Strange Ways

Max Lay

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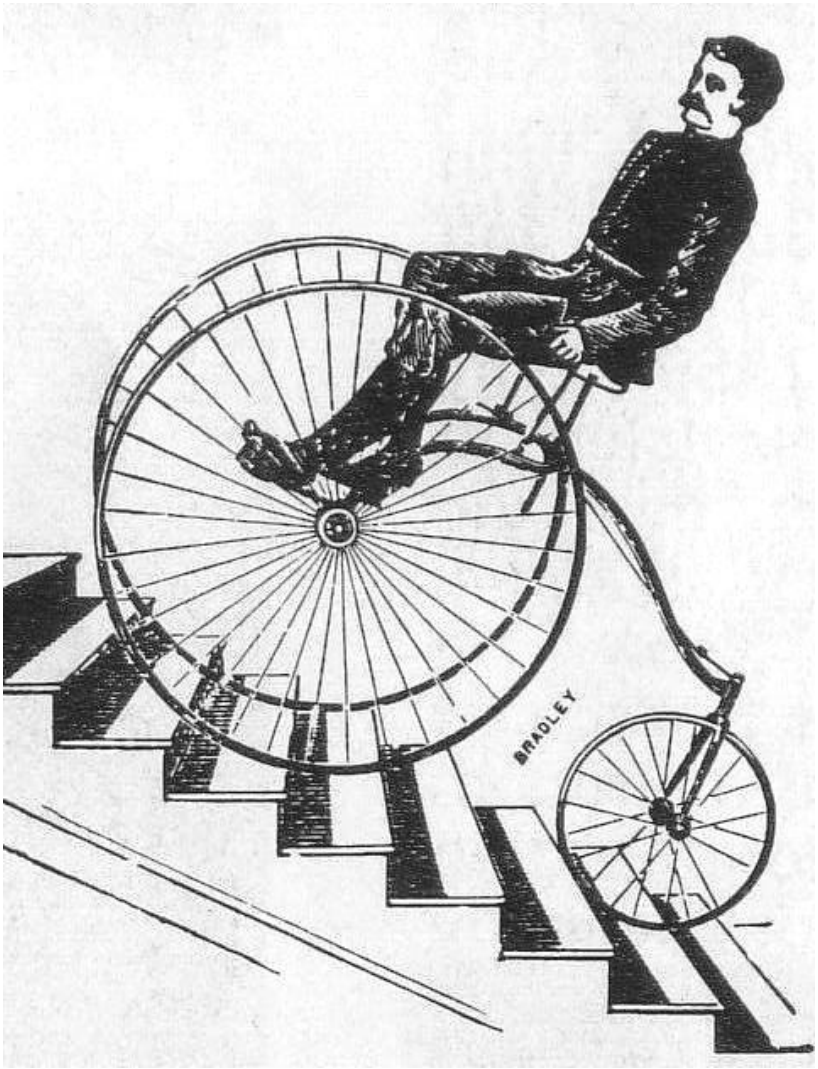

From a 19th century advertisement for “The Demon Hill Climber”, produced by the National Works in Coventry, England.

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Strange Ways

A book in which the author wantonly reveals many weird, wondrous and whimsical facts about roads and bridges and about the people and vehicles that wilfully weave and wander along them, making wise their various ways.

by

M. G. Lay

COVER: The three illustrations represent strange ways of travel not otherwise explored in the text. The lady on the self-powered aeroplane featured on the cover of an 1896 Almanac shows that youthful female comeliness will always overcome the laws of physics. The gentleman pedalling upstairs oblivious to either purpose or personal safety was part of a late-19th century advertisement by the National Works in Coventry for its "Demon Hill Climber". The two magnificent steam-powered vehicles were drawn by Henry Alken in 1825 at the beginning of the steam age. His prophecy of transport in 1829 remains unfulfilled, but his humour is as strong as ever.

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The Wayside Preface

- a introduction in which inadequate personal explanations are offered and unsatisfactory excuses are given.

Inadequate explanations

When I left – or was pushed out of – the steel industry in 1975, one of my regrets was that I had not kept a record of the many strange and curious phenomena that I had observed. On entering what was, for me, the new field of roads I resolved to rectify my previous omission and record all the follies and foibles, all the humour and hilarities, and all the monstrous misconceptions that passed my way. This book is the outcome of sustaining that resolve for three fascinating decades.

In the intervening time I had also written seven editions of a ponderous textbook on roads, a less ponderous but technically correct history of roads, and finally a dense – in all possible ways – history of the roads in my hometown of Melbourne.[1]

This current book is an essential antidote to be taken after encountering any part of those earlier works. Indeed, it contains some material that even I rejected from my previous writings as not being sufficiently serious, and a great deal more of the same ilk rejected by my perspicacious past editors. I trust that these previous discards will be your current delights.

I did not stumble into this task unknowingly. As a graduate student in 1960, my very first publication was a collection of strange statements I had found in the otherwise seriously tedious and colourless technical literature surrounding civil engineering.[2] My lasting favourite is a report by an awe-struck colleague, Bill Ward, who wrote in an English magazine of the time of the exploits of the famous soil mechanist, A. W. Skempton:

> Two of these wells, extracting salt from different levels, came into operation just before lunch, and Dr Skempton was invited to decide which well produced the saltiest water by testing a sample in a wine glass.

> Its colour was that of peaty water, but the bouquet of fine Spanish sherry registered on Dr Skempton before it reached his lips. Whereupon we were all invited to taste samples.

Having learnt a little about poisons from Agatha Christie, I had wondered at the time whether events would have taken a somewhat different course if the bouquet had been of burnt almonds, rather than of fine Spanish sherry. Certainly, I personally resolved that henceforth I would never drink any effluent offered to me by an enthusiastic soils engineer.

Some twenty years later the following two papers in a respected journal made me realise that the Skempton samplers were still out there salivating.[3] Firstly a paper called *Exotic uses of aquifers*, by S. Puri, was clearly a follow-up article on the Ward wells, written under a blatantly obvious nom de plume. The second paper *Energy potential of Irish groundwaters*, by C. R. Aldwell added another virtue to the long list of reasons for only cleaning one's teeth in Irish whisky.

If you have made it this far, and are still reading this introductory preface - don't be alarmed or doubt your personal sanity. I assure you that people do read introductions such as this. In one of my technical books on roads, I began with the Byrne quotation: "If they have no roads, they are savages." [4] I subsequently received a letter from a reader accusing me of being a racist. My acerbic reply was that savages were defined by most dictionaries as uncivilised people and that, from the manner of his letter he was clearly a savage irrespective of his race.

Unsatisfactory excuses

To protect the family fortune from predatory legal attack, I must now formally declare that all that follows should not be blamed on the individual whose name - almost by chance - appears in the accompanying text. Blame, instead, the education system. In 1966, spookily soon after my Skempton revelation, the U. S. Office of Education issued the following statement explaining education theory: [5]

* Disconnectionness is not either complete connectionness or strongness or unilateralness or weakness and some components are not connected with respect to affect-relations.
* Toputness is system environmentness.
* Storeputness is a system with inputness that is not fromputness.
* Feedinness is the shared information between toputness and inputness, where the toputness is at a time just prior to the inputness.

Before enjoying some very particular and shared toputness, it might be helpful to explain, in medical terms, the way in which this book has been written. This is done using a report allegedly penned by a Dr Brown, principal physician of the Bloomingdale Lunatic Asylum, N.Y. and appearing in the *British Medical Journal* in 1865. It stated:[6]

> Adler's German and English Dictionary, which is used as a standard textbook in the principle colleges of the country, was written in the Bloomingdale Asylum by a person of insane mind.
>
> I might also mention a number of standard textbooks which were written in that institution; and I will state as a conclusive fact that one of the leading newspapers in New York is principally edited from the Bloomingdale Lunatic Asylum, and the

leading editorial is written three or four times a week by a person of unsound mind confined in that institution.

With great disappointment I subsequently found that there was no British Medical Journal issued on 8 Mar 1865. And, although I spent bewitched hours reading BMJs from surrounding dates, and checking the New York Times for the preceding month, I found no such quotation. It is not the first time that I have been defeated by a technical reference. Nevertheless, as on those previous occasions, the "data" was too good not to use and I did find other material on Asylums which was not incompatible with the theme. In addition, I now know far more than I want to about the ravages of syphilis on nineteenth century bodies.

Somewhat more concrete evidence of this process is given *The Surgeon of Crowthorne*, Simon Winchester's wonderful account of the production of the Oxford English Dictionary.[7] He notes that the principal initial contributor to the OED had been an inmate of the Broadmoor Home for the Criminally Insane. Brown and Winchester's reports may also shed some light on the title of this book, for Strangeways is the name of a prison for the criminally insane in the English Midlands.

Undoubtedly the Bloomingdale Asylum is as productive as ever, although for some years it has been clear that its creative talents have also been active in the defence industry. For instance, in 1992 it was reported that a typical U.S. Navy cruiser was carrying 26 tonnes of manuals, a mass, which by then was sufficient to significantly affect the performance of the cruiser.[8]

And what does this preface say about your self-effacing and suitably anonymous author, whose true character is so carefully suppressed in the following pages? "Who are you?" I hear my readers ask, "Can we believe the publisher's expansive blurb?" Of course you can't. My true self was revealed to the world in 1988 when I was billed as a key speaker at that watershed conference on "*The role of science and technology in the development of Australia*". The conference publicity sheet was issued by none other than the Science and Industry Forum of the Australian Academy of Science and it prestigiously noted that: "Dr Lay lacks many positions in professional and academic organisations." Alas, that lack continues today, indeed, is even lacker now than it was in 1988.

1988! The perceptive reader might notice that most of the "current" events in the book are no longer current. This clever tactic hopefully avoids any readers remembering that is they who are the point of my particular jest, and thus prevents me offending too many readers. Strange things still happen, but most are for others to record.

Notes on the Preface

1 Lay, M. G., *Handbook of road technology*, 4th Edition, London: Taylor & Francis (Spon imprint) 2009; *Ways of the world*, New Brunswick: Rutgers University Press, 1992 & *History of Australian roads*, ARRB Special Report 29, Vermont Sth: ARRB

2 Lay, M. G., "Quotes from the classics". Cranks and Nuts (Melbourne University Engineering Students Society), 1960, 39-41

3 Quarterly J of Engnrg Geology, 19(1), 1986, contents page

4 Lay, M. G., *Source book for Australian roads*, Vermont Sth: ARRB, 1981. The quotation is from Gregory, J. W., *The story of the road*, London: Alexander Maclehose, 1931, and is explored further in Chapter 3.
5 Kohn, A., "Principles and methods of obscurantism". New Sci, 29 Jan 1970, 212-4
6 Via the spasmodically reliable J Irreproducible Results, 31(5):6, July/August 1986
7 Winchester, S., *The surgeon of Crowthorne*, London: Viking, 1998
8 New Sci, 26 Sep 1992, p9

By way of acknowledgement

- the place the author generally fails to recognise his sources and his unwitting and largely innocent helpers

Unwitting helpers

I gratefully acknowledge the inspiration that I have received from all those many people that I have observed taking themselves and their life's work too seriously. Without them, this book would not have been possible.

I am also in debt to the authors of most of the papers I have read, as without their consistent ability to bore, I would not have been forced to look for humour when I should have been seeking enlightenment. But, *in humero veritas*...

I do particularly acknowledge all my friends who responded to my disturbing plea "do you know anything funny or whimsical about roads?" Most had never thought of humour and roads as having anything in common and looked at me in mute astonishment; a few were like the barrister who informed me that when you look under "Boring" in his telephone directory, the entry says "See Civil Engineers".

One term that should be explained in the context of this book is urban legend, as it will be used frequently in unacknowledged parts of the subsequent text. The term describes stories heard frequently in many places, particularly at bars and during intervals in sporting events. The storyteller will swear the story is true, because the brother of the person involved told it to him. Many of the stories recounted in this book have been supplied by numerous such sources, each assuring me of the story's concomitant accuracy and uniqueness and its trustworthy familial source.

If you told me an urban legend, don't look here for acknowledgment and your name in PRINT - believe me, I had already heard the story from thousands.

Foreign aid

I spent part of my roading career in road research – the fact that people did research on roads was often a source of amusement to my friends. But their humour was ill-founded. People do appreciate road research.

In 1987 a colleague, Rahmi Akçelik, published a quite obscure paper on the mathematical representation of drivers' acceleration behaviour in a correspondingly obscure journal called Transportation Science. Few traffic engineering practitioners would have read it. But within a month of publication Rahmi had received a letter from a lady in Dallas, Texas, asking for a reprint. She told him at some length of her wartime experiences as a U.S. nurse treating tropical diseases in the Pacific and then explained what she would do with the reprint:

> I will read it, then give it to Dallas City Hall. They need this material. It would be very valuable. I appreciate your work in writing this wonderful article. This article will help many people.

Those of us who had actually read the article would not have been quite so effusive.

I must particularly recognise all the larger-than-life characters that I encountered in my forays into the international road research community. For example, one group I met was run by an apparently very successful fighter in her country's pre-peace resistance movement. A tough, wiry woman she had reputedly killed at least a dozen men and her current post was possibly compensation for these efforts. She certainly knew little of roads. Her deputy was a suave and handsome expert, who dreamed of being a diplomat.

The two warred publicly and continually, to the great entertainment of we privileged onlookers. The battle ended when an affair between the ex-resistance fighter and another associate came to its rapturous conclusion and the two lovers departed for distant connubial pastures.

Another research leader joined us for a South East Asian tour. Being a European, he knew nothing of Asia. At that time Malaysia was still having trouble with its so-called "communist" insurgents, and the road between Singapore and Kuala Lumpur was unsafe for car travel. We had arranged to fly, but at a civic reception in Singapore, the European insisted that as a road expert he had to travel by road. As he had read nothing about insurgents in European newspapers, they did not exist. When we still repeatedly said "no", he approached the Malaysian consular representative at the reception who, unwilling to lose face, agreed that the road was safe to travel and nominated one of his staff to drive the European from Singapore to KL.

The staff member, in earshot, paled and nearly fainted. As soon as he could, he grabbed me, told me of his wife and six children, dependent mother and father, and a myriad of other as yet unfilled but vital social obligations. He even offered me money if I could stop the foreign fool from taking them both to a certain and torturous death.

For various reasons largely unrelated to the bribe, we subsequently plied the European with alcohol, staggered him to his hotel room, and disconnected and reset his clocks and alarms. When he finally arrived in the lobby next morning, it was a satisfying task to

inform him that he had missed his car by two hours and had only 30 minutes to catch the airport bus.

A further European colleague was of obvious Scandinavian stock - indeed was clearly descended from those perpetually pillaging and raping Vikings. He lived outside Scandinavia, but remained true to his ancestry. Divorced, he was now living with his secretary in a very public arrangement. As an obvious consequence, tensions in his office were noticeably high. At weekends he sailed an ocean-going yacht.

"Could I come?" I asked my normally hospitable host.
He refused, as he said he had a strict rule of only using female crew.
"How many crew do you need?" I asked.
"Four."
"Do you ever have trouble getting four women to crew the yacht?"
"Occasionally, but if this occurs I require my female staff to fill the vacant berths."

My fantasies over this took years to subside, although he assured me at the time that the conditions in the Atlantic were usually such that he spent all his time at the helm.

There was also the wonderful Ron Bridle, head of the British Transport and Road Research Laboratory. Ron was a larger-than-life Welshman who loved to sing. One evening he took my wife and me to a play at Windsor. The work was a gloomy exploration of a depressing moral dilemma, and the cast spent most of their time on stage brooding darkly.

During one such scene, the radio on the set was playing a popular song. Ron couldn't resist and, from the midst of the sorrowing theatre, burst into a loud duet with the radio. House lights went on and actors and actresses marched indignantly to the front of the stage, gesticulating at our part of the audience. My wife and I pretended that we had never seen Ron before in our lives.

On another occasion, I took him to the restored Sovereign Hill gold-mining village in Victoria. Amongst the farriers' barns and apothecaries' shops was a large music hall, open for tourists to wander into and look around. Ron not only looked, but also leapt on stage and began singing. He was quite talented and held our rapt attention. When he finally stopped, we were surprised by the loudness of the applause and startled to find that the music hall was now full of tourists, eager to hear the second half of the act. Ron obliged, and obliged, and obliged .....

At our working meetings we always had to have a translator for our French representatives, although they spoke fluent English. One French delegate was a particularly voluble and voluminous speaker, making all his profound pronouncements in as many redundant ways as was humanly possible. Length rather than content seemed the criterion for a successful "intervention".

At one meeting, he was five minutes into one of his speeches and glaring at those of us who had not bothered to put on our translator's earphones. Yielding to his visual pressure, we raised the earpieces, but no sound emerged, despite strenuous turning of knobs. Reluctantly, we waved to the translators' booth, pointing to the quiescent earpieces. Suddenly they burst into beautiful sound: "Monsieur ***, 'e is speaking too quickly for me to translate, but, as yet, 'e has not said anything important." How we subsequently pleaded with her to attend and interpret at all our future sessions.

Local libels

It would be unwise for me to tell stories about those who inspired this book and who live close by in place or in time - unwise, but let me tell just one or two.

An Australian colleague enjoyed skydiving and he and his friends decided that it would be a challenge to skydive in formation and at night. The aviation authorities had banned this, but - being Director-General of Transport in his State - my colleague was able to locate a pilot who could be persuaded, for a small fee, to ignore the regulations.

In a masterpiece of planning, the night-divers attached green flashing lights to their helmets so that they could see each other in the dark air. Green was chosen as a colour which did not transmit over a long distance; likewise the pilot was instructed to extinguish all his lights for the ten minutes prior to the jump so there would be no chance of detection by aviation officials. The formation jump was a great success, but the radio silence and ten minutes of blackened cockpit meant that the pilot had strayed off course.

When the jumpers landed, they saw no signs of their rendezvous vehicles - just a lighted farmhouse on the horizon. They stumbled to the farmhouse, and meekly knocked at the door. The puzzled farmer's wife stared at the bedraggled group on her doorstep, all of whom had kept the green lights on their helmets flashing in order to avoid being separated in the dark.

> "I'm sorry to wake you, madam, but could you tell us where we are?" said the erstwhile Director-General of Transport
>
> "Earth." she replied, defiantly slamming the door in their alien faces.

Transport eccentricity was prevalent among the Directors-General of Transport that I have known. Another decided to take some considerable time off and sail around the world with his family. The first leg of their epic trip involved them sailing out of their east coast harbour, turning left, and proceeding north up the coast of Australia. Unfortunately they turned left a little early and irretrievably damaged their yacht on the sea wall at the mouth of their home harbour. The trip was abandoned.

Earlier, I claimed that this book arose from my experiences after I left the steel industry. However, in that industry I had accumulated a few useful steel stories that I should not waste.

A dear friend and colleague, the late Ralph Shackleford, for a time shared the task of driving to work with me. The arrangement did not last, as the intense Ralph would frequently drive past my house where I stood waiting at the kerb and, waving absently to me, continue on his thoughtful way to work.

Ralph was one of those people who attracted unusual happenings. He had once been attacked in his stationary car by a fleeing, one-legged murderer and on another occasion had unsuccessfully tried to stop a pedestrian committing suicide by throat slitting. Perhaps he was recollecting these events as he sailed past his forgotten passenger.

Ralph had been transferred to our Laboratory from a steel plant some 1000 km distant. Unable to sell his property there and disappointed with the sales efforts of his Real Estate Agent, one Friday night he and his wife drove non-stop to the property. They spent the weekend cleaning and repainting the house, and - before embarking on the long drive home - descended on the shop of the slothful Agent, demanding that he should now get out and sell the much-improved property. The Agent replied "What do you mean? I sold it last week!"

The story continues. Tired and frustrated the Shacklefords proceeded to drive home. After about 500 km of night-time driving, they realised that they were too sleepy to continue and stopped on some flat land beside the highway. A few hours later they were rudely awoken by banging on the car body and discover a distraught local demanding compensation for the damage their car has done to his manicured front lawn.

I had a reverse experience driving from Cologne to Paris. My route went via Saarbrücken where kindly traffic police waved me off the highway and into a packed car park, assuming that - like everyone else on the road that day - I had come to watch THE soccer match. I thus had a compulsory three hour rest in Saarbrücken whilst my new car park "neighbours" enjoyed their game.

But back to my task of acknowledging those who unintentionally helped with this book. When I was responsible for ARRB's 14th conference in 1988, I queried one of the authors whose submitted paper acknowledged:

> God the father, through the Lord Jesus, who is the source and giver of all knowledge.

As the paper included the prediction that a clay embankment 7 m high would remain stable for over 14 years, I wasn't so much querying the theology, but was anxious to establish who would be taking legal responsibility for the prediction. I finally accepted the paper, and subsequently received a letter from the author, assuring me that my agreement to the publication of his acknowledgment - apparently I was the first editor to do so - meant that I and my future work would be blessed. Hence, I embark on this book with some confidence.

So now that these interminable acknowledgments are finished, and your worst fears have been vindicated, it but remains to bring on the motley. Stand aside, clear the way.

Chapter 1

The Way of Life

- a chapter in which the road is seen as an icon, but of what?

First words

This book is called *Strange Ways*, so it is only proper that it should begin with a discussion of the Way - after all, the Strange bit was covered in the Preface.

Words like *way* and *vehicle* and *wagon* all come from an ancient Sanskrit root *vah*, which covered the concept of moving and travelling. Curiously, *alley* comes from the Latin *ambulare*, *to walk*, via the French word, *aller*, meaning *to go*; whereas *avenue* is from the Latin *advenire*, which means *to come*. So, as in life, we come by the Avenue, and leave by the Alley. *Road* is a much more recent word than *way*. It derives from the verbs *to ride* and *to raid* and thus also implies movement.

It is the concept of free movement embodied in the above definitions which has given the Way a special place in the social and technical development of human society. Throughout history, the Way has been very much a silver thread that has linked people and places over both time and space. It has done so by satisfying the basic human need to travel, sometimes with a frenetic intensity of purpose, and other times with no obvious intent whatsoever. Goethe's *Wander Years* contains the wonderful admonishment[1]:

> Keep not standing fix'd and rooted,
> Briskly venture, briskly roam!

Passionate support

Every traveller who has briskly ventured along a new way has felt that wonderful sense of impending, beckoning adventure that Walt Whitman captured[2]:

> Afoot and lighthearted I take to the open road,
> Healthy, free, the world before me,
> The long brown path before me leading wherever I choose...
> To know the universe itself is a road, as many roads, as roads for travelling souls.

and has shared the immense satisfaction of the journey itself, and has understood the advice that Jeremiah gave the people of Israel[3]:

> Stand by the roads, and look, and ask for the ancient paths, where the good way is: and walk in it, and find rest for your souls.

But in 1954 Carey put a somewhat different perspective on the powerful pervasiveness of the way when he wrote:

> The road itself seems to speak to him: "I shall change everything and everybody. I am abolishing the old ways, the old ideas, the old law; I am bringing wealth and opportunity for good as well as evil, new powers to men and therefore new conflicts. I am revolution."

To wax eloquent over the way and its pivotal place in society is not a failing unique to the author of this book. The way was seen by many as a mirror of society, as directly reflected by the ancient Chinese saying that *the state of the roads is a measure of the state of the civilisation*.[4] The reverse effect was also utilised for physical reasons. For example, for almost 300 years prior to 1868, the Tokugawa national government in Japan prohibited the construction of any bridge that would enable a way to link their cities together - thus they controlled the power of the feudal lords.

Late in the 18th century the Abbé Reynal observed that: "whenever we shall find no facility of travelling from a city to a town, or from a village to a hamlet, we may pronounce the people to be barbarians."[5] The theme persisted, and in the 19th century colonial governor Sir George Gray produced his oft repeated remark: "roads tend to civilise as well as cultivate a country."

