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~~The longer one lives the more is something unusual likely to happen for the first time. Modest longevity is, in fact, a prerequisite for giving the inaugural lecture of a series founded to commemorate one's own retirement. The last time I gave an inaugural lecture was in 1951 shortly after my arrival at the University of Canterbury. Inaugural lectures were cancelled not long after. I hope this series has a better fate.~~

I have, of course, given other Memorial Lectures. On each occasion I have begun with a tribute to the life and the work of the person commemorated. I deem it neither wise nor seemly to do so on this occasion, but I would like to commend the wisdom of those who took the opportunity of my retirement to inaugurate an annual lecture 'to encourage discussion of engineering matters within the profession and to promote public understanding of engineering issues.' I hope I am only human in being deeply gratified to have my name associated with it.

The longer one lives the more likely are one's hobby horses to be well known. It will come as no great surprise to most of you that I was given a choice of subject and have chosen bridges. I find them fascinating, and not merely the fascination of one's own technology. Indeed, no, 'Bridges are built by men for men?' (And I am not going to emasculate that statement for tonight's audience - every person will know what I mean). Man has many needs - sociological, economic, recreational - he needs freedom from fear of danger, freedom to move about. He needs to be inspired by the accomplishment of difficult, ennobling tasks, and he needs to find and to recognise beauty in the works of man quite as much as in the face of Nature.

Not all bridges satisfy all of these needs, but it is rare indeed to find one that satisfies none.

New Zealand is a land of rivers and to meet man's needs it has become a land of Bridges. When the pakeha came to New Zealand not much more than 100 years ago there were none. Drowning was known as the New Zealand disease; for a longtime it claimed more victims than any other cause. (John) Henry Whitcombe, a civil engineer trained under I.K. Brunel, suffered great hardships in finding his Pass through the Alps; but he survived that crossing. He was drowned trying to cross the Taramakau river. These drowning fatalities (and Whitcombe's in particular) inspired an article in The Illustrated London News which showed the New Zealand method of crossing a river. It depended upon a bland condition of flow, as did this method of crossing the Waiau river.

It needed no great technology to string a wire across a river, although it often entailed great physical effort and no little danger. But the ladies crossing the Taramakau in this box would have been greatly incommoded in a high wind. Nevertheless this method was widely adopted and survived in many places until quite recently. Such primitive methods must have had a traumatic effect on many children who had no other method of getting to school. It probably explains the actions of the sons and daughters of Robert and Isabella Stewart, who dedicated this bridge to their parents, at Island Block, which is not far upstream from Tuapeka Mouth where this punt is still the sole means of crossing the Clutha. For many years punts served the Clutha despite the attendant dangers of high winds and floods.

So many bridges were needed throughout New Zealand that engineers could not advise their political masters of a priority list. Local men of initiative tried their hands at building, local politicians brought pressure to bear to get bridges in their area. Sometimes it took a long while. Albert Town, where the Clutha leaves Lake Wanaka, was the early focal point of the Upper Clutha

Valley. It was originally known as Albert Crossing. It was the only place where the river could be forded, though not without danger. The first death recorded there (1861) was of John Gilbert, who was described as a good swimmer. He probably did not like the look of the first punt which Hassing described as 'a square box that did duty for a boat'. It was in fact the body of a gig.

Despite the traffic across the river at this point, it was not until 1930 that James Horn, the local MP, was instrumental in having a bridge replace the punt. It was a great day for the  
7 locals, who crowded on to the punt for its last journey, then drove  
8 in cavalcade in ceremonial opening of the bridge. Doubtless part of the ceremony was in the Cemetery alongside, where the records of many drownings makes sad reading.

