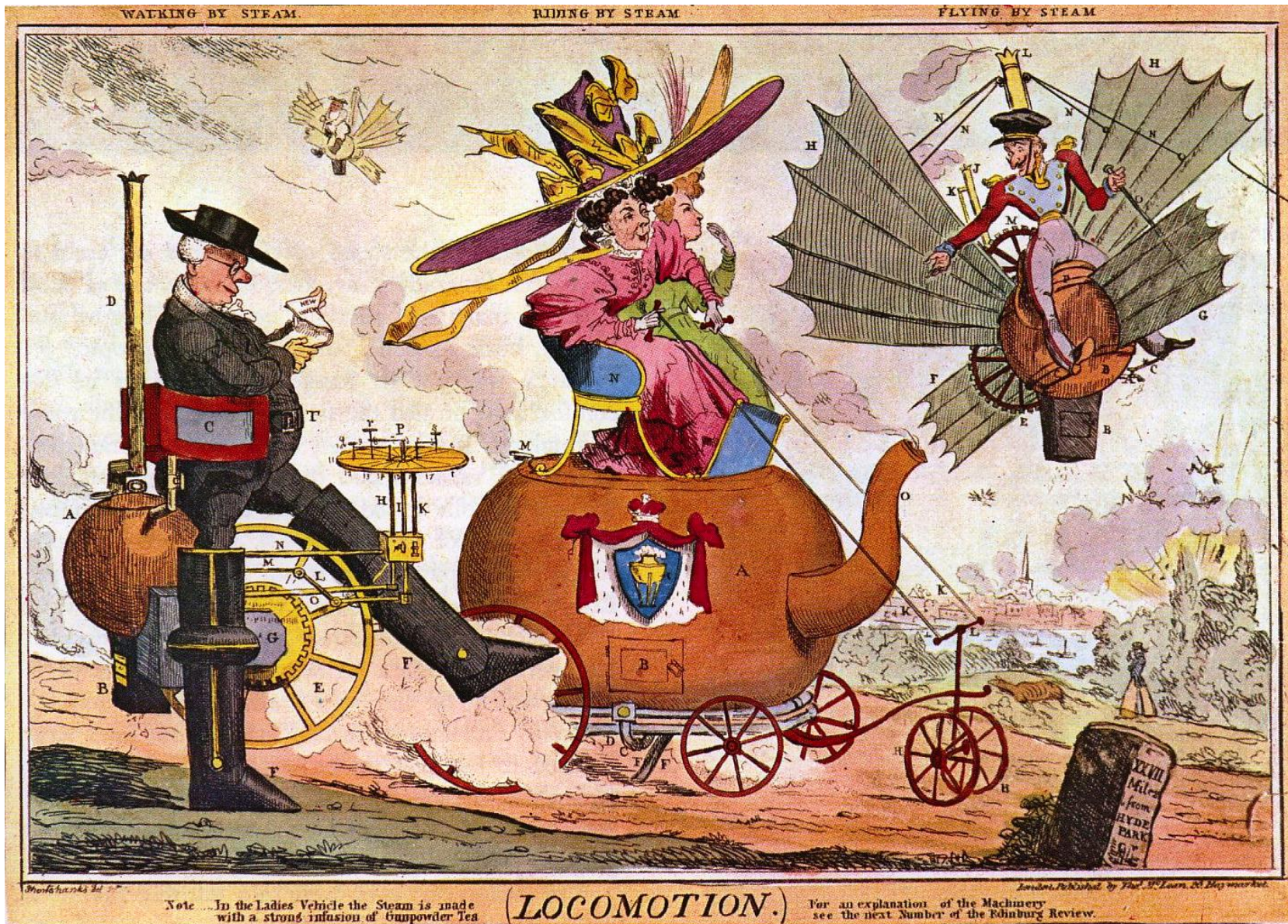
The XXth century's mark was thus the wedding of the ancient road and the new-found facility of petroleum-powered internal-combustion.

It put the internal combustion engine to magnificent and extensive use, and

- after a century, the current generation have learnt how to civilise the car and the truck,**
- although many of these lessons have yet to be put into universal practice.**
 - Perhaps most importantly, the wise outcomes have, without exception, been the consequence of a clear vision and strong long-term planning.**

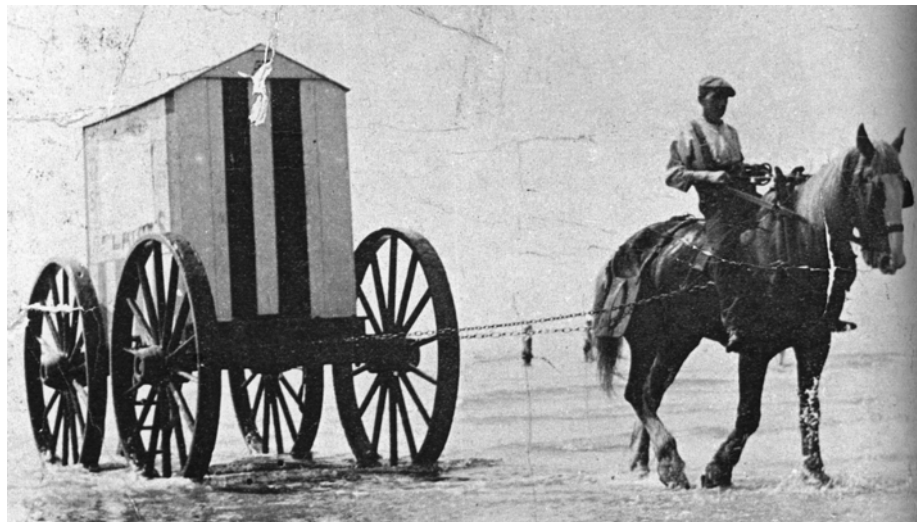
It is fair to conclude this review by saying that the XXth century, after some significant false steps, has reason for pride in its road achievements.





I have discussed the effects of roads & the internal combustion motor vehicle, on XXth century life and observed our various responses to their benefits and disbenefits.

The resulting message has a larger compass, as the world debates the sustainability of the planet.



In many ways roads are a microcosm of the wider challenges that the world now faces. We have seen that:

- the car has brought enormous benefits, but that it has also been over-used and misused.**
- The best of our road systems have shown that humankind has the ingenuity and skill to achieve wise outcomes.**