More constructively, Henry Parnell - or Lord Congleton, as his friends later called him - argued in 1838 that[6]:

> the making of roads is fundamentally essential to bring about the first change that every rude country must undergo in emerging from a condition of poverty and barbarism.

Clearly, the state of the roads told properly educated observers about the wealth, culture and health of a society. In 1864 the great U.S. Congregational Minister, Horace Bushnell, in a much-quoted Thanksgiving Day sermon argued[7]:

> If there is any motion in society, the road will indicate the fact. When there is activity or enlargement or a liberalising spirit of any kind, these require roads. All creative action, whether in government, industry, thought or religion, creates roads.

and in 1900 Austin T. Byrne in his widely published textbook judged each society on the basis that[8]:

> If the community is stagnant, the condition of the roads will indicate the fact; if they have no roads they are savages.

There is evidence that roads do humanise the otherwise brutish locals. William Hutton of Birmingham tells of his visit to the isolated village of Bosworth in the English north in 1770:[9]

> The inhabitants set their dogs at us in the street, merely because we were strangers. Human figures other than their own are seldom seen in these inhospitable regions. Surrounded by impassable roads, no intercourse with man to humanise their mind, nor commerce to smooth their rugged manners, they continue the boors of Nature.

In many countrysides, educated travellers were often unwelcome and regarded as poorly as Hutton regarded the Bosworthians. For instance, if a European passed through a village in 19th century Kenya, the locals would kill a goat and place the undigested food from its stomach on the path. This would ensure that the traveller would not return by the same way and once again defile the area by his mere presence.[6]

Extensive pathways existed in pre-European Australia and were used mainly for trade between adjoining tribes. Writing in England in the early 20th century, Gregory[7] noted these paths but then regrettably drew the following extrarordinary conclusions which reflect more on English attitudes of the time than on circumstances in either Africa or pre-European Australia:

> The remarkable Australian aboriginal system of intertribal protection of traders and envoys is probably the most primitive surviving relic of the beginnings of international law. There is apparently nothing like this system among the Negroes of Africa. Its existence among the Australian aborigines shows that they share the capacity for organisation, which characterises the Caucasian race; for they belong to the subrace of the Dark Caucasians.

Despite Gregory's views, Africa was riddled with trade routes and, of course, the Shakesperean dark caucasion theory is equally absurd.

The most powerful of all the arguments for the medical and social benefits of roads were surely those advanced by an official Select Committee in London in 1838 - the same year as Parnell's pontification:[10]

> ...there were districts in London through which no great thoroughfares passed, and which were wholly occupied by a dense population of the lowest class of persons who being entirely secluded from observation and influence of better educated neighbours, exhibited a state of moral degradation greatly to be deplored.
>
> It was suggested that this lamentable state of affairs would be remedied whenever the great streams of public intercourse could be made to pass through the districts in question.
>
> It was also justly contended that the moral condition of these poorer occupants would necessarily be improved by communication with more respectable inhabitants, and that the introduction at the same time of improved habits and a freer circulation of air would tend materially to extirpate those prevalent diseases which not only ravaged the poorer districts in question, but were also dangerous to the adjacent localities.

What a fine charter for road constructors! And there must have been some continued perceived moral benefits, as half a century later Charles Robinson continued the theme in 1901 in his book *Modern Civic Art*: [11]

> It has been found that often there is no better way to redeem a slum district than by cutting into it a great highway that will be filled with the through travel of a city's industry.
>
> Like a stream of pure water cleansing what it touches, this tide of traffic pulsing with the joyousness of the city's life and purpose, when flowing through an idle or suffering district wakes it to larger interests and higher purpose.

Occupying the moral high ground in planning had its advantages. The relatively liberal Adna Weber observed that in the U.S. in 1898[12]:

> To the Anglo-Saxon race, life in the great cities cannot be made to seem a healthy and natural mode of existence. The fresh air and clear sunlight are dear to the heart of this people.

Whilst the Anglo-Saxons fled to the suburbs to renew their links with nature, the blacks inherited the downtown slums which were, by Weber's implication, dearer to their particular hearts.

The well-known poet and essayist Hillaire Belloc became particularly expansive in 1923 when he wrote[13]:

> The road is one of the great fundamental institutions of mankind.....it is fundamental to social existence.....it determines the growth and nourishment of all.....its gives framework to all economic development.....it is the channel of all trade and, what is more important, of all ideas.

Belloc is best remembered by many for his wonderful cautionary tales for children. An appropriate example verse is:

> The poor arrived in Fords
> Whose features they resembled.
> They laughed to see so many Lords
> And ladies all assembled.

Uninfluenced by the barbarism of a recent World War, Hartmann in 1927 considered[14]:

> The provision of roads of some sort is essential to draw a country out of a condition of barbarism, but a state of civilisation cannot be said to have been reached until communications have become fairly easy.

And so roads became so much part of the public good that in 1929 the North Carolina State Prosecutor was able to ask a striking textile worker: "Do you believe in the flag, do you believe in North Carolina, do you believe in good roads?" In 1949 Will Rogers observed that in the U.S.A. a congressman was never any better than his roads.3

Even economists

The purely economic benefits of roads have long been advocated, with impeccable precedents. In France, pioneering cabinet minister Jean Colbert argued in 1699 that roads were provided to aid the economy and for the good of the people. A century later in 1776, Adam Smith in his watershed *Wealth of Nations* advised that "good roads, canals and navigable rivers.....are the greatest of all improvements."

Sometimes, the argument bit back. Governor Macquarie, one of the early administrators of the new colony of Australia, in 1810 asked his masters in London for more funds to build roads as: "such roads cannot be constructed at the entire expense of the inhabitants for many years to come." The Colonial Secretary somewhat cynically replied: "Permanent roads and bridges will be the offspring rather than the cause of material prosperity." This was a tad naughty, as the following year a report of his own House of Commons proclaimed:

> The many important advantages to be derived from amending the highways and turnpike roads of the kingdom need hardly be dwelt upon. Each individual in it would thereby find his comforts materially increased and his intent greatly promoted.

A cautionary warning

To many people in earlier times, the ancient paths that did exist were indeed a special gift. Although the Emperor Hadrian charitably observed that "The road is the gift of Rome to the world" he would no doubt have been disappointed to find that most communities soon forgot his road-building Romans.

For example, books such as Geoffrey of Monmouth's *History of British Kings* written in 1147 attributed Roman roads to either the more recent efforts of a legendary King Berlinus or to the ancient magic of the Sorcerer-King Mulmutius, who lived before Christ. Similarly, many European communities believed that their local Roman roads had been built by Queen Brunhilda, who died in 614. Remember, children, there was no sorcerer King, just lots of well-intentioned people like me doing our little bit of paving for the good of mankind.

Some balance has now returned, but there is Chesterton's description of English roads in 1914:[15]

> The Romans did that little bit
> And we've done all the rest of it.

Today there are still some in the community who see the road as a source of environmental evil. But, be warned. Roads have always had a touch of evil and mysticism about them, especially at night. As Coleridge wrote in *Christabel* in 1799:

> Like one that on a lonesome road
> Doth walk in fear and dread,
> And having once turned round walks on,
> And turns no more his head;
> Because he knows a frightful fiend
> Doth close behind him tread.

In *Ways of the World* I told at some length of the evil deeds that occurred at crossroads, which were commonly frequented by soul-seeking ghosts, hellhounds and vampires, and how suicide victims were buried there with stakes through their hearts.[16] To placate the evil spirits, the cautious traveller poured sacrificial oil on small stone shrines at each intersection. Today, many motorists still indulge in the practice of depositing oil at intersections.

These evil spirits revisited roads in 2003. The US State of New Mexico had a highway labelled Route 666. Now, it is well known from the Book of Revelations that 666 is the number of The Beast. Indeed the road had been known to locals as the Devil's Highway or a "Beast of a Road". It also had a higher than average crash rate. New Mexico therefore solved the safety problem by renumbering the road as Route 393. It's a pity that they had not sought advice from a numerologist, as 3x3=9 and so 393 in satanic circles is known as Beelzebub's Bounty, with all the horrors that that implies. New Mexico and I are not alone in sensing a problem with Route 666, as this cartoon demonstrates.

Steve Cakebread explores the deep meaning of highway route numbers[17]. Cakebread and the Melbourne Age.

I sense, however, that these and other historical truths will be too frightening for your delicate minds. So let us proceed to more uplifting matters. If ways do bring the blessings of civilisation and humanisation to both individuals and societies, then we had best learn something about how these gift-givers are, made so that we can shower them down in ever increasing numbers upon a grateful world.

Notes on Chapter 1

1 T. Carlyle's translation.
2 St 13 of "Song of the Open Road" in Whitman, W., *Leaves of grass*, Boston: Thayer & Eldridge. 1856.
3 Jeremiah 6:16, RSV
4 Forbes, R. J., *Notes on the history of ancient roads and their construction*, Amsterdam: N.V. Noord-Hollandsche. Archaeologisch-historische Bijdragen, Deel III, University of Amsterdam. 1934

5 Abbé Reynal, *A Philosophical and Political History of the Settlements and Trade of the Europeans in the East and West Indies*
6 Parnell, H., *A treatise on roads*, London: Longman, Orme, Brown, Green and Longmans. 1838. Parnell became Lord Congleton.
7 Gregory, J. W., *The story of the road*, London: Alexander Maclehose, 1931, p131
8 Byrne, A. T. *A treatise on highway construction*. New York: Wiley, 1900. introduction
9 Smiles, S., *Lives of the engineers*, Vol 3, London: Murray, 1874, p35
10 Edwards, P. J., *History of London street improvements 1865-1897*, London: London County Council1, 1898, p10
11 Robinson, C., *Modern civic art*, New York:Putnam, 1901
12 Ling, P. J., *America and the automobile*, Manchester: Manchester UP, 1990, p70
13 Belloc, H., *The road*, Manchester: C. Hobson for the British Reinforced Concrete Engineering Co Ltd., 1923, introduction
14 Hartmann, C. H., *The story of the roads*, London: G. Routledge, 1927
15 Chesterton, G. K., *Flying Inn*, London: Methuen, 1914
16 Lay, M. G., *Ways of the world*, New Brunswick: Rutgers University Press, 1992, p52
17 Melbourne Age, 9 Oct 1995, p2

Chapter 2

Having their own Way

- a chapter in which the mysteries of road planning are finally revealed

Natural causes

Possibly the best explanations for the way unplanned roads came to be the way they actually are - i.e. randomly bent and perversely kinked - was given by G. K. Chesterton[1]. He describes an Inquiry into the subject, conducted by: "authorities specially appointed by themselves to report to the Dog Quoodle, having power to add to their number and also to take away the number they first thought of."

The Inquiry must have confused the poor Quoodle, for it offered a number of conflicting explanations, all in verse, and which are now succinctly listed:

First explanation:
And so the roads they twist and squirm
(If I may be allowed the term)
From the writhing of the stricken Worm
That died in seven towns.

Second explanation:
And I should say they wound about
To find the town of Roundabout.

Third explanation:
But peace and righteousness (St John)
In Roundabout can kiss,
And since that's all that's found about
The pleasant town of Roundabout,
The roads they simply bound about
To find out where it is.

Fourth explanation:
Some say that when Sir Lancelot
Went forth to find the Grail,
Grey Merlin wrinkled up the roads
For hope that he should fail.

Fifth explanation:

Before the Roman came to Rye
Or out to Severn strode,
The rolling English drunkard made
The rolling English road,
A reeling road, a rolling road,
That rambles round the shire.

Sixth explanation:

The road turned first towards the left
Where Pinker's quarry made the cleft;
The path turned next towards the right,
Because the mastiff used to bite,
Then left, because.....

If pressed, more recent experts would tend to favour the last of these explanations.

If left to their own devices and uninfluenced by the Dog Quoodle, roads occur at minimum cost and maximum aesthetic content by keeping out of lowland swamps and following the contours and ridges in hilly country. Such roads wind in and out interminably. Every curve resembles one encountered an hour ago. Drivers half jokingly wonder if their steering wheel will unscrew and parents tell their children the old story about how the road was: "built by boy scouts who believed that one good turn deserved another."

This may have led to the otherwise questionable advice that Lady John Scott gave in her poem *Loch Lomond*?

O ye'll tak' the high road and I'll tak' the low road,
And I'll be in Scotland afore ye.

As Chapter 5 will demonstrate, in those times low roads were frequently impassable quagmires. The highest road you can possibly take is Qinghai-Tibet Highway that covers 900 km at an average elevation of 4100 m. As it was only built in the 1950s, it couldn't be the road of which Xu Ling wrote about in 550 AD:

The road that I came by mounts two thousand metres;
The river that I crossed hangs two hundred metres.
The brambles so thick that in summer one cannot pass!
The snow so high that in winter one cannot climb!

Accidental planning

A fresh approach to road planning arose in the nineteenth century when the embryonic government of Victoria, Australia, decided to establish a new town and harbour at Port Fairy, some 300 km west of Melbourne, the capital of the new State. The possibly apocryphal version of what follows is that the government commissioned an Irish surveyor to ride down on horseback and layout the new town. En route the surveyor stopped at the3 town of Warrnambool, some 50 km short of his intended destination. There he encountered an aboriginal tribe, in particular a female member of that tribe, and devoted his energies to easing inter-tribal tensions.

After some months he received a message requesting that he instantly submit his plans of Port Fairy. That very same day he penned a note saying that he had found a much better port at Warrnambool and drew some attractive plans for a port city. A grateful government in far-away Melbourne, knowing nothing of Warrnambool, happily endorsed his scheme. Warrnambool today is a pretty town, but it bears no discernible relationship to what passes as its waterfront and - because of its obviously inappropriate geography - has never had the slightest prospect of becoming a port city. Thus, whilst the surveyor took advantage of a chance acquaintance, Port Fairy was denied the chance to capitalise on its marine advantages.

It would be nice to think that things were equally disorganised in other places. Otherwise, readers might think that this book is suggesting that Australian road surveyors did particularly stupid things. The evidence is that the experiences just described are but a microcosm of international practice.

Nevertheless, consider the 1000 km route between Australia's two biggest cities, Sydney and Melbourne. Melbourne was settled almost 50 years after Sydney, and its founding fathers arrived by sea rather than land. The explorers Hume and Hovell made the first overland trip from near Sydney to the new area in 1824. Hovell was an ex-sea captain and his charter was to arrive at Westernport Bay. Navigating by the stars, as he had done at sea, and with no night-time distractions to his careful observations of those guiding stars, he led his party to Corio Bay, near today's city of Geelong, some 90 km and two whole harbours to the west of his intended destination. At sea, the ship and all that sailed on her would have been lost on some rocky reef. Indeed, Hovell clung to his belief that they had reached Western Port until sent south by ship a year or so later. When the ship anchored at Western Port, Hovell finally accepted that this was not the bay at which his earlier land journey had terminated. The major consequence of this major error in navigation was that the founding of Melbourne was delayed by a further ten years. Perhaps also, a further consequence was that the subsequent highway which follows much of their route was named after Hume rather than Hovell.

Fourteen years after Hume and Hovell there was still no road between Sydney and Melbourne and seventy percent of the route remained through "unknown country". Nevertheless, it was decided to let a contract for an overland mail service between Sydney and the new township. The successful contractors, who had themselves trekked overland to Melbourne, immediately subcontracted the task to an inexperienced sixteen-year-old boy called John Bourke. They did little more than give the lad a mailbag and then point him in the general direction of Sydney. To his eternal glory, Bourke succeeded in delivering that first mail bag, despite severe adversity and, indeed, lived on till his 88th year.[2]

Perhaps we should not be too critical of navigator Hovell, as land was not always measured with the accuracy to which we are now accustomed. The Roman mile (mille) was a thousand paces. In Britain, the mile varied from locality to locality and the first attempt at defining it as 1760 yards occurred in an Act of 1593 and was not adopted throughout the country until 1824.

Marcus Clark in his *History of Australia*[3] tells how much early land in Australia was surveyed by a method brought from Ireland.

> A string was tied to a dog's tail, and when the dog stopped running, that was taken to be a mile. Thousands of acres had been thus measured off, and endless confusion resulted.

The associated expression "You can tie the string on the dog's tail now" was common into the 1930s.

The more sophisticated English judged a mile as the distance at which a horse could just be detected. The Algerians had a more human set of priorities - their mile was the distance at which a man could be visually distinguished from a woman.

Arthur Callaway was the first Chief Engineer of the new Victorian road-building agency - the Country Roads Board. He enjoyed his whisky and so it is not surprising that his 1920s alignment for the new highway from Melbourne to Geelong, some 50 km distant, quite obviously linked all the hotels and bars along the route. He was formally instructed by his superiors to never again use this particular method of road design[4].

Callaway also gained some notoriety when he received a telegram from a road-patrolman in a remote region. It read: "*Horse died. What will I do*?" Callaway sent the terse but helpful reply: "*Bury him"*[5].

Not all roads are what they are made out to be. The famous Inca Royal Road ran for 5 700 km from Santiago in Chile to Quito in Ecuador. But for much of its length it was only a footpath, and in some places the path was so steep that it became a series of stone steps. The Road has a counterpart in modern Japan, where a part of National Route 339 near Imabetsu in northern Honshu is also a series of steps that are quite impassable to cars.

The US numbers its Interstate system very systematically, with even numbered highways running east-west and odd numbered highways running north-south. An even numbered highway, such as I-64 in Virginia, will have a carriageway that is 64-east heading east and another that is 64-west heading west. Except, of course, when I-64 loops around the towns of Norfolk, Chesapeake and Portsmouth, when 64-east delights in heading due west and 64-west heads due east.

Deliberate planning

The road makers' call to arms was first recorded by the prophet Isaiah, who exhorted his listeners to[6]:

> ..prepare the way of the Lord, make straight in the desert a highway for our God. Every valley shall be lifted up, and every mountain and hill be made low; the uneven ground shall become level, and the rough places a plain. And the glory of God shall be revealed.

Isaiah persisted with the idea[7]:

> Build up, build up, prepare the way, remove every obstruction from my people's way.

and:[8]

> They have made their roads crooked, no one who goes in them knows peace.

The theme was re-emphasised by Matthew who instructed the followers of Christ to:[9]

> Prepare the way of the Lord; make his paths straight.

So far we have been discussing major routes. Has road planning been any different on the deliberately planned roads and streets that occur between the major routes? Whilst divine inspiration and natural processes can each be great help, good old-fashioned ink-on-paper planning is a key aspect of most roadmaking.

Ways of the World discusses how the arrangement of rural roads and city streets as rectangular grids with either north-south or east-west alignments, rapidly passed from a surveying convenience to an article of religious faith and mystical significance.[10] Most of the world's cities and new rural areas are now cursed with this unimaginative inheritance from the Greek town of Miletus, where the grid was first used by a disciple of Pythagoras in 400 BC.

Occasionally, over the millennia, people saw the absurdity of it all. Even an engineer, in 1856, had been moved with some emotion to describe how[11]:

> The country is thus intersected throughout by roads running for the most part in straight lines, parallel to and at right angles with, each other. Owing to the careless manner in which some of these early surveys were made, many of these roads are found out to be laid out without any regard to the natural features of the country they were designed to traverse, being marked indiscriminately over impossible acclivities or precipitous ravines.

Perhaps inspired by an encounter with an "impossible acclivity", a South Australian newspaper in 1864 described the outcomes more satirically[12]:

> ..as they measured the land only in straight lines, turning neither to the left or to the right, lest their calculations should become disordered and themselves be lost, so did they mark out beautiful roads 30 cubits in width that went nowhere, others ran over perpendicular mountains or through impassable swamps, many went into deep watercourses or hideous caverns, and some did terminate in the depths of the oceans.

For a planner to go beyond colouring maps, and to actual create and change things in the manner of Isaiah, seems to require a marked degree of disrespect for the past or brutality towards the present. Baron Haussmann, who created the Paris we love today, would have adored the bulldozer. The "urban renewal via urban destruction" idea was introduced by Haussmann, adopted by the City Beautiful movement at the end of the 19th century, magnified by Robert Moses in New York, and continues to the present day. Indeed, the process of urban renewal by demolition was sometimes referred to as *Haussmannizing*, in recognition of the Baron's Parisian methods. As examples of the attitudes at work, recall the pronouncements quoted in page xx (Chapter 1) of the 1838 Select Committee in London and of Robinson in 1901.

The view was continued by Robert Moses who shaped New York in the middle of the 20th century. He summed up his philosophy in 1964, saying that[13]:

> You can draw any kind of picture you like on a clean slate...in laying out a New Delhi, Canberra or Brasilia, but when you operate in an overbuilt metropolis you have to hack your way with a meat axe.

Moses, incidentally, hated tunnels. He believed that the monumental bridge - big, brazen and brutal - was the only appropriate solution.

People and planning

Today, the use of the Moses meat axe in transport planning has been discarded and replaced by democratic decency rather than dictatorial decree. The two core principles are that most people want transport facilities that are:

* sufficiently close to be accessible but sufficiently far away so as not to be a nuisance, and
* attractive to their neighbours, so that the neighbours start using them and stop clogging the roads.

The first principle gives rise to the NIMBY (not in my backyard) response. Munich town planner Werner Brög relates NIMBY to St Florian – patron saint of fire-fighters - who was routinely petitioned by Bavarian farmers faced with the inevitability of a farm fire during thunderstorms with this prayer: "Oh Holy St Florian, exempt my house and kindle some other one." Procedural commitment to Nimbyism in the U. K. in the 1980s resulted in planning procedures typically lasting for ten years rather than for 10 days. As community reaction becomes stronger and as 10 year delays become commonplace, a NIMBY is transformed into a BANANA (build absolutely nothing anywhere near anyone).

Once the plans for a new road are finally available, they are normally placed on public exhibition for a statutory period. This requirement sometimes irks impatient road-builders, as evidenced in the Freudian slip in the following notice issued by a planning officer in a road-building agency[14]:

> The main purpose of the extension to the exhibition period is to provide those wishing to make submissions the opportunity to review the proposal over a four wee period.

One proper purpose of this exhibition process is to obtain an environmental clearance for the scheme. Draft student reports collected by Kieran Sharp in 1986 included the following revelations:[15]

* The animals most affected will be very small animals, like insects, and it will be assumed that they don't carry too much weight, so far as the environment is concerned.
* The river caused trouble by constantly crossing the alignment of the proposed road.
* The required noise barriers should be covered by aesthetic landscaping.
* The works are in an area which is barren, ugly, unused by animals, and of little value.

Environmentalists have long seen the roads lobby as being a juggernaut able to bulldoze anything in its path. In 1961, Jane Jacobs wrote[16]:

> We Americans will hardly need to ponder a mystery that has troubled men for millennia: what is the purpose of life? For us, the answer will be clear, established, and for all practical questions indisputable:
>
> the purpose of life is to produce and consume automobiles.

But, my children, the roads lobby is a mere figment of green imaginations. So the answer to our traffic and transport problems is not to castrate the roads lobby. The answer lies in an insight provided by the great American cowboy-humorist, Will Rogers, who died in 1935. Will said:

> There's a simple solution to this traffic problem. We'll have business build the roads. And government build the cars.

T. S. Eliot, one of the twentieth century's leading poets, was not all that impressed with the consequences of road planning. His work, *The Rock*, published in 1934 includes the following lines:[17]

> I journeyed to the suburbs, and there I was told:
> We toil for six days, on the seventh we must motor
> To Hindhead, or Maidenhead.
>
> And now you live dispersed on ribbon roads,
> And no man knows or cares who is his neighbour
> Unless his neighbour makes too much disturbance,
> But all dash to and fro in motorcars,
> Familiar with the roads and settled nowhere.
> Nor does the family even move about together,
> But every son would have his motor cycle,
> And daughters ride away on casual pillions.
>
> And the wind shall say: 'Here were decent godless people:
> Their only monument the asphalt road
> And a thousand lost golf balls.'
>
> A thousand policemen directing traffic
> Cannot tell you why you come or where you go.
> What does the world say, does the whole world stray in high-powered cars on a by-pass way?