The opening of a bridge confers such a benefit upon a pioneer community that it is generally an occasion for rejoicing, sometimes exceeding the bounds of temperance. A correspondent reports from the Wairarapa "When the long Waihenga bridge was built over the Ruamahanga River near Martinborough<sup>u</sup> in 1875, it was a major event worthy of attendance by many of political and government importance in Wellington and Wairarapa who, after the ceremony, adjourned to the nearby Waihenga Ferry Hotel, and after everybody connected even remotely with the bridge had been toasted, it was too late for many of the guests to leave for home, and it was said that many didn't even know where home was, let alone get there. The fact that there were many more guests than there were beds in the little hotel didn't worry the publican a bit, he put them in 2 or 3 to a bed, just as they were.

When the boot cleaner did his round in the night, not finding any boots outside the doors, and loyal to the hotel's boast of service, he went in and cleaned all the boots sticking out of the bed ends and still on the owners' feet.

I can remember my father telling me that he woke up in the morning between two Cabinet Ministers".

Even today the opening of a new bridge is an occasion for a community gathering. The original bridge across the Rangitata at Arundel had an interesting history (although the locals would have preferred it be shorter!) It was commenced in July 1870 to the design of Thomas Paterson, Railway Engineer for Otago Province, who had been drowned the previous December in the Kakanui river when he was bring<sup>g</sup> the plans for Rangitata bridge to Dunedin for approval. Much of the supervisory work was carried out by William Newsham Blair who ultimately became Engineer-in-chief of the Public Works Department. The original bridge was 1100 feet long of wrought-iron trusses on iron cylinders. But about 1878 the river washed out the northern approach. 800 feet of timber trusses were added, which served until 1906 when a scrub fire set alight to this extension. The proprietress of the Arundel Hotel organised a bucket brigade until a five tender arrived from Geraldine several hours later. Despite that gallant efforts of the locals until well into the night, about 300 feet of the northern portion were totally destroyed, a lot more was badly charred and twisted. Timber truss replacements have lasted until 1978, although the condition of these trusses and of the timber deck have given a rough ride over it and necessitated the imposition of weight restrictions. It has  
9 now been replaced by a prestressed concrete bridge which was  
10 officially opened in March of this year. Only one cabinet minister  
11 was present (they no longer sleep in pairs) but there were two  
M.P.s and the chairman of two county councils. A local big wig,  
Sir John Acland, cut the ribbon in the presence of several hundred  
locals.

12 The orig<sup>i</sup>inal wrought iron girders are still in good condition  
and will shortly be taken over to the West Coast to span the  
Taramakau south of Greymouth.

Arundel bridge was designed by a professional engineer but  
13 there were at the time several enthusiastic amateurs. Not all of  
14 them paid enough attention to hydrology and the prediction of  
flood levels.

XTRA  
1 The gravels of the Clutha lured men from the ends of the  
earth but its turbulent waters were a different matter. "How the  
pioneers must have cursed that river!" exclaims Robin Marks in  
his history of Tuapeka County. "A river which even an American  
would not condemn" is how Frederick Tuckett, first Surveyor of the  
Otago Block, described it. At times of low flood it displayed  
its riches for all to gather, and in this bland condition the miners  
had ample water and power for all their sluicing needs. But even  
in this condition it offered formidable problems to the traveller,  
who perforce had to cross and recross it as he forced his way up  
its banks. In flood even its tributaries are awe-inspiring. The  
flood of mid-July 1863 converted the Arrow, usually a small stream,  
into a boiling torrent that swept away a substantial dam, erected  
by the Hit-or-Miss party. Overnight the Shotover rose 35 feet,  
the Clutha 20 feet. Imprudent goldminers camped on or close to  
their workings all lost their belongings, most of their gold,  
and some (about 100) their lives. But the lure of gold kept the  
survivors there.

In 1862 Hartley and Reilly had made their strike just below  
Cromwell. It was a desolate place to establish a mining community.  
There was no timber, the skeleton and the fabric of every pioneer  
settlement. Abundant timber was also needed for making sluices.  
Two years earlier, in 1860 George Magnus Hassing with H.S. Thomson,  
Manager of West Wanaka Station had propelled a small rowboat, using  
homemade manuka oars, to the head of the lake and up the Makarora  
river to inspect the pine forest. The following year Hassing  
established a mill in the area, and before the end of the year

several other sawyers set up business there. However, only a trickle reached Cromwell and the shortage was so acute that an empty gin case would sell for £3 (perhaps almost as much as the contents would fetch in those duty-free days). But Henry Hill was there.

"He must go down in history as being more enterprising than honest, but it was he who gave the initial fillip to the timber trade on lake and river". He went up the Makarora and bought all the timber that the sawyers had on hand, and contracted to buy all their future output. In small rafts it was floated easily down the Makarora. At the head of the lake Hill had the great idea to rebuild into large rafts, each fitted with sweeps for steering, a mast and a large tarpaulin sail. The prevailing northerly took the rafts to the outlet of the lake. Here lay the problem - the Clutha was not the mild obliging Makarora. Hill experimented with rafts of differing sizes, both manned and unmanned. His losses were high even though he had retrievers downstream. But enough got through for Hill to do well by it. When the contracts were nearly finished he withdrew three-quarters of his money, filed his bankruptcy suit and departed for South America. But he had served the community well and probably thought it owed him something.

With some of the first timber brought down he had constructed two punts, one at Muttontown and the other two miles further up where Clyde now stands. He sold the punts to Duncan McPherson but reappeared in the business in July 1863 when the Provincial Government called tenders for all ferries on the Clutha and the Manuherekia, based on the following charges.

Each person 1/-

Horse alone 1/-

Great cattle 1/-

Small cattle 4d each for less than 20

Small cattle 2d each for more than 20

Vehicle 2/-

Horse with vehicle 1/-

Bale of wool 1/-

Goods 4d 100lb

with 50% surcharge after sunset <sup>to</sup> and one hour after sunrise

Mail and civil servants on duty free.

Hill was the successful tenderer for all ferries but because everyone thought the above charges extortionate the Government, two months after granting the contract, halved the rates. Hill claimed that this would cost him £6000 per annum and he claimed £4500 compensation. He was paid £3000 provided he handed over all of his ferry equipment.

15 This left him disgruntled, but he still had one string to his bow. Early in 1863 he had seen the possibilities of a bridge to carry traffic from the East bank into Cromwell. His foot and pack bridge was completed in May 1863 with a toll charge of 1/- for animals and 6d for persons. It survived the July 1863 flood but succumbed to one in July 1864. In that time it had clearly demonstrated its value and the Provincial Government undertook a reconstruction. It kindled great expectations. The foundation stone was laid over a case containing a farthing, a halfpenny of the time of Queen Elizabeth, a penny, a sixpence, a shilling, a half-crown, a crown, a half-sovereign and a sovereign together with copies of the Otago Daily Times, Witness, Dunstan Times and Molyneux Mail.

It was no sooner completed than the Government decided it was in the wrong place. The line of the main road was fixed a little lower down. Work started in July 1865 on a site identical with

that occupied by the present bridge. Construction was slow but it was opened on 16 January 1866. Not a moment too soon for the Government bridge shared the fate of its predecessor and was swept  
16 away by flood the same month. The new bridge at the Junction was a Town Lattice bridge, a type that needs protection by a roof and sidings or by continual maintenance. It had neither and endless bickering delayed approval of a replacement. It was called  
17 'that lasting eyesore of provincial neglect and imbecility'. Not until 1891 was a new bridge completed, 308 feet long and 14 feet wide. There were 1200 people at the opening ceremony. Despite neglected maintenance from time to time, the bridge still stands.