Planners as people

Given the antecedents described above, it is not surprising that transport planners are poorly regarded by the public. Mike Hamer, writing in *New Scientist* in 1981, described them as:

> a peculiar breed, almost to a person male, sipping lager, impressing each other with meaningless words and exuding blinkered self-confidence. They use an approach their ancestors got on Mt Sinai and the public has to keep taking the tablets.

Maybe Hamer had noted that most planning models of the time assumed that all travel done by women was for leisure activities and thus had no productive value. Or perhaps he was influenced by a paper in a contemporary issue of *Transportation Science*, a learned journal well read[18] by transport planners, which carried a paper entitled: "Deficit funding bus scheduling with deadheading trip insertions for fleet size reduction." It described the operations of an Israeli bus company named Egged. The authors reported that Egged were unimpressed with Deadheading and would be reverting to Gantt. Less tendentiously, at about the same time an author called L. Pickup improbably wrote a paper called: *Housewives' mobility and travel patterns*.

Planners certainly suffer a credibility gap and often even they have trouble believing what they say. In 1986 Stephen Atkins was moved to publish a learned paper which listed his profession's own statements about its frailties.[19] For example, he recalled that in 1980 John Wootton -who went on to head the Transport Research Laboratory in the U.K. - wrote:

> Twenty years' experience in using transportation models to predict future travel demands has convinced me of the inadequacy of existing models and the need to treat their results with caution.

John was then a partner in the consulting firm, Wootton Jeffreys. They had established their offices in the cemetery-keeper's lodge of the dormant Brookwood Cemetery, surrounded by its more permanent occupants. I did not realise the depth of the symbolism until I later myself became a principal in a consulting firm. Atkins also quoted his own recalcitrant self saying in 1977 that planners employed:

> a series of excessively complicated and expensive models using unsubstantiated and biased techniques to provide information of dubious accuracy for answering the wrong questions.

Then a year later came the memorable comment of one J. Akass (sic) who observed:

> We have been bamboozled by upstart experts. Guesses, dressed up as jargon, have been served up as revelations.

Atkins also presented an extensive review of the predictive accuracy of U. K. transport studies. This showed that the traffic predictions made by planning models had proved no more accurate than the assumption that the traffic would be unchanged. Thus, planners would be well advised at the outset of their careers to heed Mark Twain's advice to: "never forecast if you can help it - especially the future."

Things improved ever so slightly. In 2006 a review by some Danes of 210 major transport projects around the world during the preceding 30 years, found that for 25 percent of the road projects the difference between forecast and actual traffic exceeded 40 percent.[20]

The forecasting problem is not unique to transport, as Randal O'Toole has demonstrated:[21]

> During World War II, Kenneth Arrow, who later won the Nobel prize in economics, worked as a weather forecaster for the US Air Force. Part of his team's job was to forecast the weather a month in advance. But their long-range forecasts were no better than random, so they asked to be relieved of their task. They were told that: "The Commanding General is well aware that the forecasts are no good. However, he needs them for planning purposes."

Some of the nonsense of the past is regurgitated into the future. In Australia I have been appalled by the way crudely calculated estimates of the costs of urban traffic congestion have been thrown about as if they were the revealed wisdom of the prophets. The Australian figures, I found, as a base case assume that - in the uncongested case - traffic would not even need to stop at traffic signals. The resulting distortion is enormous, but the figures continue to be used.

I was therefore pleased to see a French colleague, Christian Gérondeau, take European Commission representative Dr Blonk to task in 2000 for similar blatant use of unsubstantiated congestion cost data. Gérondeau was able to show that Blonk's 1999 claim that traffic congestion cost 2% of the Europe's GDP was based on a single untested study presented by an obscure researcher at a seminar in 1976![22]

Of course, this discussion is not intended to be an attack on planners as people. After all, their own journal reported the following examination result:[23]

Question: What measures can be adopted to control and counter urban sprawl?
Answer: Urban sprawl is a place where people spend their leisure time in the evening. Young couples are particularly fond of an urban sprawl. As urban sprawling can be embarrassing to passers-by, it should be placed away from the town and hidden from sight by concrete stools. Strong overhead lights will prevent sprawling in unwanted areas.

Finally, it is not possible to leave the world of planners without recounting their own urban legend. It concerns the market segmentation of a community to determine their individual propensity to travel. The planning lecturer refers his audience "to Table 3, which shows the population groups within the city, broken down by age and sex."

Notes on Chapter 2

1 Chesterton, G. K., *Flying Inn*, London: Methuen, 1914
2 Lay, M. G., *History of Australian roads*, ARRB Special Report 29, Vermont Sth: ARRB, 1984
3 Clark, M., *History of the continent of Australia*, Melbourne: Bailliere, 1877, p64
4 Anderson, W., *Roads for the people*, Melbourne: Hyland House, 1994, p155
5 Anon, *Reminiscences of life in the Country Roads Board*, Melbourne: VicRoads, 1995, p5
6 Isaiah 40:3-5, RSV
7 loc cit, 57:14
8 loc cit, 59:8
9 Matthew 3:3, RSV
10 Lay, M. G., *Ways of the world*, New Brunswick: Rutgers University Press, 1992, pp 13-14
11 Hays, W. B., *Engineering in South Australia*, Australiana Facsimile Editions: No. 46, Adelaide: Libraries Board of South Australia, 1856
12 Lay, M. G., *History of Australian roads*, ARRB Special Report 29, Vermont Sth: ARRB, 1984
13 St. Clair, D., *The motorisation of American cities*, New York: Praeger, 1986
14 R. E., VicRoads, 14 Feb 1995
15 Private communication
16 Jacobs, J., *The death and life of great American cities*, New York: Random House, 1961
17 Eliot, T. S. The Rock, in *Stories of the human spirit*, 1934
18 Or so they say - most technical papers about planning are so barren and obtuse that it is doubtful if even the authors could have brought themselves to read them.
19 S. Atkins. "Transportation planning models - what the papers say", Traffic Engineering and Control, Sep. 1986, pp460-7
20 Flyvbjerg, B., Holm, M. & Buhl, S., "Inaccuracy in traffic forecasts". Transport Rev 26(1), Jan, 2006: pp1-24
21 O'Toole, R., *The vanishing automobile*. Oregon: Thoreau Institute, 2001, p457
22 C. Simpson, "Congestion costs 2% of GDP – or From myth to reality", World Highways, April 2000, p25
23 Town Planning Institute Journal, May 1959

Chapter 3

Making the Way

- an unfortunate and impractical guide to road-making

A gift of God

Following the poetic theme which underpinned Chapter 2, for the world to be able to stray on one of T. S. Eliot's by-pass ways requires the way to have first been created by either chance or construction.

Chance is more common than might be thought, for some ways do occur naturally over time, with only incidental human intervention. For instance, many countries of the Old World have ways hidden by thick and ancient hedgerows and worn metres deep over the centuries by the action of passing feet and hooves. In England such lanes are called *holloways* and a Reverend John Marriot cast them in a wonderful analogy[1]:

> Then the banks are so high, to the left hand and right,
> That they shut up the beauties around them from sight;
> Thinks I to myself, half inspired by the rain[2],
> Sure marriage is much like a Devonshire lane.

Having recounted this story to a dinner group, one of the guests told me that he had been raised in a part of Devon that still had many holloways. As most direction signs only pointed to the next small village, he had - when more than a village distant from his parents' home - navigated by driving towards a tall radio mast located nearby. However, in the holloways, even the radio mast was hidden from view and he often found it necessary to stand on the roof of his Land Rover to set his directions. This soon gained him an unsavoury reputation in the area as a Peeping Tom, as a consequence of romantic couplings that he frequently but, so he claimed, coincidentally observed on the other side of the hedgerows.

Before launching into the detail of road building, a little time should be spent on the terminology used by road-builders, based largely on the definitions that I used in *Ways of the World*. First:

* *streets* are places to be, and
* *roads* are places to go.
* *highways* are major roads connecting useful places.

For much of history, many highways were *toll roads* and were often termed *turnpikes* or *pikes,* after the barrier used at the tollgate. When Paris began turning its old fortifications and city walls into wide roads, these ex-*bulwarks* were called *boulevards* in French.

The first wide roads that provided for through traffic were the *parkways* built in association with new parks in New York at the beginning of the 20th century. The first highway built to accommodate high-speed cars and trucks - i.e with tight control over access, no intersections, no two-way traffic, and gentle curves and slopes - was probably the German *autobahn* built from 1929 to 1932 between Cologne and Bonn. At that time, the idea was being promoted in the USA that such major highways should be built as toll roads. In opposition to this, an American planner called Edward Bassett introduced the term *freeway* in 1930. For a while, it became the English-language version of *autobahn*. Today, there are *freeways* and *tollways*, and the term *motorway* is increasingly used to cover all high-standard freeways and tollways.

Urban freeways have rarely been greeted with universal acclaim and are popularly described as:

* fast routes between two traffic jams or
* linear parking lots.

But traffic is a story for much later in this exposition. It is first necessary to understand how roads are made and how cars are driven, and even then the deeper mysteries will only slowly be revealed.

Political purposes

Roads that do not occur naturally as gifts of God do need to be constructed. Over the millennia there have been six main motivators. First, society needs a certain level of roads in order to function and usually expresses that need very pointedly.

Second, many men have seen road building as a simple solution to a complex problem. When confronted by the impassability of the Alps, Hannibal exclaimed: "I'll find a way or make one." Some millennia later, in the early 1980s, the *Rolling Stones Loose Talk* column reported a similar response from President Reagan when presented with yet another problem in Vietnam. The President's suggestion was: "Let's pave it."

Third, some have seen road building as their chance to create a monument to be admired by posterity and this motivation has led to some formidable road-builders. Baron Haussman in Paris, various Popes in Rome, and Robert Moses in New York are all in this category. Such men can be unstoppable.

For example, even U.S. Presidents have not always been on top of their road-builders. President Eisenhower was responsible for initiating the building of the mammoth US Interstate System, and was one of its strongest advocates. However, upon seeing the construction of the first urban motorway entering Washington, he telephoned officials

expressing incredulous disbelief that this urban road was a part of his *interstate* system. He should have known that if you give good road-builders an inch, they'll build a mile.

Incidentally, it should not surprise to learn that Eisenhower the politician began the Interstate System, for in 1919 as a military officer he was part of a convoy of 79 military trucks that General Pershing led from Washington to San Francisco to demonstrate to the citizens the military importance of the truck to America. The convoy averaged 80 km per day.

In the real world, most people want roads (and public transport, to keep their neighbours off the streets). Thus the fourth road-building motivator is that road-building has usually been a firm vote winner for political candidates aspiring to re-election. This is not new, as the German political author Wilhelm Riehl, writing in 1854, had advised his readers that, in the past:

> urgently required roads were left unattended because nobody had thought of using them as an instrument of flattery, bribery or threats.

The motorcar rapidly raised the political importance of the road far beyond that encountered by Riehl. William Calder, the founder of the Victorian Country Roads Board, kept an extensive diary of his first few years in office.[3] In 1914 he visited the remote Shire of Walhalla to inspect their roads and recorded the following in his official diary:

Leader of Deputation:	"I am Mr Renshaw."
Calder:	"Oh, take a chair, Mr Renshaw."
Leader of Deputation:	"I am Mr Renshaw, Shire Secretary, Walhalla."
Calder:	"Oh, then take two chairs, Mr Renshaw."

Politics is never far from roadmaking. I once had cause to visit the Australian State of Queensland in my guise as a road expert. There I was introduced to the local Minister for Roads, an infamously larger-than-life figure. We were in his electorate and he informed me that the roads in his electorate were clearly the best in Queensland.

> "Why is that so, Dr Expert?" he asked.
> A tad naughtily, I suggested that perhaps they received more money than those in any other electorate. He replied:
> "Nothing so bloody obvious, they're the best because they only use material from my quarries and my sandpits."

The fifth motivator is that, many of the planners described in Chapter 2 saw road-building solving social problems. The great nineteenth century engineer, Thomas Telford, extended this view, seeing roadmaking as "*a working academy*" by which "the moral habits of the great masses of the working classes are changed."

The sixth of our historic road-building motivators is that it has often been used to alleviate unemployment. In 1622 a book by Nicolas Bergier on Roman roadmaking led to a revival of roadmaking in Europe[4]. His words had set two objectives ringing in the ears of his readers:

> The Carthaginians are said to be the first that paved the ways; afterwards the Romans did the same throughout almost all the world, to make the roads straight, and to keep the multitude out of idleness.

William Camden pushed a similar theme in the 1722 edition of his *Britannia* when he commented of Roman roads:

> In making such ways, the Romans were wont to employ the soldiers and the people, that they might not grow factious by too much ease.

In the post-Industrial revolution era, mass idleness became synonymous with unemployment. The "worthy work" theme held strong and in the 19th century many saw roads as solving social problems. As we saw above, Thomas Telford further extended this view. The author's father worked as a road labourer on a make-work scheme in Melbourne during the Great Depression in the early 1930s.

Raising the money for building those roads is usually the contentious issue and everyone can think of good reasons why someone else should pay for their construction. This is illustrated in the well-used story of the local proudly pointing out his town's new bridge.

> "That bridge cost $120 million dollars and 90 cents" he boasts.
> "How do you know the cost so accurately?" he is asked. He replies:
> "Well, we put in the ninety cents and the Federal Government paid the $120 million."

There are some political disincentives for road building. Environmental objections are too gloomy to discuss here. More's the pity, not everyone is happy when a road is built. Most of the reasons for objecting are obvious. Some new reasons occurred in Australia after the Second World War when the government began constructing Beef Roads to assist in populating Australia's empty north. The farmers were not universally pleased. Some complained that they would be required to buy a truck in order to take advantage of the new roads. Others found that their cattle would not walk on the black surface, which warmed quickly in the sun. It would not have surprised the farmers to learn later that, like most such schemes, it was not subsequently subjected to a retrospective benefit-cost analysis, for the obvious reason that it completely failed to realise its political objectives[5].

Road surveys

Most of the early constructed roads were built by the military. The first civilians known to have had a hand in the road-building process were the "*road surveyors*" - a title which dates from at least the seventeenth century, with some arguing that it developed in the fourteenth century from the name "*scavenger*" which described street cleaners. In 1718 William Nelson published a book on *The Office and Authority of Surveyors of Highways*. He noted that, as well as caring for the roads, they had also to deal with "infectious persons, diseased meat, nuisances, and the scouring of ditches."

In the days before local councils, any unresolved road problems were announced - and the associated work allocated - from the parish pulpit immediately following the Sunday sermon. Thankfully, the surveyors became engineers in England at about the time of Telford and McAdam at the beginning of the nineteenth century. This conversion had its very own John the Baptist, in the person of the slightly incredible Blind Jack Metcalf. His story comes later in Chapter 6, when you are better prepared for its revelations.

Before a road is built, its location must first be established. Today land surveyors do this task. Chapter 2 made it clear that planning surveys were often unreliable, and the same applies to many road location surveys. Indeed, a Queensland State Government publication only half-jokingly noted that when the term *way* was used to describe a road, it should be assumed that the local government officers who had established the route had been lost for at least part of their survey[6].

Not everyone is pleased to have a new road pegged out in his or her area and citizens have various ways of redressing the balance. For example, despite all the skill that might have gone into locating a new road, road builders are never surprised to learn that the small snippets of land taken from each farm along the way will inevitably be the most valuable and indispensable piece of land on that farm.

Similarly, objects of amazing importance may subsequently be discovered along the route of the road, as if the surveyors had been drawn by magic to the one critical spot in the whole vast landscape.

At one site of a proposed road I was personally shown what was seriously alleged to be a 150 year-old track constructed from logs placed side-by-side across the road. This was an old method called *corduroy* and was therefore of great archaeological significance. This was despite the fact that exposed timber in that area rarely lasted more than 30 years and the very level formation with its large and intact transverse timbers clearly indicated that it was actually the remains of a recent rail-track servicing a nearby gold-mine.

In Sydney, builders of the M2 motorway were shown ancient aboriginal sacred stones which investigation revealed to be World War 2 gun encasements, and trees with magic aboriginal signs which were actually weathered paint marks left by the surveyors who first pegged the new road alignment.

A tree in Victoria allegedly bearing the marks of a canoe carved from its bark 150 years ago, on closer study became a tree that had been hit by a truck a decade previously. The claimants had first asked for $250 000 compensation - after the revelation they revised their claim to a ride home and some firewood. I must add that in each of these cases, whilst the alleged artefacts were aboriginal, the claimants were not.

Rare animals from threatened species also flock to road reservations. One of my jobs was delayed six months because a tuft of hair found on a tree might just have come from an endangered species of possum. The possum itself had never been seen in the area, despite intensive post-tuft investigations. A nearby resident, coincidentally, was then involved – at a distant university – in research on that species.

Once the centreline of a road is established, many important elements such a gutters, kerbs and drainage pits are located by measuring a certain distance at right angles from the centreline. Engineers do this quickly and accurately with a lens called an *optical square*. A curious tradition amongst such engineers was that the road workers should not be allowed to use optical squares - after all, if they could do that, what else might they want to do?

Road workers were instead instructed to "*clap square off*" - a technique which requires the clapper to stand on the centreline with arms horizontally out-stretched on either side of the body and pointing along the centreline. The eyes are closed, and the arms are brought together to clap the hands. It is assumed that this blind clapping brings the two hands together at right angles to the centreline, despite a continuing lack of field evidence to support the assumption, and many examples of where it has failed. For instance, many strange drainage locations and unexpected pavement narrowings have resulted from clappers with an arthritic shoulder or a cigarette protected in one hand.

Road workers

When the centreline is established, road workers can commence their constructive efforts. From scavenger and sermon-stopper and clapper, the role of the road worker has rarely been well regarded.

At one extreme, in the 19th century, many countries used convicts to build their roads, none less humanely than in Australia. In the 1830s every male convict was put in irons on arrival in New South Wales and sent to labour on public works. When this term was finished, a convict was assigned to a settler or, in the event of misconduct, was placed in a road gangs. These gangs of recycled, recalcitrant prisoners became the refuse of the convict population. Their members were frequently required to sleep in the open air and were subjected to pitiless flogging by their overseers[7].

At the other extreme, outside the prison system the road worker has long had a reputation for a languid attitude to the task at hand. A satirical journalist writing as Pasquin[8] made these comments on South Australian road workers in the 19th century:

> One man makes a desperate blow - enough to stun a mosquito - then looks at the injured point sorrowfully. To relieve his feelings, he seeks his pipe, cuts his tobacco and goes half-a-mile for a match: stops to consider the movements of an adjacent pig and calculates weight and proper time for killing; having settled all this to his satisfaction, he returns for a steady solemn smoke, and having finished, knocked out the ashes, and returned his pipe to its native pocket hanging on the fence, finds it near dinner time.
>
> This important sanatorial duty occupies some time, much reflection and a great deal of repose - which being duly attended to he gets to his work in earnest, resolved to earn his wages like a man or perish in the attempt.
>
> His weapon descends with a hideous crash which threatens to reduce all the main roads to a jelly; sad mishap - the pick handle is rent in twain, and poor Paddy retires to install another, which fully occupies him in the service of his country.

A typical cartoon has a couple of road workers leaning on their shovels, looking passively at the queue of waiting cars stretching to horizon and beyond, saying words like:

"I guess we'd better get on with it before we start causing unforeseen delays".

or

"Looks like they really did need this bit finished today. "

or

"We should head home ourselves before the traffic gets really bad."

There are many shovel jokes. We can manage just three. One is that you can tell north on a road job (if you are in the northern hemisphere) by seeing which sides of the road workers' shovels have moss on them. The second concerns the foreman who ordered a new shovel to replace one broken on the job. The depot sent back the reply that:

> It would be a week before a new shovel arrived. In the meantime, could two workers lean on the one shovel?

The third is about a visitor from head office who noticed who noticed a man and shovel, rigid and unmoving.

> "Who is that man and what's the matter with him?" the visitor asked.
> His host replied "The fact that he has not moved at all indicates clearly that he is a roadworker and he is suffering from digger mortis."

In Melbourne in 1913, two men were arrested for "loitering" on the footpath. In Court it subsequently transpired that they were overseers discussing how to repair the pavement[9].

In Chapter 4 we will learn how McAdam introduced broken stone into roadmaking. A fiendish associated invention was the one-legged stool on which the stonebreakers sat whilst at work. It was instantly apparent if any stonebreaker fell asleep on the job.

Indeed, road construction is conventionally associated with the painful pleasure of helping aggrieved traffic to inch its way past quiescent roadworks. Most drivers would query the word "help" and their worst fears were confirmed in 1990 when Britain's *Financial Times* carried an interview with a deposed marketing director who found himself "temporarily" working on the roads.[10] He told how he altered the temporary traffic control signals to make sure that only two or three vehicles passed through on each intermittent occasion when he fleetingly permitted the signals to turn green. He commented: "The looks on drivers' faces when that happens almost makes up for no longer being one of them."

Furthering this attitude, my Parish priest - Fr Len Egan - reported the following construction feat at our Parish school in his newsletter of 3 June 1990, explaining with religious certitude how some of those remarkable ancient roads and pyramids had been built:

> Long bluestone steps were removed from a side door of the church school, so that a ramp could be built for the disabled. For some days, the children in the junior school happily moved the steps from place to place as they played. When the men came to take the steps away, it took six men to lift each step.

Road engineers

Today, the supervision of road building is more the province of engineers, rather than of convict overseers. However, modern road workers often have as much respect for their engineers as did the convicts for their overseers. Fred Ward[11], himself an engineer, tells of a colleague, Charles *, who told one of his road gangs after a town meeting that they should be more respectful in the way they addressed him in public. "However" he said "it's O.K. to call me Charlie on the road." Henceforth he was universally called 'Charlie-on-the-road'.

This lack of respect for the road engineer also affects the general population. For instance, consider this standard "*engineer*" story. An engineer surveying the route for a new road through rugged country is asked by a local to explain what he is doing with his sophisticated survey instruments.

> "Well," says the engineer "I'm establishing the alignment for a new road".
> "That's not the way we do it," replies the local, "around here we go to the village at the end of the new road, find a donkey enjoying its carrots and its lady friends, and cart it back to where the road will begin. We then release the donkey. We mark the route it takes on its return journey by tying a leaking bag of lime to its rump. This always gives us the best route for the new road."
> "Ah" says the engineer, jumping at the flaw in the proposal "but what would you do if you couldn't find a donkey, they aren't that plentiful in many areas?"
> The local looks at the engineer pitifully, and replies: "If we couldn't find a donkey, then I suppose we'd have to use one of you engineers, but I'm not sure you could manage the bag of lime."

Being a road engineer is certainly not all that difficult. Even my most casual acquaintance knows more about my job than I do. This opinion was publicly reinforced in 1984 when the Department of Main Roads in the State of NSW advertised for a Deputy Engineer-in-Chief. The advertisement formally invited applications from people, regardless of their level of intellectual impairment.[12]

This selection process might explain the behaviour of C. Cannam, who was appointed Engineer of the Nunawading Roads Board in Victoria in 1862. Soon after his appointment he was dismissed by the Board Chairman because, inter alia, he "knew nothing of engineering." He gained notoriety by then – as his last official act - writing a letter to himself, advising himself of his dismissal, and apologising for not notifying himself sooner.[13]

Engineers, to regain their self-respect, tell jokes about road workers. A Canadian example concerns new immigrants who initially filled all the worst jobs, including labouring on road projects in much of middle and western Canada. Canadian legend has it that one such group of new labourers became distressed when they realised that they were each doomed to be the eternal labourer, never even reaching the rank of foreman. They dispatched one of their more articulate members to talk to the project engineer about their lack of opportunities for job advancement. The head-of-delegation met the engineer at the edge of the works area.