Other bridges on the Clutha have not been so fortunate. Describing the great flood of 1878, Gilkison writes ' The Shotover river, boiling down in flood to its junction with the Kawarau, stopped the outflow from Lake Wakatipu, and actually flowed into that lake. The Clutha rose thirty five to forty feet at Cromwell bridge, and all the other tributaries became swollen torrents ... soon all the low-lying lands were submerged and higher parts threatened. Then began the great destruction of bridges. Of the fine structures which the colonists had built with great expense and labour to span its course, only two survived - those at Cromwell and Inchclutha. The great bridges at Beaumont and Roxburgh were submerged and carried off. The beautiful suspension bridge at Clyde for sometime resisted the onslaught of the current, even after the water was flowing over its decking, but an accumulation of trees and debris gathered against it and the pressure became so great the wire ropes on one side gave way. Then, with a great effort the flood pushed its way through and swept the whole structure away. On 29th September at 11.30 a.m. the wreck was seen passing Alexandra and, later on, the remains of the Clyde and Roxburgh bridges, lovingly linked together, passed

Balclutha on their way to the sea".

The bridge at Balclutha survived this traumatic experience and held its own through the worst of the flood. But the centre pier was undermined and it followed the others about a fortnight later.

The bridge at Bannockburn, two miles up the Kawarau from Cromwell had joined the procession downstream. It deserved a better fate. It opened in 1874 as a private toll bridge and continued to operate as one despite vigorous opposition led by Vincent Pyke, County Chairman and D.A. Jolly, Mayor of Cromwell. Their efforts were rewarded when the Government bought the bridge in February 1878. At a grand reopening ceremony Vincent Pyke, in symbolic gesture, hurled a bunch of keys into the river. Little did he realise that the bridge would follow the keys seven months later. Pyke, whose contribution to the well-being of the district was monumental lost no time in having it replaced. Pyke was unlucky with another bridge at Rocky Point, on the Clutha just upstream of Cromwell. Hearing of the proposal to erect a private toll bridge there, Pyke arranged for a county bridge instead. John McCormick completed this bridge in the early part of 1878. In the same flood of September the river decided to leave it alone. It washed out the approaches then cut a new channel for itself some distance away. High and dry the bridge afforded some satisfaction to the promoters of the toll bridge, who were doubtless responsible for naming it 'Pyke's Folly'.

John McCormick built a suspension toll bridge at Nevis Ferry, called Victoria Bridge, further up the Kawarau from Bannockburn. This was replaced about 1960 with trusses from a hangar at Ohakea which had become surplus following World War II. The reconstruction sequence is interesting.

Further up the Kawarau is the Gorge bridge, also built by  
22 John McCormick. This was designed professionally by Harry Higginson  
who received at prestigious award from the Institution of Civil  
Engineers in London for his paper describing it. It was built to  
23 last, as this anchorage will indicate. It has now been replaced,  
24 but the old bridge is being maintained as an ancient monument. The  
25, 26 replacement involved a similar sequence of operations to that at  
27, 28, 29 Victoria bridge, but more sophisticated. (Alexandra) (Manuherikia)

Even this abbreviated story of the Clutha has perhaps taken  
more time than we can spare this evening. But it covers a period  
when bridges were not taken for granted and loomed large in the  
daily lives of people.

One cannot leave Otago without mentioning the works of one  
professional, John Turnbull Thomson. Time does not allow a  
description of his prodigious work in the survey of Otago. But  
his bridges are worthy of notice because they lasted - two still  
operational, the others superseded while still operational.  
Born in the North of England and trained as an engineer in Aberdeen,  
he had a distinguished career as engineer and surveyor to Singapore  
Harbour Board. He came to New Zealand for his health and took the  
job as Otago Provincial Surveyor because he was told it was a desk  
job. Within 3 years he had traversed the whole of Otago and  
Southland, discovering and surveying huge tracts of land. Using  
Palmerston as starting point for many of his surveys, he must have  
thought it would develop into an urban community, because he built  
bridges of stone over both arms of the Waianakarua River, <sup>4</sup> South of  
30 Herbert. Each bridge still carries the main road to Dunedin.  
31, 32 His suspension bridge over the Mataura river, built in 1868, lasted  
71 years before being replaced by one more suitable for modern  
33 traffic. His 1868 bridge at Skippers gave good service although  
not much more than an access bridge. But considering the access

34 afforded by the road in, it was a notable construction.

The early engineers of Canterbury had their problems spanning the rivers athwart its main lines of communications. The road to the north had to cross the Waimakariri and the Ashley rivers and the early punts and ferries gave a lot of trouble. So did the early bridges.

Ashley was a toll bridge, part of a very much disliked turnpike system. There were riots from time to time to get rid of the tolls. When the toll house was moved from the Carlton to the corner of Harewood and Papanui Roads it was demolished overnight, placed on a bed of straw and destroyed by fire.

The Provincial Government sponsored a competition for the design of a bridge over the Waimakariri. The judge (Colonel Mould, RE) had an easy task - there was only one entry, by Henry Whitcombe probably helped by Edward Dobson, Provincial Engineer. The Government reneged on building it, on the grounds of cost, and accepted an offer by William White for a cheaper structure. When it was completed in 1863 Dobson declared it unfit for traffic because piles had split, bracing was bowed and joists had been made from unsuitable timber. The northern settlers were not impressed and accused Dobson and his assistant for North Canterbury, James Wylde, of professional jealousy. A personal and petty controversy raged until as if answering a call for judgement from on high, the heavens opened, a flood poured down the Waimakariri, leaving in its wake a sorely strained government supervised structure by Edward Wright and a completely undamaged White's bridge. There was no further difficulty about a completion certificate. William White received the gratitude of and a gold watch and chain from the farmers of North Canterbury. The latest bridge has nothing to do with him but it and the locality are still known as White's Bridge.

Nothing succeeds like success and he received a number of other construction commissions, notably Rakaia bridge which had a

35      chequered histroy<sup>h</sup> but survived as a combined road and rail bridge  
until 1939.

36      About the time he was building that bridge another ~~M~~averick  
was building railway stations on the line from Christchurch to  
Rakaia. He was Joseph Dawson who had come to Christchurch from  
Tasmania and at the age of 26 became apprenticed as a carpenter  
to Daniel Reese, first President of the Canterbury Master Builders  
Association. Dawson was a magnificent physical specimen who was  
for some years champion sculler of New Zealand. He and his brother,  
with Daniel Reese and his brother joined together as champion four  
which won the New Zealand championships. His relationship with  
Reese was not exactly that of apprentice and employer. He married  
Reese's sister, and ended his apprenticeship after 2 years, to  
become a foreman and went south building railway station buildings.  
He trained himself to be both architect and contractor. He designed  
and constructed many buildings in East Christchurch, including  
Ward's brewery in Kilmore St. About 1882 he went to the Wairarapa  
and responded to the challenge of that rugged area by building many  
bridges and earning himself the title of ' the grand old man of  
Forty-Mile Bush'. He started with a bridge for a farmer at  
Kopuranga, it had a span of 90 feet and cost only £100. He gradually  
37      perfected a system of building suspension bridges, the details of  
38      which are shown at Ashley Clinton where he built two bridges, one  
of them still in service.

39      His fame spread and he built Maoribank and Melling bridges  
over the Hutt river and two bridges at Up~~s~~ton Downs in Marlborough  
(<sup>1/2</sup>South of the Awatere). His biggest project was over the Manawatu  
at Opiki - a main span of 473 feet, with reinforced concrete  
towers 48 feet high. A steel tramline was originally laid across  
it and horsedrawn trucks each weighing three tons were pulled across  
bringing flax to the mill. The bridge was built in 10 months, from

March 1917 to January 1918. When the mill closed in 1919 the bridge was converted to a road bridge and lasted until the National Roads Board replaced it in 1969.