> "Why can't one of us be made a foremen?" the delegate asked.
> "Well," replied the engineer "to be a foreman requires intelligence."
> "What's 'intelligence'?" the delegate queried.
> "It's a difficult concept to explain, so I'll demonstrate it to you. I'll hold my hand in front of this tree, and when I count to three, I want you to punch my hand as hard as you can." said the engineer.

On the count of "three" the delegate punched vigorously, the engineer moved his hand sideways, and the delegate's fist smashed into the tree trunk. Wringing his bloodied fist and in intense pain, he staggered back to the cluster of his mates, working busily on the wide new pavement

> "Are you a foreman yet?" they questioned.
> "No".
> "Why not?" they asked.
> "You need intelligence."

"What's 'intelligence'?" they chorused.
"It's difficult to explain" replied their delegate and, noting that there were no trees in the middle of the partly-made road, began to improvise: "I'll hold my hand in front of my face like this, and when I count to three....."

Road-building

There have been some great road-building feats. My hat is raised to those who built the Yungas Road near La Paz in Bolivia, appropriately nicknamed the road of death and shown below. A similarly spectacular cliff road is the Guoliang "tunnel" in Hunan Province in China.

Yungas Road in Bolivia, appropriately nicknamed the road of death. Wikipedia

Roads and bridges are usually built by contractors, a much-maligned and misunderstood group, given the frequent telling of versions of the following story. God sends down a message to his people on earth saying that in future any souls wishing to enter Heaven should ensure that they are wearing strong boots when they die. The message is heard with some incredulity and its authenticity is widely doubted. God sends a second message: "I had hoped my people would have realised that boots are needed, as we have no roads in Heaven, due to a total absence of contractors." This story has many forms. In another version, St Peter uses the same excuse to explain the lack of freeways in Heaven, compared with the superb system in Hell.

Not even a superpower could resist the onslaught of road construction and the roads lobby. This was evidenced in 1993 when Igor Previn, a colonel in the KGB during its heady days as the Soviet Union's secret service, revealed to the world that his organisation had installed a number of caches of money, gold and other essentials of life in secret locations throughout the West. These caches would enable them to continue to operate during a third World War. The contents of the key cache near Grenoble in France had, he explained, been completely lost to the KGB when it was buried by a construction company building a French tollway[14].

Road builders take drainage very seriously and give it paramount importance. For example, a paper to a 1985 municipal engineering conference was unabashedly entitled: "The effect of manhole geometry on energy loss." At about the same time, design manuals were encouraging engineers to install extensive underground drains to remove water from beneath the pavement and the keep the foundations dry. After spearheading a campaign to encourage road builders to install such sub-surface drainage, it came as a shock to discover that many engineers were filling their new drains with tanker loads of water to check whether they were working properly, regardless of whether the process might saturate the carefully-dried materials.

In my time as its leader the Australian Road Research Board even ran a conference on road drainage. On the advice of our Sydney colleagues, we chose the New Crest hotel in the inner suburb of Kings Cross. This meeting of Australia's leading drainage experts - a toughish lot - went well, until the afternoon break for drinks. We had been advised that there was a bar outside the meeting room and this was one of the attractions that the venue had offered to us. However, since our informant had used it, the bar had become a major watering hole for Sydney's gay community. Its members were easily distinguished from our drainage engineers. Drainage engineers are usually alarmingly inquisitive in toilets, but on this occasion all seemed to prefer the privacy of their own rooms.

One of my road-building jobs passed beside an explosives factory and a government munitions depot. The contractor had dug a trench that over night had filled with water. Noticing a drain-like pipe in the bottom of the trench, a workman knocked a hole in it to provide a ready-made outlet for the trench water. Instead of removing the rain water, a pungent and almost-luminescent yellow fluid bubbled out of the ruptured pipe. The explosives factory was quickly alerted and the pipe was even more quickly repaired and the trench drained, although the strangely-clad repair team remained tight-lipped about nature of the yellow fluid.

Blasting a way through solid rock is one of the colourful aspects of road building. As an example, construction of the I-287 by-pass of New York City in 1987 required the removal of a 60 m length of obstinate rock by blasting. Four 70 tonne trucks were lined up as shields against the explosion. Someone miscalculated and the blast bodily picked up the vehicles and threw one against a nearby bridge pier, destroying both the truck and the pier[15].

Modern road building involves a great deal of construction planning and the detection and management of critical paths within the work program. A key feature of this form of planning is the achievement of various project milestones. They are a delight to achieve and a curse to miss. I was therefore not too surprised when one of my project managers delivered me his monthly report headed "Project Millstones".

My own dedicated secretaries have perpetrated two monumental "typos" on my behalf. One of my reports submitted to my governing Board proudly proclaimed that "Progress had been raped", rather than *rapid*. On another occasion at an international conference I showed a slide with a caption intended to say "shared public facility" on the arrow pointing to a roadside area. I never learnt how the French and Spanish translators managed my effort to convince the alert but sceptical audience that the area did not indicate a "*shared pubic facility*". In 1997 I co-authored a report which inflamed some readers by speaking of "bridge love load models", when it had innocently meant to refer to "live load models".

Cursèd openings

When the construction of a road is finished, the work is often launched by a senior cleric or a vote-hungry politician. The use of clerics has somewhat gone out of fashion since Western Australia employed a bishop to sprinkle holy water over a new length of the iconic round-Australia road, Route 1. The pavement was still saturated with holy water when the first truck rolled through. There was a collective dropping of the jaws, hearts and crosses of the watching dignitaries, as they observed great strips of the new, blessed bituminous surfacing adhering to sacrilegious truck tyres.

Official openings by politicians are no more successful, and are always invitations to disaster, and are not encouraged by wise road makers and bridge-builders. I recall, for instance, the official opening of a length of the Hume Freeway in north-eastern Victoria. The new road was to be jointly opened by a Federal and a State politician, both men of major ego and well-proclaimed self-importance. They were far too busy to use the road to drive to the site and left that mode to their minions, whilst both great men were flown to the location by charter planes - one from Canberra and the other from Melbourne. They landed at the closest airfield, a small and isolated airstrip on the far side of a nearby range of hills.

Our official chauffeur was instructed to drive to the out-of-the-way airstrip, collect the Ministers, and bring them to the site chosen for the ceremony. Unfortunately, on a wet and windy day the word *Ministers* is difficult to distinguish from *Minister*. The aircraft from Canberra arrived first; the chauffeur collected the Federal Minister, and proceeded to drive back to the ceremonial site, oblivious to the fact that the real purpose of his trip

was to collect a ministerial pair. Minutes later, the State Minister stepped off his plane, which then departed for its next charter flight, leaving him standing alone and unattended on a cold and totally unserviced airstrip, without a supplicant or even an elector in sight. Indeed, the only living creatures to be seen were some ominously large cattle who were approaching the city-bred Minister will obvious evil intent.

Whilst we lesser beings all waited impatient but secure in the well-stocked hospitality tent, our Minister and his accompanying crowd of curious cattle wandered through the windswept countryside, fruitlessly seeking an occupied farmhouse equipped with a phone and not guarded by savage dogs. During these Mosaic ministerial meanderings, the chauffeur - who had been redispatched to the airstrip - returned, reporting it barren and deserted. The charter pilot nevertheless confirmed that the eagle had indeed landed. Subsequent events revealed conclusively that Hell hath no fury like a forgotten, lost and abandoned Minister.

This event, salutary though it was, did not prevent its re-occurrence. A year later I was organising a meeting with local industry to initiate work on a new traffic system. The same Minister agreed to open it. To prevent a career-destroying repeat of the earlier fiasco, all possible people were briefed on the location of the event. As it was an early morning start, the Minister's minder came separately and stood outside the carefully designated address, and waited and waited and waited..... Meanwhile, stunned and distraught, I opened the meeting, giving some lame excuse for the Ministerial absence.

The minder subsequently located the Minister back in his parliamentary office, fuming. He had gone to the venue and arrived on time, but nobody was there to greet him and nobody knew of our meeting. He was clearly surrounded by incompetents. Indeed, on travelling to the venue, he had even had to point out the correct building to his driver, when that fool had attempted to go in the wrong direction. The driver, of course, had been proceeding in precisely the right direction - however neither the minder nor I ever had the temerity to ascertain which building the Minister had falsely fixated on, despite all our prior oral and written instructions.

Another Minister at the launch of a new "initiative" for motorcyclists spent the first ten minutes congratulating his leather-clad audience on the way in which they had improved productivity in the poultry industry. Someone in the crowd, who was actually listening, advised the Ministerial minder that his boss was probably reading the wrong speech. We all genuinely admired the way the dexterous Minister was able to switch smoothly from poultry to motorcycles.

At yet another cursed opening, the federal Minister of the time was flying in from Canberra to a country town to open its new by-pass. When he arrived over an hour late, the food and drink had been demolished but the by-pass was unopened. The Minister explained to the remnant of the satiated remains of the original crowd that the reason why he was late was that his staff had phoned the charter company and been told that the flight time would be "one oh seven". They had therefore left themselves an hour and seven minutes for the journey. Anxious questions of the pilot after an hour in the air revealed that the flight would take its planned 107 minutes. Of course, their waiting Melbourne-based driver also became lost between the landing strip and the by-pass.

On a further opening on the Hume Freeway, the Minister of the time also arrived late. The guests stood around occupying their waiting time by eating and drinking and talking and visiting the toilet. When the Minister finally arrived with his wife, her first act was to rush to the portable toilet. She emerged red-faced, and furiously demanded that the opening be cancelled to teach us all a lesson for having a toilet without paper. The angry dame was not placated by the excuse that: "An hour earlier, ma'am, everything was fine."

Perhaps there is a deeper reason than humour for this plethora of stories about politicians misopening roads - after all, the engineers did all the work, and made all the mistakes. Why shouldn't they get their name on the memorial stone? Road engineers pine for the good fortune of General Wade who built roads in Scotland in the early 18th century. A roadside obelisk erected to mark his work reads[16]:

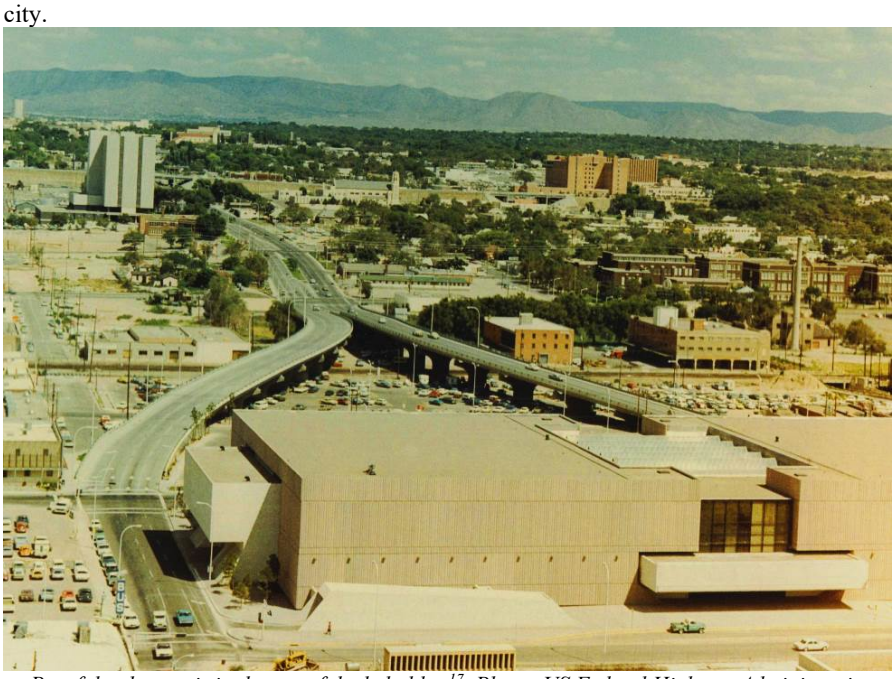
> Had you seen this road before it was made,
> You'd lift up your hands and bless General Wade.

Living with the Devil

Some of the roads built as a result of all this frenzied construction activity have proved appallingly ugly, and yet even they are still loved by the aficionados of the roads lobby. My favourite is the following photograph from a U. S. bicentennial publication[17] which was admiredly captioned:

> The Great Avenue Overpass makes a graceful split to avoid the Albuquerque Convention Center, and at the same time provides space for off-street parking.

From the photograph, it looks as graceful as a bow-legged robot about to rape an innocent city.



Proof that beauty is in the eye of the beholder.[17] *Photo: US Federal Highway Administration.*

Overpass is at least a fairly neutral word. For a while, the British - with hopeful euphemism - called the same structures *flyovers*. For instance, the trip into London from Heathrow Airport has long included the infamous Hammersmith Flyover where a brutally ugly steel structure whisks the traveller within easy earshot of a bevy of innocent bedroom windows. Thus, the operative phrase became: "like a convoy of trucks in a continuous flyover of my bedroom."

However, most cognoscenti would vote the New Jersey Turnpike as the world's ugliest road. It has even had a paean of praise written to celebrate its ugliness - *Looking for America on the New Jersey Turnpike*[18]. The book tells touchingly, for instance, of the thirteen rest areas along its length, and conjures up visions of how dignitaries might recoil with horror from the thought that a rest area could be named after them. They quote a New Jersey columnist, Calvin Trillin, who pondered:

> In my constant search for an honour I might decline, I have decided that I don't want a rest area on the New Jersey Turnpike named after me. Without meaning to be ungrateful, I'd have to say that having a service area named after you does not strike me as a completely ennobling experience.

Nevertheless, *Looking for America* also tells how New Jerseyans have come to love their monster. When newspaper editor Jill Ross hears someone criticising it, she comments:

> That's why we built it. To get people like you in and out of the State as quickly as possible.

Paul Bradley in a 1985 book[19] on New Jersey claimed that "the Turnpike is our Broadway." Linda Brown in 1975 called it[20]:

> New Jersey's metaphor, conveying the popular impression of New Jersey as not really a State, or even a place, but a corridor...

Looking for America contains no photographs of the turnpike. Nor does the Turnpike Authority's website. I wonder why?

Ed Gross, the Executive Director of the New Jersey Turnpike, was sued in 1997 by three of his senior female executives for a tangle of matters ranging from contract misadministration to sexual discrimination. The editor of the *Toll Roads Newsletter*, one Peter Samuels, was unable to resist heading his article[21]:

> Gross behaviors alleged.

When the ugliness of a road becomes too apparent, citizens can be assuaged a little by some tree planting along its edges. This very old practice has a number of other virtues. It was used in ancient India and China to delineate the road and provide shade for travellers. These reasons also led to its widely application in France during the resurgence of road building in the post-medieval era.

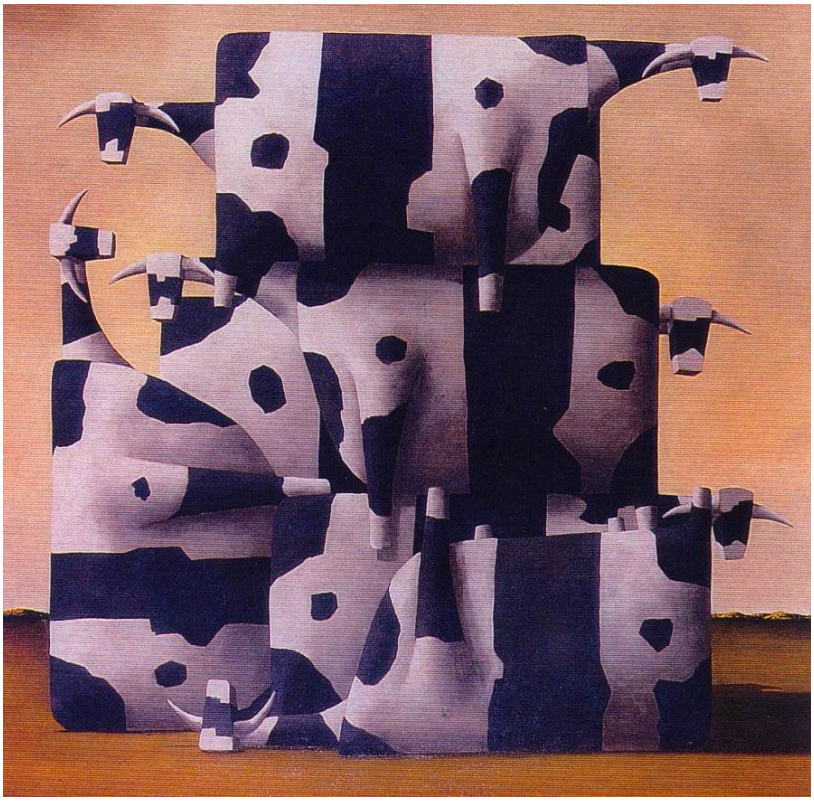
However, there have been many contrary views on the beneficial role of roadside trees. In 1285 the Statute of Winchester required bushes and woods in England to be cleared for a distance of 20 m from the roadside, so that there would be no place "whereby a man may lurk to do hurt".

The Statute was apparently not too effective as a subsequent law required abutting landowners to prevent their own trees from impeding the traffic using the road, and permitted travellers to pass through the landowner's property if trees on the road

inhibited their journey. A further Statute soon extended the 20 m to 60 m, in order to make it more difficult for robbers to descend unexpectedly on travellers.

Today, trees are kept clear of the roadside to prevent the chance of impact with cars that unintentionally leave the road. In the early 1980s, your author advocated an obstruction-free roadside in an Australian professional journal. He was roundly attacked by closet-Calvinists amongst the readers who believed that the errant drivers deserved to be punished for their poor driving and that the trees delivered that punishment whilst at the same time protecting pedestrians – particularly women pushing pram-loads of much-loved children – and property owners from being struck by the deviant cars[22]. The argument is morally and statistically ludicrous, but - as would be expected - was put with great passion.

Some have attempted to rectify the lack of aesthetic appeal along our roadsides. William Dobell was a famous Australian painter who served as a camouflagist during the Second World War. One of his tasks was to make papier maché cows to trick Japanese pilots into thinking that airfields were actually dairy farms. In 1996 a group of artists suggested that Dobell be recognised by a roadside sculpture evoking his cows. One proposal is shown below.



John Kelly's Cow Depot, proposed as a roadside sculpture. Photo: John Kelly.

The ungracious title of the widest road in the world was wrenched away from some Chicago freeways by Route 401, the intended northern "by-pass" of Toronto, Canada, which soon became more a northern "Main St" than a by-pass. The New Jersey Turnpike also grew to over 14 lanes wide in parts. However, in 1996 the road width record moved to the *Autopistas del Sol* in Buenos Aires, although its 18 lanes only occur over a short distance. The record is now well and truly back in the US with the I-5 boasting some 27 lanes near San Diego.

In terms of actual width, the record is held by the 6-lane Monumental Axis in Brasilia which is 250 m wide. Route 401 carries over 500 000 vehicles per day, which is probably another world record.

Streets

Toronto holds another road record. Yonge St (one of its oldest) begins lakeside in the downtown area and the heads north, crossing routes 401 and 407 and finally finishing some 1896 km away, making it - according to the Guiness Book of Records[23] - the world's longest street with the same name.

Streets themselves have to be named, as well as rest areas and flyovers. The first preference of local politicians is usually to name streets after local politicians. In this context, it would be nice to think that *Fredbert St* in Leichardt in Sydney was not named after a Councillor of Teutonic ethnicity, but as a compromise when councillors Fred and Bert could not agree. I have a street named after me in Ti Tree in Adelaide - the local council were not impressed with the implications of either Max St. or Lay St, but thought that Maxlay St was acceptable. I have since been told that locals now believe the name to be of Slavic origin.

Of course, we are all familiar with the North American system of numbering streets alphabetically or numerically. New York is a prime example, although Wall St was the site of an early city wall. Properties are usually numbered sequentially along the street, except in the otherwise-logical Japan, where they are assigned sequentially on request to the properties in an "island" bounded by a set of streets. This makes it a great challenge to find a Japanese business from the street address on its letterhead.

Notes for Chapter 3

1 Smiles, S. *Lives of the engineers*, Vol 3., London: Murray, 1874, p7

2 Or, *And hence, you'll allow, 'tis an inference plain,*

3 See Chapter 4.

4 Bergier, N., *Histoire des grands chemins de l'empire romain*, Paris: Ch Morel 1622 (2nd Edition 1728, 3rd Edition 1736)

5 Lay, M. G., "The role of large civil projects in Australian development". Australian Academy of Science, Science and Industry Forum, Report on the role of science and technology in the development of Australia (C. D. Kimpton, editor), Aug. 1988

6 The Road Builders, 1(3):47, June 1986

7 Hughes, R., *The fatal shore*, London: Collins, 1987, pp 431-2
8 Tapp, W. 1985. "A look into the past, Part 3 - building roads and charging tolls", Highways South Australia, 24(4):8, Dec.
9 Brown-May, A. "The highway of civilisation and commonsense: street regulation and the transformation of social space in 19th and early 20th century Melbourne". Australian National University, Urban Research Program, Working Paper 49, April 1995, p39
10 Financial Times, 12 Nov. 1990, p14
11 Anon, *Reminiscences of life in the Country Roads Board*, Melbourne: VicRoads, 1995
12 Engrs Aust, 13 July 1984, p46
13 Lemon, A, *Box Hill*. Box Hill CC, 1978, p44
14 Melb Sunday Age, 14 Mar 1993
15 AASHTO Quarterly, July 1992, p17
16 Haldane, A. R., *New ways through the Glens*. London: Thomas Nelson, 1962
17 FHwA, *America's highways, 1776-1976*. Washington: FHwA, 1976 p306
18 Gillespie, A. & Rockland, M., *Looking for America on the New Jersey Turnpike*, New Brunswick: Rutgers University Press 1989. 139 & xiv
19 Johnson, J. P., *New Jersey: A history of ingenuity and industry*. California: Northridge, 1987, p385
20 Brown, L. K., "American studies at Douglass College". American Quarterly, 27(3):342, Aug 1975.
21 Samuels, P., "New Jersey Pike, Gross behaviors alleged - & politics". Toll Roads Newsletter, 22, Dec1997, p1
22 Engs Aust, 51(17):2, 24 Aug 1979 & 51(21):5, 19 Oct 1979
23 McWhirter, N., *Guiness book of records*, Enfield: Guiness., 1982, p231

Chapter 4

Paved with good intentions

- a chapter showing that even road pavements have their interesting ways

Rocks and stones

The pavement is that part of the road that provides a running surface for traffic, spreads the traffic loads out to a level where they do not damage the underlying natural material, and protects the natural material from water, weather and wear. Pavements are often made from natural, local materials, but as the traffic becomes more demanding they increasingly are constructed of pieces of stone, often bound together by a mortar of bitumen or cement.

There is some semantic dispute about whether we are speaking of stones or rocks. It is generally agreed that *rock* applies to the bulk material and *stone* to the finished material, but in between there is a whole range of applications where the two words are used inter-changeably. I have personally been involved in a major court-case over the meaning of these words, and - although we experts argued our cases passionately - we could well have swapped sides and argued the contrary case.

The stone used for road making must be carefully chosen. No selection process could have had more respectable antecedents than that used by early Quaker road-makers, who took some pleasure in obtaining their material from the holy crosses previously used - in the Quaker view, with ostentatious excess - on graves and church altars.

In the early nineteenth cent+ury, the famous road-building innovator, John McAdam, required that all pieces of stone used with his method be no larger than 20 mm. The field test was whether the stone would fit into the stonebreaker's mouth. Of course, those that passed the test were orally removed. On one occasion, McAdam accused a workman of placing stones that were too large. As the accused turned to defend himself, McAdam was confronted with a large, gaping, and very toothless mouth[1].