40 Dawson's bridge at Taoroa was completed in 1914. It had a  
span of 253 feet and the deck was 270 feet above the Rangitikei  
river. In 1960 a sheep truck weighing twice the legal limit broke  
through the deck and plunged into the river. A replacement was  
built using Callendar - Hamilton trusses, designed by A.M. Hamilton,  
40 a graduate of Canterbury University College. These trusses had  
41 been used in many countries throughout World War II, being second  
42 in popularity to Bailey bridges. The sequence of operations at  
Taoroa have a military precision. The cantilever arm dipped  
seventeen inches before the gap was bridged, and there was only one  
inch to spare when it reached the outstretched ~~area~~ from the other  
bank.

43 The finished bridge has an outline similar to that of Waiau  
ferry bridge, built by the firm founded by John Anderson, the Scots  
blacksmith who made good in Christchurch. Waiau bridge is  
described as an understrutted cantilever with continuous lattice  
deck span of 250 feet. Andersons Ltd built many bridges throughout  
New Zealand and made a notable contribution to the construction of  
the railway viaducts. At Makatote (1905-08) they set up a complete  
44 structural shop using timber columns from the forest, and the  
whole of the steelwork was fabricated there, not only for Makatote  
but for 3 other viaducts as well. Makatote was a flourishing  
community for a short while. H.B. Anderson, then a young engineer,  
marked out the steel work in the shops. At full production,  
Andrew Anderson brought his wife and family to live on the job.  
Mrs Anderson was a wonderful hostess, well remembered by many of  
the young engineers who worked there or who were travelling through.

45        Andersons established a reliable routine for erecting steel  
46 structures which was followed through the building of the North  
47 Island Main Trunk. Designers, notably P.S. Hay of the Public Works  
Department, adopted these types and they knew they could rely on a  
well-drilled, highly-skilled cadre of workmen. They saw no reason  
to change. Consequently when the East Coast Main Trunk was built  
about 30 years later, similar designs were adopted. Mohaka was  
designed by the PWD and constructed by their work force (Mr Tom  
Robinson, their foreman is here tonight with his son, Dr Ward  
48 Robinson). The sequence is similar to that at Makatote, but they  
49 had a real river to contend with. Just north of Mohaka is a similar  
50 via duct at Maungaturanga, easier to reach and easier to  
51,52 photograph.

53        These viaducts reflect great credit on designers and constructor  
but from a maintenance point of view they have a significant  
54 disadvantage. Looking at the underside of Makatote we see many  
joints from which moisture must be excluded if deterioration is not  
to take place. Perhaps the designers have taken too little notice  
of this factor and paid too much attention to maintaining the  
work force in an efficient groove. But the latter were resilient  
practical body of men who could adapt themselves to all methods  
and materials. Mr Robinson, for instance had worked on Balclutha,  
55 a reinforced concrete bowstring bridge of major proportions. Later  
he came out of retirement to act in a consulting capacity on the  
56 new railway bridge at Hamilton - another reinforced concrete bridge  
set more than 20 feet lower than its predecessor. This has meant that  
the railway could be lowered beneath the main road in Hamilton,  
with great benefit to the flow of traffic. The old bridge has  
become a road bridge but does not share its deck with the railway.

This is in line with modern thinking. Common deck road and

57 rail bridges are on the way out. Rakaia went in 1939, Waitaki in  
1956. Waitaki might never have been a common deck bridge if  
John Millar's advice had been heeded. But he had run foul of  
58 the Town Board of Dunedin when he was their engineer and crossed  
swords with leading engineers. Time generally has proved him right  
and he certainly had his adherents during his lifetime. The  
Otago Daily Times in January 1864 referred to "the flagrant  
incapacity of the Town Board ..... Mr Millar, however eccentric,  
at any rate possesses ability, which is more than can be said for  
the Board" But at Waitaki the combined weight of top brass,  
reinforced by overseas opinion, went against him. He wanted 28  
spans of 133 feet each with railway on top and road beneath as  
against the structure built of 110 spans 33 feet each with a  
common road-rail deck requiring a man on duty continuously to  
shut and open gates as and when a train passed through - 80 years  
59 of unnecessary labour. Millar's idea was certainly workable, as the  
of you who have crossed Awatere bridge will know.