John Loudon McAdam. 1865 engraving by Charles Turner in British Museum, Cheylesmore Collection.

McAdam's name has passed into the literature as *macadam*, the form of pavement he invented, and a later form called *tar macadam* soon became *tarmac*, a word still widely used to describe the pavements at airfields.

Tar is a by-product of coal and wood processing and is very similar to bitumen. The two materials are often confused, particularly by translators. Tar preceded bitumen in road-making, but is now rarely used due to its poorer road-making properties and higher carcinogenic potential.

On two grounds the McAdam name was a fiction. First, he wrote his name M'Adam. Second, the family name had been McGregor, but life-threatening troubles with their English overlords meant that the family had to flee its home and a new name had to be found. As strict Scottish Calvinists, their consciences were assuaged by the belief that they did not tell a falsehood if they informed any enquirer that their name was McAdam, which literally means "son of Adam".

McAdam was an innovative but difficult man who made many very public and very acerbic comments about the abilities of his contemporaries, for instance[2]:

> *road engineers*: deceive the public and delude the trustees; elected because they can measure; they might as well be elected because they can sing; their want of science has gone hand-in-hand with improvident expenditure; without energy or character.
> *trustees of private roads*: narrow and jealous.
> *their accounts*: obscure, confused, perplexed and dilapidated.
> *their road-making*: their defect lies in the want of science; a great waste of public money.
> *public servants*: worthless.

Despite these antecedents, a problem with pavement technology is that it is a subject that excites little or no public interest - indeed, rarely has it even managed to excite engineers. McAdam explained England's poor roads with the remark:

> I think the defect lies in the want of science in roadmaking.

Frederick Deacon, one of the major 19th century practitioners in the area, complained[3]:

> As a branch of civil engineering, street paving has never occupied a very high place.

More recently, a contemporary expert, R. C. Koole of Shell, wrote:

> Pavement engineering is the art of moulding materials we do not understand, into shapes we cannot precisely analyse, so as to withstand forces we cannot assess, in such a way that the community at large has no reason to suspect our ignorance.

Come the car

One of the first consequences of the introduction of the motorcar was that overnight the pavements that had served slower traffic well for generations, became unacceptable to drivers and bystanders alike.

For example, a speeding car rapidly creates enormous dust clouds when travelling over an otherwise satisfactory surface employing unbound local soils. Chapter 10 will recount Rudolf Diesel's pleasure at creating one such cloud in an Italian valley. In desperate attempts to find some low-cost solution to the "dust problem", local road engineers frequently succumbed to the local snake-oil salesman.

Products with names like Eastrumite and DustStopper were far dearer than water, but no more effective. Initial tests were usually successful, as the salesmen would encourage the engineer to spend greater than normal time getting the road into "shape", before spraying it with the magic water.

One dust suppressant company that I crossed swords with was actually selling an oil-refinery waste product that was mainly recycled sulfuric acid. We published a warning about the product and its owner then challenged me to appear with him on local television, where we would both plunge our bare arms into a barrel of his product. I agreed to follow him on live camera, once it was clear that his arm was not dissolving and that our pH readings must have been wrong. Strangely, he "forgot" his challenge and concentrated his marketing efforts elsewhere.

A timber industry company became quite excited to learn that one of their by-products - lignin sulfonate - had the technical benefit of binding the dust particles together into larger particles, which were then less likely to become airborne dust. The company was disappointed to be required to tell consumers that its magic cure would wash away in the first rain shower.

Later in this Chapter we will discuss how the dust problem outside the Monte Carlo Casino led directly to the invention of the spray-and-chip seal method of using bitumen to provide high quality but low cost pavements. At the same time, the Californians were trying a solution involving covering the road surface with straw. There were just two problems - the straw was either burnt by sparks from passing cars or discarded cigarettes, or eaten by stray cattle.[4]

Bitumen

Despite the above cynicism, the development of pavements is a fascinating story and it is recounted in Chapter 7 of *Ways of the World*[5]. Many pavements are built of asphalt which is a mixture of bitumen and stone; just as concrete is a mixture of cement mortar[6] and stone.

Bitumen is the viscous component of petroleum. It occurred naturally in Mesopotamia and so its use - mainly for waterproofing - dates from some of our earliest ventures into civilisation. In about 1000 BC under Assyrian law, a useful punishment was to pour hot bitumen over an offender's head[7]. The effect was extremely painful, but the protective nature of the bitumen ensured that the offender lived to publicly display the resulting disfigurement.

The original word for the material was *pitch,* but the down-market uneulogistical name certainly worried writers in the Middle Ages, who thought the solution was to Latinise *pitch* into *pitchumen*, and *pitchumen* soon became the more sayable *bitumen*. More light-heartedly, an almost anonymous A. W. J. of *Shell* wrote[8]:

> When the scripture's perused, we find bitumen used
> In a manner that's almost quite mystical:
> But in Biblical time, it was called *pitch* or *slime*,
> Which could scarcely be called eulogistical.

As *pitch*, bitumen is mentioned in a number of places in the *Bible*. The coracle that carried the baby Moses in the bulrushes was waterproofed with bitumen. However, the mention is not always favourable and Sirach warns[9]: "Whoever touches bitumen will be defiled."

As a civil engineer, I have always been moved by the wonderful section of Chapter 14 of Exodus telling how Moses led the people of Israel out of bondage in Egypt, raising his staff to part the waters of the Red Sea. After his people were across and into the Sinai, he lowered the staff and the returning waters engulfed the pursuing Egyptians. I once told a Jewish friend how much I loved this reading. He said:

> "Ah, but at this point in our readings, today we all groan."

I must have looked puzzled for he explained:

> "Moses then had two choices, turn left and head into Israel with its milk and honey or continue on into Mesopotamia and with its limitless oilfields. And he turned left!"

Bitumen has a long oral tradition. In the *Apocrypha* Daniel defeats a marauding dragon by feeding it with an incendiary mixture of bitumen and hay, which was ignited by the legendary fire in the dragon's belly, thus destroying the creature with a severe attack of heartburn.[10]

Lest all this seems a tad unhealthy, I must note that bitumen was widely promoted in the Middle Ages as an external medicine for treating wounds, skin disorders, rheumatism, tumours, gout, toothache, and epilepsy. As, fire breathing dragons were - by then - less common, emulsions of bitumen and beer were also used internally to treat diarrhoea and other digestive upsets. More recently, in Mexico, a popular chewing gum was a mixture of chicle and bitumen.

When bitumen first came onto the market for roadmaking, it is therefore not a surprise to learn that road workers tested its viscosity by chewing it in their mouths. The technique was still in use in the 1920s. It has been described as follows[11]:

> The "chew" test was the best for control, as laboratory tests available were neither fast nor reliable. It was run at a constant temperature, 37 C, and was based on matching control samples. With chewing rates and mandibular compression as variables, coupled with a tooth count and a proper frame of mind, answers could be masticated into shape.

Some bitumen producers supplied a box of calibrated chewing samples with their product.

All this oral background provides a lead into a common roadmaking story in which a workman complains to the foreman that he can't repair a pothole because the bitumen he's been given is too hard. The bitumen had clearly become too cold.

> "Eat it" says the impatient, h-dropping foreman.
> The astonished workmen asks: "And once I've eaten it, 'ow long will I 'ave to wait before I can fill the pothole?"

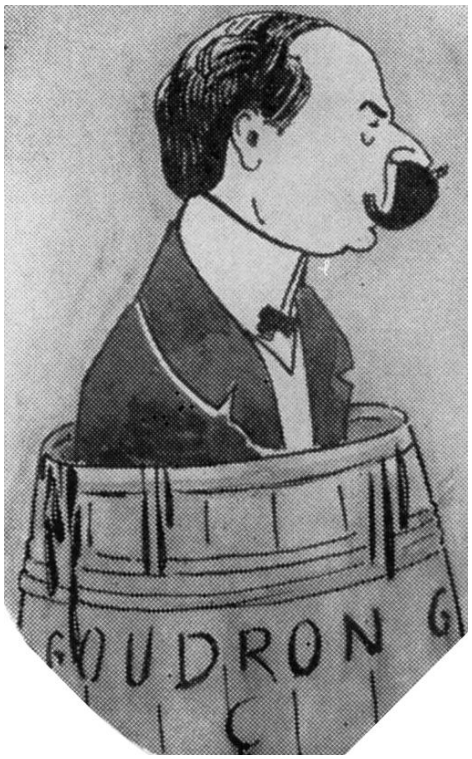
The various medical uses of bitumen may have confused people, for they certainly had trouble knowing exactly what they had taken. In the 17th century Thomas Blount in his *Glossographia* defined it as: "A kind of clay or slime, naturally clammy, like pitch, growing in certain countries in Asia."

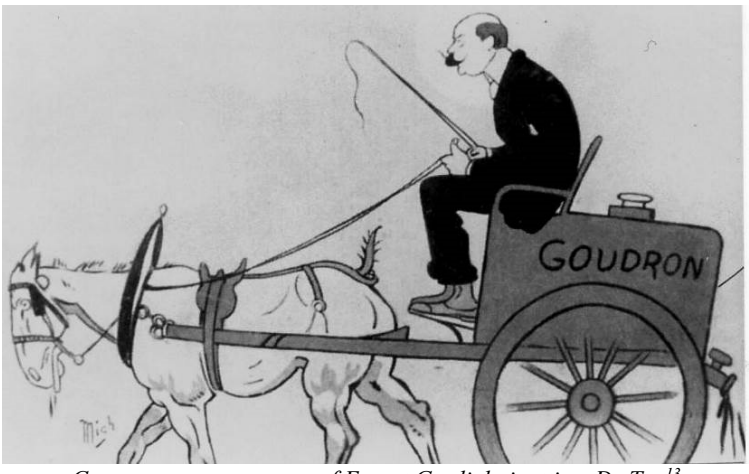
Although some bitumen still occurs naturally, it is present in most petroleum and the material used today is a by-product of oil refining. It was a great natural coincidence for road makers to find that producing the fuel to power the motorcar also produced an excellent material for making the roads needed to carry those cars.

Bitumen is not only used as a glue to hold the stones together in asphalt - it can also provide a road surface in its own right. The spray-and-chip seal method for using bitumen in this way was invented towards the end of the nineteenth century, in the following manner. Prince Albert I of Monaco was publicly despairing over the deleterious effect that dust from the Grande Corniche Road was having on business at his Casino.

During this period of dark princely despair, a Swiss physician, Ernest Guglielminetti, was in Monte Carlo to lecture on mountain sickness and to describe some devices he had invented to lessen its effect. The Prince was impressed by the lecture and asked if the innovative doctor could also solve the problem he was having with the dusty Corniche road.

Thinking laterally, Guglielminetti recalled that when he had worked in Indonesia he had used tar to seal the floors of his tropical hospital.[12] He reasoned that the tar was such a sticky, strong and durable substance, that it might also work if sprayed on the Grand Corniche Road. So successful was he at solving the Prince's problem in this manner that he came to be known in France as le docteur Goudron (Dr Tar), as the contemporary cartoons below illustrate.





Contemporary cartoons of Ernest Guglielminetti as Dr Tar[13]

In the Guglielminetti method, tar or bitumen is sprayed on a firmly rolled surface of small stones and, when still sticky, the resulting film of bitumen is covered by a layer of sand or broken stone. The bitumen provides a tight, waterproof seal and the broken stone roughens and protects the surface from tyre damage.

The spray-and-stone surface is far cheaper than asphalt and lasts for decades if properly maintained. Maintenance usually involves nothing more than using bitumen to seal any cracks that do occur. Nevertheless, road-builders were surprised in 1989 to read that the City of Oakleigh in Melbourne was asking them to tender for a "crack ceiling" contract[14].

The bitumen is sprayed onto the road surface from the back of a truck. On windy days, the spray is often blown beyond its intended bounds and the road builder faces angry and often-provocative damage claims from black-besplotched citizens. The most extreme in my experience was from a local doctor who submitted an account for $3000 to replace his silk underpants. We thought briefly of asking if his partner required similar recompense?

Incidentally, the Grande Corniche Road - i.e. the great ledge or cornice road - referred to above runs along the Mediterranean coast east from Nice towards Italy. Frederick Treves, who cast a book around it, disparagingly described the road as:[15]

> The best known and most popular of the great roads in Europe. It can claim no historical or engineering distinctions. It is comparatively modern and it cannot boast any great achievement in its making. It goes practically nowhere, since long before Mentone is in view it drops into a quite common highway, and thus incontinently ends. It is not even the shortest way from point to point, being, on the contrary, the longest. It cannot pretend to be what the Italians call a "master way", since no road of any note either enters it or leaves it.

Treves thus gives neither a tourist promotion for the road nor an explanation for its Grande title! Somewhat more positively, the road certainly contains some spectacular scenery and in the early nineteenth century Napoléon and his French Empire saw its

construction as assisting its militaristic influence on the Italian states and called it the Grande Italian Road[16].

Guglielminetti's spray method was enthusiastically ad+opted in many countries and developed to an art form in Australia and New Zealand during the 1920s. An Australian supplier - Tarvenac - went so far as to publish the following prayer amongst its trade advertisements[17]:

> My roads are right, I have no fear
> For no roads last like mine.
> I make them strong, my pride is such
> In surfacing each way,
> That as I give the final touch
> My prayer is - "Let us spray".

Bitumen's black paving surface can have its negative impact, as C. A. Mullett, a letter-writer to the Melbourne Age in the early 1980s, reminded us. He proposed that the black strip of paving from Melbourne to Perth - about 3 000 km in length - was influencing Melbourne's weather pattern by causing thermal up-drafts which unhelpfully deflected the good weather born by the westerlies to the empty south. He suggested that the road should be painted white to reduce the blackbody radiation, and that even the now-black centreline stripe should be broken rather than continuous. A few days later a U. R. Fysh suggested in a further letter that a less dramatic solution might be to paint the occasional white speed-hump transversely across the highway.

Asphalt invention

As we have now provided a sound description of the chemico-physical properties of bitumen, let us return to the romance of asphalt. Although asphalt is simply a mixture of bitumen and stone, a great deal of public confusion surrounds the meaning of the word. For example, that august source, the Shorter Oxford English Dictionary is quite incorrect in its entry for *asphalt*.[18] It was perhaps influenced by a 1927 English work that described asphalt as: "a kind of liquid lava found between Italy and Switzerland."[19]
The confusion is certainly worsened by the practice of many American technologists to refer to *bitumen* as *asphalt*, which they see as an abbreviation for *asphaltic cement*.

In many oil-rich areas, the bitumen has seeped into the surrounding rocks to produce a natural asphalt. Until the roadmaking use of asphalt was discovered, this natural asphalt was quarried and then heated to remove the bitumen that was sold for medicines and waterproofing applications.

One of the stories told in *Ways of the World* is of the urban legend surrounding the invention of asphalt roads and that book catalogues some thirteen outbreaks of the same basic story between 1849 - when it actually occurred - and 1901. All appeared in reputable journals and all ascribed the same discovery process to their own particular circumstance.

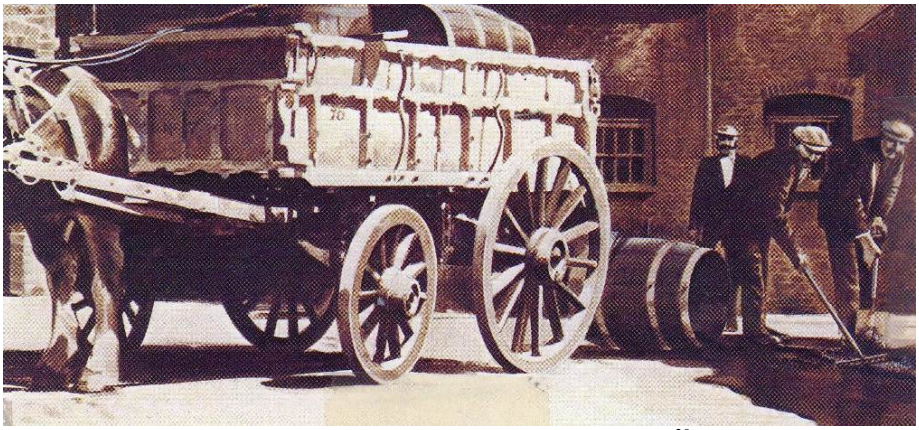
The original (or real?) story is that the method of making roads from asphalt originated in 1849 when André Mérian, who was chief engineer of the Swiss canton of Neuchâtel, visited the Seyssel asphalt mine in France, and observed horse-drawn trucks

taking mined natural asphalt from the mine to a facility to remove the bitumen. Mérian noted that pieces of asphalt rock falling from the trucks were being powdered by the iron-tyred wheels and then rolled by later wheels into a very useful road surface.

He returned home and immediately conducted trials aimed at transferring this serendipitous technology to his local asphalt. As a demonstration, he powdered Neuchâtel native asphalt and then cold-rolled it into the surface of a macadam pavement on a road, between Val de Travers and Les Verrières, leading to Pontarlier in France.

This story has reappeared in a number of guises. For example, a related sighting was an equivalent quarry road trial conducted at the Seyssel mine, mirroring the competitive success at Val de Travers. A third form ascribed a staged discovery, beginning with the use of powdered natural asphalt but then following an otherwise similar sequence. A similar nineteenth-century story in Australia had asphalt unloaded from a ship falling from a truck in Adelaide and serendipitously proving to be a good paving material.

The story reappeared a fifth time in 1901 when Purnell Hooley observed that a barrel of tar which accidentally burst over slag, or clinker, at England's Denby Iron Works produced an admirable road surface. After some further research, he founded the Tarmac Company in 1903 to market the new product. It was to prove extremely successful in Britain and received significant official endorsement. Mixing tar with natural stone was by then a well-established practice, so Hooley's total serendipity in producing tarmacadam based on slag might be doubted. Further outbreaks of the legend occurred in Santa Barbara in southern California, in Mexico, and in Trinidad, thus bringing the total to eight.



Tarmac's version of the discovery of asphalt.[20]

In a letter to Scientific American in December 1898, M. Meigs of the U.S. Corps of Engineers reported sightings nine to twelve:

* in Pennsylvania, where a leaking oil pipe accidentally improved a clay road;
* in Austin, Texas, where oil from leaky drums in a depot was compacted to a hard, firm pavement;

* in Missouri, where the inevitable barrel of oil had fallen from a wagon onto a road and subsequently and accidentally produced a good pavement; and
* from the Pennsylvania Railroad.

All this led Meigs to record the thirteenth "legend"' in the form of some U.S. Corps of Engineers experiments in Indiana, which were directly sponsored by John Rockefeller of Standard Oil.

Asphalt application

A Melbourne asphalt contractor, Serge *** of Emoleum, vouches for the following asphalt construction story and so it must be true, and not another urban legend. At the end of a long day during Serge's period as his Company's State manager for asphalting, his foreman telephoned to say that he had taken the asphalting plant to the site of tomorrow's job - the car-park of a take-away food store. He had unloaded the plant from the truck and put it in the car park. As he told Serge, when he returned to his truck, a strange event had occurred;

"Someone has parked an expensive motorcycle in the truck, why would they do that?"

Serge feared that he knew the answer.

"Is the motorcycle damaged?" he queried.

The foreman went to look and returned to answer in the affirmative.

"The front wheel" asked Serge;
"Yes";
"And is the bike at the front of the truck tray?"
"Yes";
"And had you left the back of the truck tray down on the pavement after you had driven the asphalting machine down its ramp?"
"Yes":
"Well mightn't someone not paying attention have driven up the ramp and onto the truck?"
"Yes, but there's no rider there".
"Did you look at the front of the truck where he might have spun if he had hit the back of the truck cabin hard?"
"No, I'll go and look now".

Sometime passed until the foreman telephoned the anxious Serge again:

"Everything's OK boss, I found him where you said and I've called the ambulance."

Emoleum's local competitor, Boral, has their version of this legend in which the motorcycle is replaced by an old lady in a small car. She is so shaken by finding both herself and her car on the back of a truck that she refuses to leave the car. Traffic police are called to remove her but say that, as she is not actually on the road, she is outside their jurisdiction.

Asphalt has even been immortalised in song. A ballad called "*Hot asphalt*" was recorded in Ireland by the *Dubliners* and is labelled in music catalogues as "traditional", in what must have been one of our more recent traditions. The storyline of the song is of your normal placid, innocent, Irish asphalt-worker who receives the death penalty after pushing a needlessly inquisitive police officer into a cauldron of very hot asphalt. Please don't ask for a better description of the story - this is as much as I can deduce.

By now, you - gentle reader - will appreciate that the policeman must actually have been pushed into a cauldron of hot bitumen, and not hot asphalt. Nevertheless, each verse and chorus of *Hot Asphalt* ends with great emphasis on the very words "hot asphalt". For example:

> But now I wear the geansai and around me waist a belt
> I'm the gaffer of the squad that makes the hot asphalt.

I do concede that hot bitumen would have been far less poetical and lacks a certain euphony.

Wooden and stone blocks

Even before the car, the outcomes of the Industrial Revolution had created major demands for better roads. Sometimes these demands were satisfied, not by bitumen, asphalt or paving stones, but by wooden blocks. The blocks were initially imported into Europe from Russia and soon came into wide use. However, the pine used for the blocks degraded rapidly under the influence of incessant wetting, pounding hooves, and grinding iron-tyred wheels. Nevertheless, remnants of wood-block paving can still be found in many cities.

One of the more remarkable stories in the history of pavements concerns Adrian Mountain, city engineer of Sydney, Australia, in the 1880s. He realised that Australian hardwoods would give far better service as paving blocks than would the soft Russian pine.

However, by this time Trinidadian and European asphalts were being successfully imported into Australia and the importers realised that Mountain's innovation would threaten their livelihood. They therefore successfully argued that wood-block paving was a health hazard, giving forth dangerous vapours when wet - a view undoubtedly reinforced by the large amount of horse excrement present on the road surfaces of the time. Malaria, typhoid, and yellow fever were said to be the common consequences of breathing these vapours.

After pressure from the importers, the NSW State Government in 1884 appointed a Wood Pavement Board to enquire into this threat to the health and wealth of its electorate. They called just one witness; a doctor had recently emigrated from India. He told the Board that many of his Indian patients had died from malaria. It soon became clear to him that they were catching the malaria from vapours produced when the wooden floors and walls of his hospital were washed. He had therefore banned all washing of hospital floors and walls. Malarial deaths had then declined dramatically (history does not record what happened to deaths at the hospital from golden staph infections).

The Board was totally convinced by this damning medical evidence, and just possibly by the commercial blandishments of the asphalt importers. They therefore banned wooden block paving in NSW. Mountain's counter-argument that wooden blocks were used near Louis Pasteur's laboratory in Paris carried no weight. The Board asked: "Who was this Pasteur, anyway?" A writer at the time commented[21]:

> The Board reported adversely on wood pavements, condemning them from every point of view. Notwithstanding such unmerited condemnation, wood block paving has steadily grown in favour.

The indignant Mountain nevertheless left NSW for Victoria where he became the city engineer for Melbourne in 1886. He developed a flourishing business exporting wooden blocks to Europe, and received a British engineering medal for his work.

Mountain had at least one blemish. Someone once told him that he looked like the Prince of Wales. He henceforth dressed in exactly the same manner as the Prince, in so far as could be judged from the latest issues of London magazines making the long sea voyage to Australia.

The wooden blocks - which were frequently saturated with tar and creosote - did have a tendency to burn. Whole streets spectacularly came ablaze during major city fires. For example, the wooden streets of Chicago burnt in the Great Fire of 1871.

A more recent burning road occurred in Queensland where a future chief of the State's road organisation, gained his exalted position despite having once ignited one of the organisation's roads. One very hot and windy day, his work gang had just completed spraying bitumen and had finished the edges of the job neatly by using some sheets of protective paper overlay. A tidy man, the future chief ordered the gang to burn the sheets. For efficiency, the sheets were lit where they lay upon the road. Fanned by a strong wind and fuelled by volatiles from the new bitumen, the flames raced along the road like a speeding red sports car, consuming the entire day's work.

Pavements have uses unforeseen by road-builders. In the 19th century, France was led to adopt asphalt at an indecent rate by the effective use that insurgents and revolutionaries made of stone paving blocks, both for throwing at the forces of the right, and for building barricades, as immortalised by Victor Hugo in *Les Misérables*.

In 1992, some citizens of South Melbourne in Victoria admired the industry of council workers similarly removing the stone paving blocks from their street, to such an extent that they gave coffee to the weary workmen. When weeks had passed and no replacement surfacing had arrived, a query of the local council revealed that the industrious "workers" had been thieves who had stolen the blocks under the admiring and helpful gaze of the citizenry[22].

In February of the same year a British tabloid called *Sunday Sport* reported that "renegade navvies" and/or "bitumen bandits" were stealing asphalt from English roads and exporting it to Mauritania[23]. The very English headline read "Tar very much!". Clearly, an international Mafia had been threatening the future of civilisation, as road-builders then knew it. When a similar event occurred in Liverpool in June 1998, the press delighted in commenting on the level of "street crime" in that city.

The problem continued, for in 1997 thieves were reported to be systematically working across Britain stealing aluminium road signs and bridge parapets for sale as scrap metal.[24] In 1998, the cobblestone thieves struck again in England "removing an entire street".

If all this seems just a tad too prosaic, then perhaps the view might be rosier from the distance. In his seventeenth century comedy, *Heir at Law*, George Colman wrote:

> Oh, London is a fine town
> A very famous city,
> Where all the streets are paved with gold
> And all the maidens pretty.

Of course, it is really the streets of heaven that are paved with gold. Thus, when a successful business man tries to enter heaven with a large suitcase of gold that he has brought with great difficulty as far as the pearly gates, St Peter inspects the bag and asks with astonishment: "You brought road pavement?"

Making the pavement

The early road-builders placed their material with relative gentleness. However, as traffic grew heavier, it became evident that paving had to be well compacted. This created problems, as some common pavement materials, such as clay, are not easy to compact adequately.

The solution came in 1905 after a couple of Californians - John Fitzgerald and Walter Gillette - had spread the material for a road they were building and then went home for the night. When they returned next morning they were distressed to find that a flock of sheep had run across their newly placed layer. When they tried to rework it, they found to their increasing anger that the previously almost-uncompactible material was now too well compacted to move.

When his initial anger abated, Fitzgerald realised that the sheep had succeeded where he and all his men and equipment had previously failed. Taking advantage of the serendipitous event, he proceeded to reproduce the effect by attaching steel studs resembling sheep's' feet to a large drum. The ensuing *sheepsfoot roller* is still widely used in making roads and dams[25]. Australians still indecently chortle about New Zealanders tying sheep to a log to make their own version of this device.

One of the testing devices now used to measure the compaction of roadmaking material employs low-level nuclear radiation, and is colloquially known as a *nuclear tester*. Public consternation occurred in Ontario, Canada, in the early 1980s when a journalist discovered that, despite Canada's then passionate attacks in the U.N. opposing the testing of nuclear weapons, the Ontario Ministry of Transport and Communications had issued a "*Nuclear Testing Manual*".

Visible testing can also be a cause of official embarrassment. The Country Roads Board of Victoria had a large enclosed truck with the words FOUNDATION INVESTIGATION UNIT prominently displayed on its side. In 1983 the media therefore enjoyed printing photographs of the truck bogged in poor foundations beside the Princes Highway at Nar Nar Goon.

A truck which failed to heed its own advice. Packenham Gazette.

Another form of testing embarrassment occurred in 1982 when I was in charge of the Australian Road Research Board and thus responsible for producing its annual report. Colleagues in other bodies were quick to subsequently point out with inordinate glee a paragraph on p92 of the 1981-82 Report. This had intended to say "Three field studies were completed at three sites on the Princes and South Gippsland Highways, without any major equipment failures, taking a day at each site." Unfortunately for our reputation, some printer's devil had changed just one letter, so that "taking" became "faking".

The devil was not exorcised as when I was subsequently associated with a committee of the Australian Department of Science producing a public report on *Scientific and Technological Information*. Table 3.7 of the report dealt with the activities that managers used for keeping up-to-date with technical information. It showed that 12% of managers indulged in "Visiting other planets". A reanalysis of the data suggested that an unwanted "e" had been inserted by the same printer's devil. Others have similar problems. The program for the 1997 annual conference of Intelligent Transport Systems - America announced on p147 that: "core participants are in a partnerwhip with the U.S. DoT." Perhaps the partners were linked by some form of bond?

Drawing the line

When the road is nearly finished, it comes time to paint the lines on the pavement surface. A pair of parallel longitudinal lines down the centre of the pavement universally indicates that overtaking is prohibited. In 1983, following a number of serious crashes, local authorities decided to add such double lines to a section of the A48 near Pylle in South Wales[26]. The work was to be completed on a Sunday by two crews painting from each end of the crash-prone section. The road already had a single centreline and so the supervising engineer instructed the crews to add the new line on the left of the existing line. When the crews met near mid-section they discovered a certain flaw in the engineer's instructions, which would soon add a new twist to their work.

In 1985 the citizens of Caulfield in Victoria complained to their Council that the newly-painted centreline in Grange Road was not only wavy and meandering where it

was surely meant to be straight, but also wandered across an entire intersection, to the confusion of all intending travellers. The city's Works Manager explained that the paint had been applied by a new employee who had been instructed to place some occasional spots of paint to mark the route for another crew. However, his enthusiasm to exercise his newfound power had led him to seek a wider canvas. The citizens were not totally assured by the advice that no further action was needed as the spotting paint the novice artist had used would disappear in about six months[27].

As noted above, road-makers are in the public eye, and perhaps it is a little too easy to tell of their follies, but this shouldn't stop a good story. In December 1996, a line-marking crew in the Australian State of Tasmania painted their new white centreline on the Arthur Highway right over the top of a dead wallaby, lying on the road in an advanced state of rigor mortis. A photograph of the striped wallaby was tabled in the State parliament, but the painting practice was excused when it was pointed out that the painting contractor was from interstate[28]. Those "foreigners" clearly couldn't tell a dead wallaby from a bump in the road.

The "foreigners" defended themselves by pointing to a similar case in Pennsylvania where the crew had painted the centreline of Route 896 over an equally dead deer. The Mayor of Bowmanstown had officially pronounced the deer to be at least three weeks dead at the time of striping, and State officials had declared that painting over dead deer was contrary to State policy. The still-life line markers had offered the defence that they couldn't meet their contractual schedule if they had to push every dead deer out of the way[29]. The event keeps reoccurring and in 2004 the Arizona Department of Transport gave it's *"Not my job"* award to a line-marking crew who painted double yellow lines over an animal carcase on the. AZ 85 in Litchfield Park, Arizona.

Notes for Chapter 4

1 Deveraux, R. *John Loudon McAdam*, London: Oxford University Press 1936
2 Reader, W. J., *McAdam*, London: Heineman, 1980. p36
3 Deacon, F. 1879. "Street carriageway pavements". Proc. Institution of Civil Engineers 58(4):1-30
4 Robinson, J., *Highways and our environment*, New York: McGraw-Hill, 1971, p42
5 Lay, M. G., *Ways of the world*, New Brunswick: Rutgers University Press, 1992, Ch 7
6 *Mortar* is a mixture of cement, sand and water.
7 Lay, M. G., *Ways of the world*, New Brunswick: Rutgers University Press, 1992, p50
8 "The history of bitumen", AAPA Newsletter, 70:4, Aug 1990
9 Apocrypha, Sirach 13:1, RSV
10 Daniel 3:23, RSV
11 Krchma, L. C., and Gagle, D. W., "A U.S.A. history of asphalt refined from crude oil and its distribution". Proc. Association of Asphalt Paving Technologists, 43A(50th Anniversary Historical Review): 1974, pp25-88 (p45).
12 There is bitumen in Indonesia, however, Guglielminetti would have used tar from coal treatment plants.
13 "The Prercursors", Routes/Roads 1989, 268(II): p89
14 Melbourne Age, 14 Oct 1989
15 Treves, F., *The Riviera of the Corniche Road*, Cassell: London, 1923, p8-9
16 Reverdy, G., 1993. *Les routes de France du XIXe siécle*, Paris: Presses Ponts et Chaussées, 1993, p206-9
17 Australasian Engineer, 33, 1933

18 *The shorter Oxford English dictionary*. Oxford: Clarendon 1985
19 Paterson, J.*, The history and development of road transport*, London: Pitman 1927
20 Tarmac. *Tarmac 1903 - 1978:75 years of achievement*. Wolverhampton: Tarmac, 1978
21 Coane, J. M., H. E. & J. M., *Australasian roads*, Melbourne: George Robertson, 1908, p227
22 Bulletin Magazine, 30 June 1992, p12
23 New Civil Engineer, 6 Feb 1992, p29
24 Melbourne Sunday Age, 17 Aug 1997, p2
25 Lay, M. G. "The history of compaction, Part 2, The sheepsfoot roller", Routes/Roads 290(II):44-50, April 1996
26 loc cit 7(6):2, Dec 1983
27 Melbourne Herald, 27 Mar 1985, p2
28 Melbourne Sunday Age, 8 Dec 1996, p2
29 loc cit, 15 Dec 1996, p2

Chapter 5

Mending our ways

- everyman's repair manual for roads, in one easy chapter

Maintenance management

When the road is finished and in use, it then has to be maintained. In early English law, if a road was impossible to travel - such roads were aptly described as *founderous* - the public had the right to breakdown adjoining fences and travel over the adjacent property. This gave a strong impetus for local road maintenance.

Road maintenance was always a thankless, unwanted and poorly rewarded task.[1] To resolve this problem in Europe, the repair of roads was projected as a pious and meritorious work, similar to visiting the sick and caring for the poor. For their efforts at road maintenance, sinners could earn indulgences – typically the remission of sufficient sins to reduce their stay in purgatory by 40 days.

Astonishingly impractical but common methods of road management were popular in the period (e. g. 1500 – 1800AD) when road maintenance was done reluctantly by local farmers devoting three or four compulsory days a year to the task. They brought along their farm tools and skills and were advised with some religious fervour but not a speck of engineering sense to: "use materials that returned the roads to their natural state". They were directed by unpaid local officials – today's pavement managers – in a process described as:[2]

> The ridiculous farce of appointing one of the parishioners annually at no salary to enforce from his relations, friends, and neighbours a strict performance of a duty which probably he never performed himself, and from which, by showing leniency to his neighbours, he would expect to continue to be excused.

Not surprisingly, the community has persistently been sceptical of engineering efforts at road maintenance. A 17th century English tanner whose pants had been torn by a dog during a visit to London explained how it happened:

> Here the stones are fast in the streets, and the dogs are loose, but in the country the dogs are fast tied, and the stones are loose to throw at them.

For the road maintainer, the harsh reality of his task was best captured in 1667 by John Bunyan in *Pilgrim's Progress*:

> His labourers have, by the direction of His Majesty's surveyors, been for above these sixteen hundred years, employed about this patch of ground....here hath been swallowed up at least twenty thousand cart-loads ..of the best material to make good ground of the place, but it is the Slough of Despond still, and so will be when they have done what they can.

Today, roads are designed - if not for a Bunyanesque whole-of-creation - at least on a whole-of-life basis. This concept was well summarised by Robert Louis Stevenson in an address to the Chiefs of Samoa on the opening of the Road of Gratitude in October 1894.[3]

> Chiefs! Our road is not built to last a thousand years, yet in a sense it is. When a road is once built, it is a strange thing how it collects traffic, how every year as it goes on, more and more people are found to walk thereon, and others are raised up to repair and perpetuate it, and keep it alive; so that perhaps even this road of ours may, from reparation to reparation, continue to exist and be useful hundreds and hundreds of years after we are mingled with dust.

Soon we will discuss the front-of-stage role of potholes, ruts and quagmires in determining road performance. However, there are other problems. In December 1984 a truck disgorged 3500 live chickens on the Mt Barker Freeway in South Australia[4]. The problem was not so much the chicken feathers, as the excrement with which the frightened chickens soon befouled the pavement. Emergency staff had to abandon their shovels and resort to high-pressure hoses in order to restore a safe route through the slithery and malodorous mess. Fortunately for the credibility of this book, no one at the scene was coarse enough to have dismissed the concerned and anxious media with the comment that: "The problem was chicken shit."

It is not uncommon for uncommon things to be spilt on a pavement. In October 1983 industrial adhesive leaked from a truck onto a London street in peak-hour traffic[5]. The fact that several cars were glued tightly to the surface was evidence enough of the adhesive's potential, but the ultimate irony occurred when the rescue vehicle sent to unstick the traffic also became permanently attached to the road surface.

Potholes

Citizens in their cars and trucks take a deep interest in potholes, which continually confirm the citizens' assessment of the competence of the local road-minders. When the Mayor of Houston was attacked in 1980 over an estimated 1.5 million potholes in roads under his jurisdiction, he offered two defences.

> First, his electorate was affluent enough to repair their cars if they were damaged by potholes.
>
> Second, potholes were acts of God rather than of the Mayor and his Council.

The caption of this 1991 cartoon read: "Either the locals have started making their own speed traps, or it's a pothole from Hell."[6] *le Lievre & Melbourne Age*

A frequently recycled pothole joke has a traveller finding a hat over a puddle in the road. When he picks up the hat, a voice from the puddle says:

Put my hat back, I'll be through this one in a few minutes.

There are a number of versions of this hat and pothole story. In my favourite, when the traveller picks up the hat he realises that he has actually taken it from the head of a man almost totally submerged in the water of the pothole.

"Do you need any help?" the traveller asks.

The head replies in one of three ways, according to who is telling the story:

"Hold on fella, I've just hit bottom."

or: "No, but I'm beginning to worry about my horse."

or: "No, I'm on horseback."

Another popular cartoon theme has men sitting around a pothole, fishing.

These stories are more than exaggerated metaphors. *Ways of the World* recalls the many pre-McAdam stories of people drowning in potholes[7]. A gem from the fifteenth century concerns a glovemaker from Leighton Buzzard in England. Travelling to sell gloves at a Christmas market at Aylesbury, both he and his horse drowned in a 2.5 m deep hole in the road. An official inquiry found that Richard Boose, a miller, had dug the hole to obtain clay for his mill. However, Boose was acquitted of the murder charge on the grounds that he had no alternative source for his clay[8].

At the beginning of the motorcar age, U.S. farmers were usually well rewarded for using their teams of horses to drag embattled vehicles from a muddy piece of road. To further improve the distribution of wealth, large potholes were frequently covered by

brush branches, "after the manner of an animal trap"[9]. Perhaps pavement engineers are unadmired and unappreciated because the community does not quite realise how bad were the unpaved roads of the past?

The pothole easily survived the invention of asphalt. In 1983 the Nagpur Times in India published an Ode to the Nagpur Road by Aparna Asolkar:[10]

> The holes are round, the holes are square,
> The holes you see them everywhere,
> And manholes open their mighty jaws,
> While rainwater tries to hide all flaws.
> Teeth of stone chomp tyres away,
> No time to think of what to say,
> Here a jockey might be trained with ease,
> For a tough hazardous steeplechase.

Asolkar clearly qualified for the McGonagall prize for 1983.[11]

In 1988, Bill McAlonan, head of the Strathclyde Road Department in Scotland, made a public appeal for locals to come forth with any Roman artifacts that they had found. The Glasgow Herald responded by remarking that the most fruitful source would be for the Department to continue its mining operations in: "the many deep, ancient, and historical potholes which are to be found in the region's roads."[12]

Given such community attitudes, pavement engineers realise that it is not always politically wise to admit that the roads they have built at great public expensive will be damaged by the trucks they are designed to serve and are thus unlikely to survive untouched for a decade. In 1980 the Country Roads Board in Victoria issued a memo to its staff advising:

> When describing the condition of a pavement the words "failure" and "failed" are often used when "distress" and "distressed" would be the more correct terms. "Failure" means non-performance or collapse and a road pavement only fails when vehicles are no longer able to negotiate it. It is requested that the words "failure" and "failing" not be used in reports, applications for funds etc to describe road pavement conditions unless this is the case.

Wittgenstein would have been proud of them. The journalist who delighted in publishing this piece of engineer-speak commented that he hoped that "this edict will be carried out without fail".[13]

The Victorian model was widely copied. In 1988 the U.K. Department of Transport instructed its bureaucrats to only use the word "damage" when referring to accidental impact.[14] The effects of daily traffic were henceforth to be described as "wear and tear".

The reason why the Country Roads Board was so sensitive was that in 1977 it had had a major and highly publicised pavement failure (or was it a distress?) on the Hume Highway near Wallan-Broadford. Unfortunately, its Annual Report had just hit the newsstands with a great photograph of the pre-failed pavement on the cover of the report, and equally glowing words inside describing its undoubted longevity.

Bad roads

Now the presence of a pothole or two at least implies that there is good pavement in between the holes. Such was not always the case.

The above stories of pothole drownings hopefully indicated the depth of the problem. Let us now study its extent. Lord Macaulay reported in his *History of England* that in 1685 the road to the Irish ferry at Holyhead was so bad that "stout Welsh peasants" were routinely employed to dissemble coaches and carry them on their shoulders piece by piece between Conway and Beaumaris.[15] In 1700 Dean Swift wrote of the same road:[16]

> Next time, I do protest, Sir,
> I'll walk to Dublin,
> Ere I'd ride to Chester.

Incidentally, in 1726 Swift made the journey from London to Dublin in a fast seven days, commenting that in doing so he had "passed through many nations and languages unknown to the civilised world." So much for the Welsh.

An English cartoon of the time has a coach driver asking a veteran with a wooden leg whether he would like a free ride in the coach. "No thanks," says the veteran "I'm in a hurry." Indeed, in 1743 a blind Jack Metcalf walked the 300 km from London to Harrogate in six days. His local Member of Parliament, Colonel Liddell, had left London at the same time and offered Metcalf a ride in his coach. Metcalf refused the offer, and arrived home two days before the Colonel[17]. We continue the Metcalf story in the next chapter of this book.

Great figures in literature thought the state of the roads worthy of description. Daniel Defoe in 1748 described a piece of road at High Cross where: "the water stands as in a dish, and the horses sink into the stiff clay up to their bellies."[18] Horace Walpole in 1749 told a friend[19]:

> If you love good roads, conveniences and good inns, be so kind as never to go into Sussex.

Two years later a Dr John Burton had clearly ignored Walpole's advice and travelled to Sussex. This led him to ponder publicly:

> Why comes it that the oxen, the swine, the women, and all the other animals are so long legged in Sussex? Can it be from the difficulty of pulling the feet out of so much mud, so that the muscles become stretched and the bones lengthened?

Things were generally bad, and not getting any better. In 1769 the Ipswich town paper reported the death of a traveller who - upon being thrown from his horse on to the road - proceeded to "suffocate by mud and filth."[20] The circumstance was confirmed by Arthur Young writing of his travels in England in 1770. He described roads as:

* pools of liquid dirt, and a scattering of loose flints just sufficient to lame every horse
* ruts four feet deep, floating with mud after a wet summer, what must it be after winter?
* full of hugeous stones as big as one's horse
* a cursed string of hills and holes by the name of a road.

In 1774 *Postlethwayt's Universal Dictionary of Trade and Commerce* noted the poor state of the roads in Middlesex and observed the laziness of its English road workers.[21] It

therefore recommended that the African Company: "should furnish Middlesex with 200 Negroes, who are generally persons that do a great deal of work."

We still use the word *quagmire*, but those old mud-filled and boggy ruts were often called *quags*, a name that must have euphonistically suggested the sound of a foot being finally pulled loose from the sucking mud. A traveller in Virginia at about the same time wrote of: "hopeless seas of mud, with archipelagoes of stumps."[22] And not just Virginia, for Kenneth Roberts in his 18th century novel, *Arundel*, described Maine roads as "little better than a succession of bog holes, with the horse perpetually slipping into the muck up to its withers."[23]:

In 1833 British novelist Captain Frederick Marryatt described Canadian roads:

> Every mile or so you descend into a hollow, at the bottom of which is what they term a mudhole, which is of depth unknown. It is very possible for a pair of horses to disappear, wagon and all, in a mudhole.

Marryatt also pointed out that the expression "I am stumped" came from American coachriders halted by an unexpected tree stump in the roadway.

A sober 1813 report on agriculture in Northampton County in England stated that the only way to pass along some roads was by swimming[24]. Perhaps there were more drownings on the road than at sea? In 1839, my hometown newspaper carried the following notice, just probably intended as a joke[25]:

> Tenders will be received until the 1st of December, by parties willing to contract to operate a ferry along the middle part of Elizabeth Street; the state of which in rainy weather, renders it impassable without the help of a punt.

Heavy rain in Melbourne in 1858 caused a man and his horse to drown in the self-same Elizabeth St and another pair in the adjacent Swanston St was swept into the swollen Yarra River[26]. In 1884 an engineering journal reported that in nearby Gippsland a woman crossing a road had become so stuck in its mud that four workmen with planks were required to extricate her[27]. A New Zealand newspaper said of the road between Te Puke and Tauranga in the late 19th century: "very little more water would make the road navigable."[28]

Roads certainly were not prepared for the advent of the car, as the following US photograph illustrates.

US 101 in Ventura County, California, in 1901. Photo: *Caltrans Library History Centre.*

Caught in a rut

Ruts make a way of their own, as only vehicles with very similar wheel-spacing can use a rutted road, and even then are largely restricted to precisely following the course of the rutted path. This is a serious problem and even created the Oedipus Complex. In Theban legend, Oedipus encountered a traveller coming in the opposite direction on the Cleft Way. The wheels of both vehicles were using the only pair of ruts that existed on the narrow and perilous path. To gain right of way, Oedipus slew the other traveller, never realising that it was his own father, King Laius. There is more to the story than this, but the other bits don't concern roads and so are of little interest.

Travel in those times was very difficult - indeed, the very word comes from the Latin word, *travail*, meaning work or hardship. Travellers were "regarded as unfortunates worthy of protection or assistance"[29]. Thus, travellers' tales are inherently horrific. In the same year as our lady was rescued from a Gippsland road, the otherwise readily-pleased Thomas Stevens noted as he passed through Bulgaria on his penny-farthing bicycle:[30]

> For lunch I halt at an unlikely looking inn near a cluster of mud hovels, which, I suppose, the Bulgarians consider a village, and am rewarded by the blackest of black breads, in the composition of which sand plays no inconsiderable part, and the remnants of a chicken killed and stewed at some uncertain period in the past. Everything about the place plainly shows the proprietor to be ignorant of the crudest notions of cleanliness.

Mud and slush and …

The use of urban streets as open sewers, and the polluting effects of animal traffic, meant that the problem of street hygiene had long been a widespread and troublesome issue. Any untended thoroughfare quickly became either slushy or dusty. In 1184, the stench of Parisian streets so offended King Philip II that he ordered all the streets to be paved, to at least make it possible to remove the daily excremental muck. Of course, urban muck not only came from the transport animals. It was also the norm for abutting owners to tip all their household food waste and excrement into the street.

The management of this situation consisted of laws making it compulsory to warn pedestrians before tipping. For example, Parisians were required to shout "Watch out for water" - gardez l'eau - three times before tossing. On the other hand, the Scots placed the obligation on the traveller who had to call "don't throw" whenever he thought it appropriate. The timetable for some of these Parisian edicts is illuminating:

1154 - locals must share carts used to dump street refuse,
1349 - the dumping of rubbish and the running of pigs in the street is banned,
1374 - abutting owners must pay for street cleaning,
1389 - the nobility must also pay for street cleaning
1399 - the religious must also pay for street cleaning,
1405 - throwing street rubbish into the Seine is banned,
1476 - each citizen must pay a tax to fund street cleaning,
1517 - prisoners must undertake street cleaning,
1540 - street cleaning must meet defined standards.

Street cleaning is an old profession than this, with records of its role in ancient Rome. The titles scawageour, scavengeour, rakyer, skawager, and street surveyor were in use by the end of the fourteenth century An English Act of 1662 required Londoners to sweep the streets outside their houses twice a week and parishes to provide a street scavenger. Rising urban standards attracted increased horse traffic and many city streets became lakes of putrid mud, despite the most careful of street-cleaning laws. Many major streets were muddy open drains, often with small foot-bridges provided to permit safe and clean pedestrian passage. Separate footpaths for pedestrians became a necessity. The need could be met, as the increasing use of longitudinal curb side drains made it possible to construct raised sidewalks along the property line. In London, one of the first such installations was a high pavement installed in 1614 on the Great Road North at Islington, in order to protect churchgoers from being splashed with mud by passing carriages. The carriages were further separated from the pedestrians by the use of a row of vertical posts called *bollards*, a practice first used in 1710. A policy encouraging separate sidewalks was introduced in 1765, although they did not become common until the nineteenth century.

As we saw in Chapter 3, in 1718 William Nelson published a book on *The Office and Authority of Surveyors of Highways*. He noted that, as well as caring for the roads, they had also to deal with: *infectious persons, diseased meat, nuisances, and the scouring of ditches.*

The polluting effects of pre-car traffic were also enormous and beyond our present day comprehension. In New York City in the year 1900, horses each day created 1100 tonnes of manure, 270,000 litre of urine, and 20 carcasses. Haulage animals frequently died in

service and their bodies were left where they fell. I first used these figures in Ways of the World and my citation records indicate that they are most quoted figures in the book. So my reputation appears based on horse excrement.[31]

Notes on Chapter 5

[1] Lay, M., *Ways of the world*, New Brunswick: Rutgers University Press, 1992, p66-69
[2] Clarke, E. 1793, *A tour through the south of England, Wales and part of Ireland made during the summer of 1791*.. In 1808, Clarke was appointed the first professor of mineralogy at Cambridge.
3 Stevenson, R. L., *Vailima letters*, London: Methuen, 1895, p5
4 Melbourne Sun, 18 Dec 1984
5 Melbourne Age, 15 Oct 1983
[6] Doncaster & Templestowe News, 22 Nov 1991
7 Lay, M., *Ways of the world*, New Brunswick: Rutgers University Press, 1992, p66
8 Green, A., *Town life in the fifteenth century*, London: Macmillan, 1907
9 Finch, C., *Highways to heaven*, New York: Harper Collins, 1992, p85
10 via Safety on the Road, India, Jan 1984, p4
11 If you wish to apply, read more about McGonagal in Chapter 9.
12 Datum Line, New Civil Engr, 17 Mar 1988, p13
13 Melbourne Herald, 22 July 1980
14 New Scientist, 21 Jan 1988
15 Macaulay, Lord, *History of England* (now Harmondsworth: Penguin), 1871 edition, pp182-6
16 Swift, Dean J., *Journey to Chester*, 1700
17 Lay, M., *Ways of the world*, New Brunswick: Rutgers University Press, 1992, p72
18 Defoe, D., *A tour through the whole of the island of Great Britain*. London: Strahan, 1748, ii:425
19 McCausland, H., *The English carriage*, London: Batchworth, p14
20 Mountfield, D., *The coaching age*, Hale: London, 1976, p21
21 Postlethwayt, M. *Universal dictionary of trade and commerce*, 4th edn, 1774
22 Newlon, H. & Pawlett, N., *Backsights*, Virginia: Virginia Department of Highways and Transportation, undated, p48
23 Roberts, K., *Arundel*, Greenwich, Ct,:Fawcett, 1929
24 Pratt, E. A., *A history of inland transport and communication*. London: Kegan Paul, 1912. reprinted by Kelley, New York, in 1970
25 Garryowen (Finn, E.), *The chronicles of early Melbourne*, 2 vols, Melbourne: Fergusson, Mitchell, 1888, Vol 2, p953
26 Lay, M. G., *History of Australian roads*, ARRB Special Report 29, Vermont Sth: ARRB, 1984, p19
27 Discussion of Adrian Mountain's "The evolution of the modern road", Proc. Victorian Institute of Engineers, 7 Nov. 1884
[28] Watson, J. 1996. *Links; a history of transport in New Zealand society*. Wellington: GP publications, p101
29 Hartmann, C. H., *The story of the roads*, London: G. Routledge, 1927
30 Stevens, T., *Around the world on a penny-farthing*, 1888, Arrow reprint, London 1991, p74
[31] Lay, M., *Ways of the world*, New Brunswick: Rutgers University Press, 1992, p132

Chapter 6

I did it my way

- the life and times of the incredible Blind Jack Metcalf

Early days

Road building and road builders might well all be considered dull. Let me therefore tell you a true story of John Metcalf - a story that is a cross between an epic heroic tale and a Mills and Boon novel. Metcalf's career has been somewhat overshadowed by his technical contemporaries, but none could overshadow his remarkable life[1].

John Metcalf was born in 1717 to a poor working family in Knaresborough in the West Riding of Yorkshire about 25 km north of Leeds. At the age of six he was permanently blinded by a smallpox attack and thereafter received no formal education.

Known as Blind Jack, the young boy soon became famous in Knaresborough for his shrewd cleverness and for the things he could do despite his affliction - he climbed trees, raced horses, became an expert at swimming and diving, saved three people from drowning in the Nidd River, was hired to dive for bodies and objects feared lost in deep holes in the river, and played the fiddle professionally. The fiddle playing was not unusual, as at the time it was the main paid occupation of the blind.

He matured into a tall adult and was of "Herculean strength". He led an active life, galloping and gambling at horse races, riding in fox hunts, racing hares, organising cock-fights, playing bowls and cards, roaming the countryside, driving a wagon, selling fish, clothing, and horses, guiding sighted travellers through the Knaresborough countryside, and operating a carriage service between Knaresborough and York.

Not all Metcalf's pursuits were innocent and it was widely suspected that he traded in smuggled tea and brandy and other products of uncertain origin. He was a stern competitor. On one occasion when he suspected an opponent of cheating in a cockfight, he waited till the still of night, surreptitiously sealed the windows and door openings of

the opponent's house. He then poured in such a large quantity of water that the opponent awoke next morning to find water lapping the underside of his bed.

He won two noteworthy horse races. In the first he was challenged to race on an oval course. The challengers assumed that the blind jockey would soon stray off course and wagered heavily against him. However, Metcalf posted his friends around the track and had them shout directions as he rode by.

Determined to get the better of him, he was then challenged to mount a wild horse and stop it within 250 metres. His shouting friends were banned from the vicinity of the gallop. In a foretaste of his engineering talent, he went out onto the moors and paced off a distance of 250 metres from a deep bog. Metcalf then mounted the untamed horse and galloped wildly towards the bogside, at which point the horse came to the complete halt required by the wager.

The ways of men

In 1740, after being correctly accused of fathering the unwanted child of a young Knaresborough maiden, he hurriedly left Knaresborough for Whitby, where he joined a ship for London.

This led to one of his more famous achievements when Colonel Liddell, a Member of Parliament for Berwick-on-Tweed, asked Metcalf to return with him to Knaresborough. Metcalf agreed to return, but declined the offer of a ride in Liddell's carriage. Instead, he walked home over 300 km of unknown road from London to Knaresborough, completing the journey in six days and finishing two days ahead of the Colonel, who had left London at the same time in his carriage attended by a retinue of sixteen servants.

The next adventure occurred when the still poor and wild young man eloped with Dolly Benson, daughter of the wealthy landlord of the Royal Oak hotel and, according to one biographer, the "handsomest young woman in Harrogate". The event occurred on the eve of her wedding to a rival suitor, with Metcalf marrying her on the morning of the planned wedding, before the rival even knew that his intended bride had eloped.

The story has the ring of a romantic novel. A maid at the hotel had alerted Metcalf to the wedding. He went to Dolly and asked her why she was doing such a thing. She replied that he had never asked her to marry him.

"But" he said, "I am so poor, could you bear starving?"
"With you I could" replied Dolly, and they galloped off into the sunrise!
Later, when asked why she had married a poor, blind man she explained:
"Because I could not be happy without him."

His new mother-in-law - a fearsome woman - was most aggrieved by the inappropriate marriage and for some time Metcalf wisely and noticeably avoided meeting her. Finally, his friends challenged him for a large wager to go to the Royal Oak and pay his respects. Metcalf won the bet by jumping on his horse and riding into the hotel, demanding loudly from the saddle that Mrs Benson serve her son-in-law with a pint of ale. He took the drink, thanked his mother for both drink and daughter, rapidly quaffed the ale, and

galloped out the door. The marriage nevertheless lasted well and the couple had four children. At the time of John's death in 1810, there were twenty grandchildren and ninety great grandchildren.

Despite, or because of, his escapades, he was a popular man. This characteristic led Squire William Thornton to engage him as a recruiting sergeant to assist in enlisting volunteers to join the Royal (English) Army and fight against Bonny Prince Charlie's 1745 Scottish rebellion to Yorkshire's near north. Metcalf played marching tunes on his fiddle as he led his sixty-four volunteers northwards to join Harry Pulteney's regiment. They soon to become part of the English Army's defeat at Falkirk.

During the ensuing chaos, Thornton disappeared, hiding in a farm cottage. Metcalf thought the Scots had captured his leader. Posing as an itinerant blind musician, he infiltrated the enemy lines to search for him. He was soon recognised and held prisoner for three days before being released into custody. He escaped custody by telling his new guards that he had been asked to play his fiddle for the Prince and needed buy some new clothes. He never returned from his shopping trip to the south.

Metcalf had a quick and certain wit. After the defeat at Falkirk, Army officers were sceptical that so many of Thornton's men had survived the defeat unscathed. At the court martial, Metcalf was asked how even a blind man had managed to flee so successfully. He replied:"Oh, I found it easy, I followed the sound made by the hooves of the Officers' horses, as they fled from the Highlandmen."

Such were his accomplishments in his pre-roadmaking days that he appears in Phyllis Riches' famous "Analytical Bibliography" - not as a road engineer - but under the heading "Blind athlete and soldier". He also features in two classic texts on the achievements of blind people – Bennett Johns' 1867 *Blind people* and Bernard Mannix' 1910 *Heroes of darkness*.

Metcalf is relevant to this book as he went onto become a major and innovative roadmaker - what other career could such a man have followed? But then roadmakers and roadmaking are dull, so I won't bore you with this part of the story as it is covered in the article listed in the endnote to this Chapter. Instead, here is how he looked in ripe old age. Metcalf died in 1810, after an innovative and remarkable career. For generations, his astonishing achievements in the face of adversity were both legend and inspiration.

P. G. Reyner's etching of John Metcalf at 79 years of age.

Note on Chapter 6

1 This Chapter is based on Lay, M. G., *The Metcalf inheritance*. PIARC Routes/Roads 293(1):pp65-71, 1997

Chapter 7

The way across

- a chapter which astonishes with the revealed wonder of bridge-building

Preparing the ground

When insurmountable barriers are met, bridges are required. And when there is no bridge, travellers must find other desperate ways. An astonishing example comes from the border of Shaanxi and Sichuan Provinces in China, a region of deep and precipitous gorges and rapidly flowing rivers. In 300 BC the sheer vertical cliffs had yet to succumb to the wiles of the bridge builders. To provide passage, a series of horizontal holes were drilled into the cliff face, about a metre apart. Travellers were issued with four strong poles, which they inserted in the first four holes. Sitting on the three forwardmost poles, the traveller reached behind for the last pole and moved it ahead to become the new lead pole. And so each voyager cautiously inched his or her way along the cliff-face.

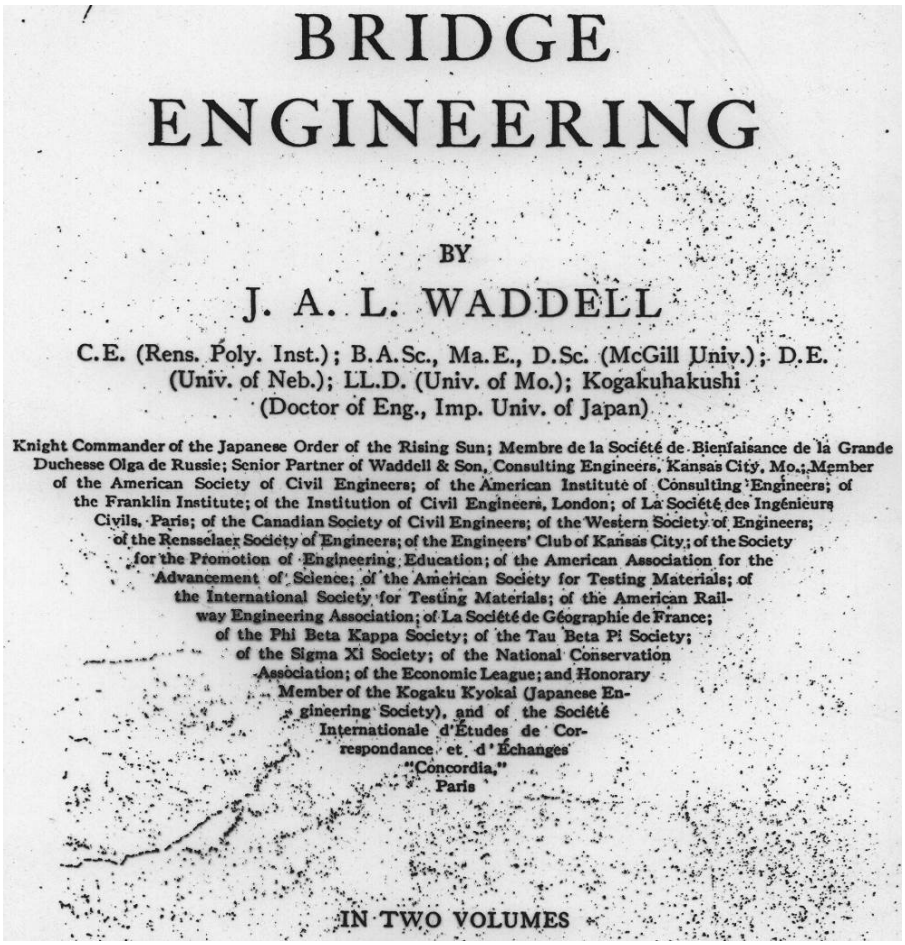
An alternative method was presented in a somewhat incredulous 1911, when a well-known bridge engineer of the day - J. A. L. Waddell - suggested that monkey bridges could be found in South American jungles.[1] The first drawing from his then-popular book on bridge design is reproduced on the next page. It is not at all clear how the monkeys constructed and deconstructed the bridge. Certainly, the last monkey hanging would have had a rough passage as he swung pendulously towards the cliff face. Overtaking was prohibited.

Waddell's version of the monkey bridge[1].

Incidentally, as shown on the opposite page, Waddell's awards and positions under his name on the title page of his textbook itself deserves an award as it runs to some 22 lines and includes 32 individual items.

Before work begins on any serious human bridge-building, the money must be found. A West African colony devised a fund-raising scheme to subsidise its rail system by diverting money provided for building highway bridges[2]. For a while they deceived the lenders by still building the bridges, but only making them half as wide as intended. Considering that most were initially single-lane bridges, this looked good on the map but provided little vehicular help on the ground.

Once the money and the will have been marshalled, one of the first tasks in bridge building is to have surveyors place pegs and other more permanent markers at various locations around the site. Aggrieved landowners sometimes make it a hazardous task.



Waddell's award-winning awards

One of the finest examples of the way in which citizens can react to such unwanted intrusions occurred in the early 1920s when the surveyors for the Sydney Harbour Bridge placed two of their large survey pegs in the tennis court of the State Governor's waterfront mansion. They then erected a cast-iron permanent marker in the middle of his private lawn. The vice-regal wrath was almost unseemly.

Surveyors are not always as accurate as their own mythology would suggest and most construction folk have their own surveyor-induced scars. An ambitious colleague was watching the first of the long concrete beams for his job drop into place when he realised to his horror that it - and thus its six kin - was a good two metres short. He soon found that the real problem was that the surveyors had located one of the abutments that carried the beam two metres away from its correct position.

Realising that he would be held accountable and recalling that his boss had not been to the site for a month, he decided to use explosives to quickly demolish the wrongly-placed

abutment and then immediately rebuild it. The hastily-placed charges did no more than severely crack the stubbornly-offending abutment. When the dreaded boss visited next day, he found to his fury an abutment that was both incorrectly placed and badly cracked.

Another highly organised colleague was instructed to construct with some urgency a culvert to carry a stream that had been frequently flooding and consequently closing a remote but important rural road. There were many stream crossings in the area and so, in the dry season, he drove to the area to locate the correct spot. Not trusting his work gang's surveying skills, he was pleased to note that there was a power pole at the intended site and that it was numbered 407. Next morning he instructed his gang to build the culvert as close as possible to pole 407.

The following day, as the gang approached the locale, poles began to appear beside the road. The first pole was at the top of the ridge that marked the watershed of the flood-prone valley. The gang stopped to see how the numbers ran. Lo and behold, the pole on top of the hill was numbered 407. Mystified but obediently unconcerned, they duly built their culvert across the road at the top of the ridge. Even with a Noah-like flood, it would never carry water.

When the colleague was forced to confront his folly, he learnt to his regret that all the poles along the road were part of power-line number 407.

Bridge builders

To prove the worth of a bridge-builder's work, the Romans introduced the requirement that he stood under his bridge when the falsework for the arch was removed and the first travellers crossed over the bridge. This perhaps gave confidence to one of the great Roman bridge-builders, Caius Lacer, who had the following notice carved on his Acántara Bridge in Spain:

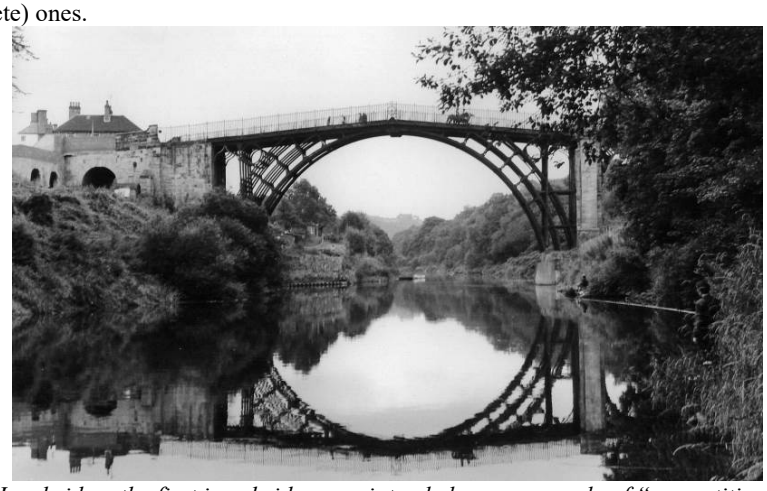
> Lacer, famous for his great skills, built this mighty bridge to last forever.

In a more recent example, the designer is presumably the gentleman in the following photograph standing "hands free" as his colleagues gleefully test his bridge.

Bridges have always presented a technological challenge. The span to be crossed is a very measurable gauge of the bridge-builder's achievement. However, the many quantum jumps in the span achieved have sometimes been made possible by a new technology that has been surreptitious in its approach.

Victorian bridge designer puts reputation on the log. VicRoads

For instance, the first European bridge to successfully use iron was Thomas Pritchard's wonderful Ironbridge at Coalbrookdale in England. It was completed in 1781, but Pritchard had first published its design in 1773 in a book entitled "*On cementitious architecture as applicable to the construction of bridges*". Ironically, in subsequent times there has been raging competition between iron (and steel) bridges and cementitious (or concrete) ones.



Ironbridge, the first iron bridge was intended as an example of "cementitious architecture". Ironbridge Gorge Museum Trust.

Writing in the 1890s, a prominent American social reformer, W. D. Bliss, said: “Those men whose lot in life it is to build bridges - are indeed singled out and blessed of God.” This gracious view was somewhat at odds with a group of common bridge traditions from earlier times, each with magical connotations.

The first tradition was to inter in a bridge the bodies of all those who had died during its construction. Thus St Bénézet, now the patron saint of bridge builders, was buried in the chapel of the Pont d’Avignon[3]. The second, more gruesome, tradition was the belief that a bridge would not be successful unless a living person was entombed within it during construction.

The third tradition was that the Devil would take the soul of the first traveller to cross a new bridge, as a toll for daring to provide a way where none had previously existed. The cunning locals often thwarted the Devil by ensuring that an old dog was first to use the bridge. There was indeed a menacing medieval mysticism associated with bridges and their perilous nature. A well-used 16th century riddle was:

Q. “What is the more frightful, the smaller it is?”
A. “A bridge!”

Many bridges which crossed otherwise impassable gorges and ravines were called the Devil’s bridge, with the Devil as both the builder and the toll-collector. As Henry Longfellow described[4]:

This bridge is called the Devil’s Bridge
With a single arch from ridge to ridge.

Today’s bridge-building problems are somewhat different. George ... was one of the Victorian Country Roads Board’s legendary bridge foremen involved in building timber bridges in remote areas[5]. He camped on the job. To improve the unsanitary conditions revealed during an engineer’s visit, George was issued with a sanitary bedpan for his personal toilet. The next visit by the engineer revealed that George was using the bedpan to store his bread supply. On another occasion, and for similar reasons, he was provided with a metal bath. George shouted: “What do I want that bloody thing for? I go home once a month.” Not that the bread would have deserved much better, as other stories tell[5] how it was delivered to the camps by packhorse. The trees and bushes were so dense that the undergrowth continually pounded the packs. Consequently, the bread arrived as breadcrumbs, which were then eaten by mixing them with butter and jam to make a thick, sticky paste.

Bridge failures

Fortunately for William Edwards, the Roman practice that opened the previous Section was not followed in Wales in the eighteenth century, as his first three attempts to build the Pontypridd bridge led to early failure[6]. His fourth bridge was such a delight that the area became known as Beautiful Bridge, or Pontypridd in Welsh.

The mighty Québec Bridge also took three attempts before it was successfully finished and open to traffic. Certainly, coincidental with the demise of the Roman law, many bridges don’t survive their construction phase.

Service failures are relatively rare and, when they do occur, are liable to be misinterpreted. For example, the view is still prevalent that a marching army should break step when crossing a bridge. This nonsense has been written into official military manuals for over 150 years. It arose in the early nineteenth century when the decrepit Broughton suspension bridge near Manchester in England collapsed as an army marched across it - the bridge collapsed under the weight of the soldiers and would have done so irrespective of whether or not they were in step. The troops in step were merely the straw that broke the camel's back. Humans - whether in step or not - produce a very heavy bridge loading.

The French, incidentally, have a similar ban on marching over bridges as a result of a suspension bridge over the River Maine at Angers collapsing when providing passage for 500 soldiers, half of whom consequently drowned. The equipped soldiers would have weighed some 50 t, so once again whether they were in step or not may have been irrelevant.

Armies have a poor reputation with bridges, being far more skilled at their destruction than their preservation. A popular theme in old children's stories is of the wicked general worried over whether a perilous bridge would safely carry his army across a deep ravine. To test the bridge he sends our young hero who skips happily across. The general, clearly not a structural engineer, is convinced of the bridge's strength, and orders his army to proceed, whereupon the structure collapses under the weight of their armaments and all but our hero plunge to their well-deserved deaths. Others more systematically test-loaded their bridges. Elephants were often used for this purpose, as it was believed that they could intuitively sense an unsafe structure.

One of the more incredible failures due to crowd loading occurred in 1845 when a suspension bridge over the River Bure at Great Yarmouth in England collapsed. The failure was due to a clown called Nelson who was being carried up the Bure in a bathtub drawn by four geese. As the spectators moved across the bridge to watch his passage, one of the chains failed and 400 people fell into the river. Only 260 survived the goose-bumping ordeal[7].

Nelson had clearly copied his act from Usher whose 1841 performance is advertised below. Much later in the book we will return to the matter of REAL cats.

Not only four geese, but also four cats. From an 1841 poster.

Despite prior warnings, it took the Tay Bridge disaster to finally show many designers how little they knew of wind loading. In 1879 gale force winds in Scotland blew down the high-level Tay Bridge in Perth after it had been in service for just eighteen months. The Edinburgh mail train and thirteen of the bridge's 60 m span wrought-iron beam-trusses plunged into the icy Tay River. Seventy-five passengers died in the tragedy.[8]

Thomas Bouch, the designer of the bridge, had been knighted for his work. After the collapse, he said that he had made no special provisions for wind pressure, although high winds were commonplace in the area. He died in the following year. It is easy to criticise Bouch for ignoring wind forces, but this was common practice at the time and he had consulted many other eminent engineers on the question. They, in turn, had consulted the Astronomer General, Sir George Airy, who had recommended using pressures only one-fifth of those then in use in France and America.

Indeed, Airy had an unfortunate track record for estimating pressure, which could have alerted Bouch to a problem. For instance, he had incorrectly predicted that Crystal Palace would blow down and that the new Atlantic telegraph would collapse under water pressure. Perhaps these personal failures had led him to take an alternative stance with his Tay Bridge advice.

Eleven years after the Tay collapse the infamous Scottish poet William McGonagall penned some verse now widely regarded as the World's Worst published poem. Published in his 1890 anthology *Poetic Gems,* the opening verse of the *Tay Bridge Disaster* provides the following inimitable lines:[9]

Beautiful Railway Bridge of the Silv'ry Tay!
Alas! I am very sorry to say
That ninety lives have been taken away
On the last Sabbath day of 1879,
Which will be remembere'd for a very long time.

This is followed by nine more appalling verses. He had previously written a paean of praise to the bridge. This misnamed song of praise had begun:

Beautiful Railway Bridge of the Silvery Tay!
With your numerous arches and pillars in so grand array,
And your central girders which seem to the eye
To be almost towering to the sky.

In his introduction to the 1985 reprint of *Poetic Gems*, the great comedian Spike Milligan poetically proclaims:

His greatest poem was praising the bridge over the Tay,
Which was a pity as it fell down the next day,

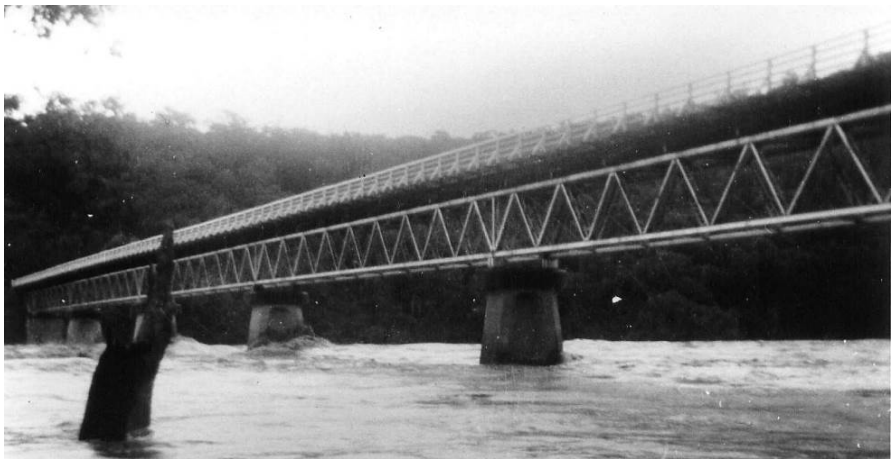
Bridge failures do tend to attract bad verse. As another example, Julia Moore is widely regarded as America's worst published poet[10]. The pinnacle of her work was reached in 1867 when the Ashtabula Bridge collapsed due to design errors, killing 92 people[11]. Julia wrote consolingly:

Have you heard of the dreadful fate
Of Mr P. P. Bliss and wife?
Of their death I will relate,
And also others lost their life
In the Ashtabula Bridge disaster,
Where so many people died.

When this continuing catalogue of woes is combined with our inherent fear of heights, it is not surprising that people do find even safe bridges to be frightening. The Brooklyn Bridge in New York was opened in 1883. A week after the opening, twelve people were killed when a crowd of some 20 000 on the bridge panicked, on hearing a rumour that the structure was unsafe.[12]

Victoria provides an example of a bridge failing between being successfully built and being put into service. Work had started on the 250 m long McKillops Bridge in 1932 and was completed in 1934, achieving instant fame as one of the world's first fully-welded steel trusses. Whilst waiting for the Premier to come and perform the official opening, the bridge was washed away in a record flood. The locals broke the news to Head Office with great tact:[13]

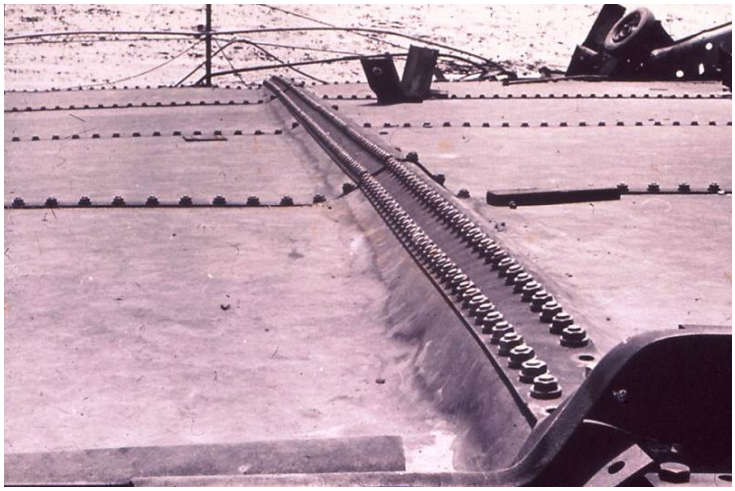
Caller: "If you're still coming up to open the bridge, you won't be doing it."
H.O. "Why?"
Caller: "The bridge ain't here anymore".
H.O. "What?"
Caller: "It's been washed away."



McKillops Bridge surviving a subsequent flood. VicRoads.

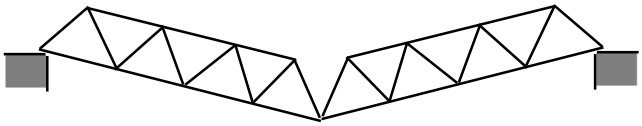
Bridge openings are always complicated. On one occasion, local politicians decided to name a large new bridge after a well-loved football hero who was stricken with terminal cancer. However, an obscure but obstreperous Place Names Committee pointed out that one of its rules prevented a place being named after a living person. The problem was solved by higher powers threatening to abolish the Committee. Sadly, the hero died the night before the opening.

One of the risks with bridge construction is that people who don't understand how a bridge works will start tampering with it. For example, the event that precipitated the collapse of West Gate Bridge in Melbourne in 1970 was the undoing of the joint that spliced the bridge together at midspan[14]. It was being undone to correct a few local defects caused by other problems, but it was very analogous to sawing off the tree limb on which you are sitting.



A failed compression joint from the West Gate collapse. The author.

Steel trusses often suffer in this way as builders and demolishers frequently assume that some small piece can have no useful purpose, and quietly discard it. Often it is a piece of the lateral bracing system that allows a series of adjacent trusses to support themselves against toppling over sideways. The common cartoon theme usually has a more critical component omitted.



"But I only left one piece out!"

Bridges do fall down occasionally while traffic is using them and there are graphic accounts and photos (e.g. *see below*) of vehicles plunging to destruction or teetering perilously on the edge of a missing span. A number of people tragically lost their lives in this manner when the Los Angeles earthquake struck in late 1993. The death toll almost rose by one in January 1994 when the caterer delivering food to the demolition teams took the wrong turn on a partially collapsed piece of elevated freeway and drove over the recently-severed edge. His van fell upside-down onto a bulldozer working below[15]. He miraculously survived, cushioned no doubt by hot dogs, pizzas and bagels.

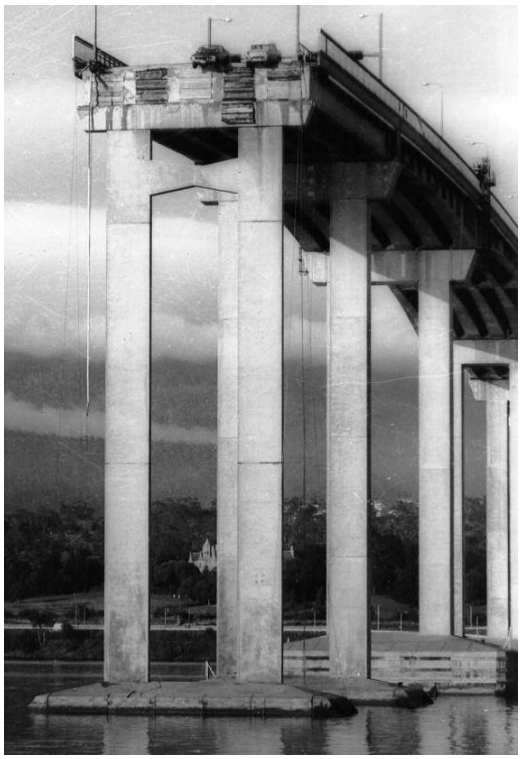
In 1975 the Tasman Bridge failure shown below resulted in 15 deaths, to date the greatest number of fatalities in a collision between a ship and a road bridge. The disaster highlighted just how frequently ships strike bridges - despite the bridges being large, immovable, well mapped, and well lit. A further examination of the data showed that these collisions have a great deal in common with collisions on the road, in so far as a disproportionately large percentage of the drivers and captains involved are rolling drunk.

The bridge shown on the next page at Milford Haven in Wales fell conveniently during construction into a street between two rows of house.

Bridge maintenance

Once built, a bridge must still be managed and maintained. The Canadian province of Alberta claimed that its Leduc overpass south of Edmonton was the world's most battered bridge. By late 1979 its girders had been bent into an S shape by repeated impacts from over-height trucks. It was struck twice whilst detailed inspections were in progress in December 1979 and twice whilst repairs were under way in January 1980. Monitoring devices installed in July 1980 recorded one impact in August, three in September, and three in October. Officials were delighted when new warning signs meant that trucks only hit the bridge on four occasions in 1981.

Another type of bridge maintenance problem occurs in outback Australia where resourceful truck drivers found that the nuts used to hold bolted steel bridges together were exactly the same size as the nuts needed to bolt their wheels to the truck axle assembly[16]. As the nuts were often lost when spare tyres were changed, it was expedient to change tyres near a suitable bridge.



When the Tasman Bridge in Hobart collapsed when struck by a ship in 1975 two drivers narrowly escaped death, their cars teetering on the brink of the Derwent's icy waters. Hobart Mercury.

Steep approach to Milford Haven bridge in Wales in early 1970. Actually, the bridge fell conveniently into a street between two rows of houses. Photo by author.

Corrosion is the cancer of the steel bridge, but we have still to adopt Louis Carroll's solution, which he revealed via the White Knight's *Ways and Means*:

> I heard him then, for I had just
> Completed my design,
> To keep the Menai Bridge from rust
> By boiling it in wine.

Reporting things like this to higher authorities is the bane of many a road manager's existence. Some crack under the pressure. In 1984 the New Zealand National Roads Board received the following letter from D. C. Forrest, the nominated report-producer for Grey County, in response to a request for a report within 15 days on the condition of all Grey County bridges.[17]

> Your notification arrived in this office on the 12th of March. Three days later they agreed to let me out of hospital providing I was accompanied by an attendant and promised to stop biting people. I am now in the depths of despair and may never ever recover.....I am sure, knowing the author as I do, a well-adjusted family man and a lover of roses, that he must have meant 1985.... This humble County has just completed the longest year it has ever known. The weather was stuffed up early. The first bridge completed this year was the Report bridge, it is seven reams long and supported on a genuine national roads board.

To all this, his secretary felt obliged to add the following P.S.

> He's gone off his trolley again. 'Tis raining here today.

The press also has trouble reporting on bridges, possibly because their minds are on other - higher - matters. Here are two examples[18]:

> All narrow brides had been widened, except for one that is now under reconstruction.
>
> The bride is not expected to be opened for traffic until next month.

Notes on Chapter 7

1 Waddell, J. A. L., *Bridge engineering*, New York: Wiley 1916
2 W. A. Lewis, "Problems of nationalised industry", in Robson, W. A., *The price policy of public corporations*, London: George Allen & Unwin, 1952
3 Lay, M. G., *Ways of the world*, New Brunswick: Rutgers University Press, 1992, p267
4 In H. W. Longfellow's "The Golden Legend", 1853
5 Anderson, W., *Roads for the people*, Melbourne: Hyland House, 1994, p156
6 Lay, M. G., *Ways of the world*, New Brunswick: Rutgers University Press, 1992, p270
7 Bond, J., *The hazards of life and all that*, Bristol: Inst Physics Press, 1996, p114. Further reference to the haulage capabilities of geese is given in the end-notes to Chapter 11.
8 loc cit, p169
9 McGonagall, W., *Poetic gems*. London: Folio Society (reprint 1985) 1890, p45-7
10 Pile, S., *The book of heroic failures*, London: Routledge & Kegan, 1979, p87
11 Lay, M. G., *Ways of the world*, New Brunswick: Rutgers University Press, 1992, p284
12 Bond, J., *The hazards of life and all that*, Bristol: Inst Physics Press, 1996, p137
13 Anon, *Reminiscences of life in the Country Roads Board*, Melbourne: VicRoads, 1995, p243
14 Lay, M. G., "Some recent box girder bridge failures and the Merrison report". Forum on the West Gate Bridge Report. IEAust, Victoria Division, 3 Dec 1971, pp31-43
15 New Civil Engr, "George Street", 27 Jan 1994, p42
16 Mitchell, E., *Chauvel country*, Sydney: McMillan, 1985

17 Roadways, June 1984, p3
18 Spiegel, F., *What the Aussie papers didn't mean to say*. Sydney: Ure Smith 1969, p58&64

Chapter 8

The London way

- London Bridge, the story behind the distortions of the nursery rhyme

With rhyme and reason

The theory developed in the preceding chapter can be illustrated by giving the practical example of London Bridge, demonstrating incidentally that there is more to a bridge than some assembled pieces of engineering[1]. Many of us as children learnt indelibly that nursery rhyme used as a chant whilst beating the internal bounds of the kindergarten:

London Bridge is falling down, falling down, falling down,
London Bridge is falling down, my fair lady.

What is the meaning of such a rhyme?

London Bridge had been purposely located at the only high ground near the lowest, adventurous ford crossing of the Thames. The Romans had built a relatively short-lived bridge at the site. In about AD 980 the Saxons constructed a wooden bridge carried on a foundation of wooden piles. In AD 1010 the bridge became a nuisance to the Vikings on one of their routine missions of plunder, pillage and rape. Their energetic activities were impeded by a group of Danes who were camped at Southwark and who used the bridge to dispatch arrows, spears and large stones towards any Viking ship that attempted to travel upstream.

Olaf Haraldsson, who led the Vikings, joined with the English, led by King Ethelred the Unready, to attempt to remove the Danes. Ethelred - more properly Aethelred II - was named Unraed, which originally meant “evil counsel”. This didn’t help his image much and was later retranslated, with some relevance, as “unready”. He had massacred all the Danes he could find on St Brice’s Day in 1002. The effort doubly infuriated the Vikings as he unsportingly conducted the slaughter on the seventh day of the week, when all good Danes were taking their weekly bath, en famille. Ethelred was succeeded by King Canute (or Knut), a true Dane.

To attack the Vikings, Olaf built strong wooden roofs on his ships and sailed up to their bridge-based bastion. Despite the protective roofs, many still could not withstand the onslaught of stones and spears, but a few were able to use grappling hooks to attach ropes to the timber piles. They then sailed downstream pulling the piers over as the heavy current carried them away from the bridge. The bridge, packed with Danes and their weaponry, gave way and all plunged, defeated, into the river.

The Scandinavian version of the destruction of the bridge then has Ethelred's troops hurling stones from the bridge and the united Vikings destroying it. As Scandinavia was torn with division at the time, the truth probably leans towards the English version.

The Scandinavian account of the story was told in an epic poem called *Heimskringla* and written by Ottar Svarte and contained in Snorre Sturlason's *Saga of King Olaf (Haraldsson) the Saint*, produced in about AD 1200.

Olaf, incidentally, did not become a Saint for the effectiveness with which he plundered, pillaged, and raped the English, nor for pulling down their only significant bridge. He did not even become a Christian until he returned to Norway and he gained his saintly reward for using quite vigorous force to convert his fellow countrymen to Christianity. Today, he is Norway's patron saint.

Svarte had a way with words, at least when translated from Norwegian into English. His wonderfully recitable poem is:

London Bridge is broken down,-
Gold is won and bright renown.
Shields resounding,
War-horns sounding,
Hildur shouting in the din!
Arrows singing,
Mail-coats ringing-
Odin makes our Olaf win!

Blood-stirring stuff, but it never quite passed the kindergarten censor. So by 1760 it had become, on the way to the current version,

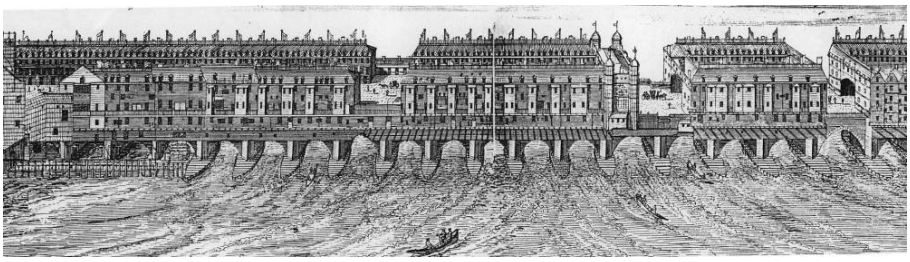
London Bridge is falling down,
Dance o'er my Lady Lee.

The Lady Lee was an allusion to the Thames and the falling down probably referred less to Olaf's efforts with grappling irons and more to the contemporary effects of fire, water, ice and water-borne debris.

Stone and substance

This is not the end of the London Bridge story. In 1163, Peter de Colechurch, the chaplain of St Mary Colechurch, a parish church in London's Grocery Alley, supervised the construction of a new timber bridge at the same location. It proved inadequate and in 1176 the Normans gave Peter the task of replacing it with a masonry arch bridge. Peter died in 1206 whilst the bridge was still under construction.

King John had been impressed by French bridges that he had seen and so he gave the job of completing London Bridge to a successful French bridge builder called Isembert. He came from Saintes, where there was a famous extant Roman arch bridge. The work on the new London Bridge was partly funded by a tax on wool and by major contributions by the Archbishop of Canterbury and the papal legate. When completed in 1209 it was 6 m wide and 360 m long and supported by nineteen pointed masonry arches and a drawbridge, each spanning between 5 and 10 meters. The arch piers were built by the cofferdam method and reduced the waterway by 75 percent, as can be seen in the following drawing of the bridge.



London Bridge, after giving birth to a nursery rhyme, but before the Great Fire of 1666. The chapel can be seen to the left of centre.

This leads to a story that I particularly enjoy telling. Early records indicate that the bridge foundations in part utilised packs of wool, as "they were durable against the force of water."[2] It was not an unusual technique and was used also, for instance, by Lovebone when he built the Wadebridge in Cornwall in the 16th century[3]. It is also a method used today in the form of the application of geofabrics. Nevertheless, economists over the years have consistently misinterpreted the statement that the bridge was founded on wool as being an allegorical reference to the fact that the capital cost of the bridge was obtained in part by a tax on wool. As one who has spent much of his working life battling the efforts of so-called rational or dry economists to divert funds away from the nirvana of road and bridge construction, I am delighted to have been able to give you yet another example of their collective wrong-headedness.

London Bridge was severely damaged by fire in 1212 and by ice in 1282, and was partly rebuilt in 1396. Indeed, four great fires swept the bridge. The deck carried many timber shops, inns, and houses and the carriageway operated as a narrow and cluttered street. This produced a major traffic hazard, causing many deaths, but the buildings were not removed until 1761 when the bridge was also considerably widened.

This use of the bridge as a place rather than as a passage was widespread throughout the Europe of the Middle Ages where hospitals, markets, shops, factories, churches and courts were frequently located on key urban bridges.

Bridges of the time were structures of great esteem and importance, and it was common for them to be dedicated to saints and to contain bridgehead shrines. On a mid-river pier, London Bridge had a beautiful chapel, which Peter of Colechurch had dedicated to Thomas à Becket who had become a martyr saint in 1172. Peter was buried in the chapel, which survived until 1553 when a poor posthumous and reformationist view of Thomas and his actions led to his chapel being demolished by the new Protestant powers.

Between 1304 and 1678, the southern half of the bridge included the Traitors Gate, above which were placed the staked heads of citizens executed for treason[4]. The first such "traitor" was the Scottish resistance leader William Wallace in 1305 and the last was William Staley, a Catholic banker. Sir Thomas More - my own personal hero - and Guy Fawkes also graced the gate in this manner. In 1598 a beheading record was set with some fifty severed heads on simultaneous display.

The bridge was the only London crossing of the Thames until 1750, when Westminster Bridge was opened. It was so important to Londoners that it became common to leave money to "God and the bridge." Tolls were introduced in 1286 and continued to be collected over the life of the bridge. The revenue raised not only paid for all maintenance but also financed its replacement and the construction of the nearby Tower, Southwark, and Blackfriars bridges.

London Bridge was demolished in 1832, after 600 vibrant years. A prime reason for its destruction was that the wide and frequent piers created a major restriction in the waterway, causing fast river currents, making boat passage hazardous, and incurring high maintenance costs as the water scoured the foundations. Boat passage was called "shooting the bridge" and claimed thousands of lives. When the bridge was demolished in 1832, the greater river flows and tidal movements scoured the upstream foundations of Westminster Bridge, which soon had itself to be demolished.

Ex-millwright John Rennie used the elliptical masonry arch that he had seen used on Parisian bridges for the five-span replacement of Colechurch's London Bridge. This bridge was opened in 1831 and demolished in 1968 when its foundations proved inadequate. It was sold to developers in the United States and now spans part of Lake Havasu in Arizona. It is widely believed that the developers thought that they were buying the far more visually interesting Tower Bridge. The current London Bridge is a three-span concrete structure of unobtrusive proportions.

Patricia Pierce, a Canadian, has written a serious history of the bridge, although she curiously omits some of the juicier bits that I have wisely included in this Chapter.[5]

Notes on Chapter 8

1 This Chapter is based on Lay, M. G, "A curious history of bridges", Proc Innovations in structural design: strength, stability, reliability. A symposium honoring Theodore V. Galambos, Univ of Minnesota, June 1997, pp 213-224

2 Moryson, F., *An itinerary* 1605-1617, Fol., 3 pts, In Latin and English, London: Beale, 1617, p88.

3 Leland, J., *The laboryouse journey and serche of Johan Leylande for Englandes antiquities, 1535-1543*, Oxford: Thomas Hearne, 8vol, 1549, p60

4 Londoners clung to the practice for another 100 years, moving the heady display to Temple Bar.

5 Pierce, P., *Old London Bridge*. London: Headline, 2001