The Rakaia gorge bridges were intended to be common deck  
road and rail bridges, but the railway was never built. Before the  
proposal was scrapped, however, the bridge for the North Arm had  
been ordered and it was erected in 1881. Because it was designed  
to take railway traffic it still serves as a highway bridge and  
60 hopefully it will continue to do so. It is a Bollman truss, called  
after its designer, an early chief Engineer of the Baltimore and  
Ohio Railroad. There is only one other example still extant. That  
is in the United States, and it is being preserved as part of  
their engineering heritage.

61 The south arm bridge was down graded, and built of timber.  
It was replaced with a well - proportioned reinforced concrete  
arch in 1944.

When is a bridge a viaduct? or vice versa? The Oxford Dictionary does not help: it defines a viaduct as "a long bridge like structure for carrying a road or railway over valley or dip in the ground". Mohaka crosses a most pronounced dip in the ground, but I do not regard it as a viaduct. Makatote on the other hand, is a viaduct. The difference is that at Mohaka there is a quite considerable river to be crossed whereas Makotote and the example shown here of Hapuawhenua carry a railway over a dip with nothing more than cross-drainage to contend with. But really the question is semantic, because a bridge is part of a road or railway.

The terrain to be traversed by the North Island Main Trunk dictated the adoption of a number of structures like Hapuawhenua. But it could be argued that the engineers were at their best when they avoided them. There is a classic example.

The route for this railway was a political hot potato. Wellington - Auckland overland mails had always been routed through New Plymouth, but the engineers favoured the direct route. Ultimately the problem was solved by a Parliamentary Committee consisting solely of all the South Island members, who recommended the central route. There was still an outstanding problem. Everyone knew that the high point was the plateau at National Park, 3000 feet up. From the south there was no problem and John Rochfort, surveyor, saw no great difficulty coming the other way. He proposed a wide sweep and another half-dozen viaducts. But in the detailed stage it was not so easy. In the end R.W. Holmes came up with the answer - follow the country up to Raurimu then treble the distance to National Park with a spiral. This gave him a manageable grade of 1 in 50, although some of the curvature was wicked! But it works!

With road traffic today moving at speeds comparable with

those of the railway it is necessary to build Hapuawhenua type  
64 structures on the highway. The Shotover bridge is a good example.  
The three-dimensional characteristics of concrete make it eminently  
suitable. There is a beauty of form - a sculptural quality about it  
65 that renders superfluous the extra embellishment given to the piers.  
66 Mohaka is another fine example of the roadmakers art, where a bridge  
has been incorporated into a high speed curve.

Ladies and gentlemen, the word 'environment' means different  
things to different people. To most present-day New Zealanders it  
means the unspoilt beauty spots of Nature to which we can travel  
at high speed without fear and without thought over well engineered  
roads and well-constructed bridges. And why not? This is what  
engineers are for. I hope you will continue to do so, but not  
without thought. You have been reminded<sup>d</sup> tonight of some of the  
harsh faces of Nature and of times when bridges occupied the thoughts  
of everyone in the community. If today we take the bland face of  
Nature for granted it is because enough men and women cared for  
their own technology enough to want to improve it and they will only  
continue to do so if they find their technology fascinating. No  
danger lies therein - danger lies with all of us if we believe in  
the self-sufficiency of our own technology and fail to see the  
value of others.

If you love the rural environment, well and good. A reviewer  
of my book A SPAN OF BRIDGES, in the Oxford Times (University  
Oxford, not Canterbury) coined a phrase that I envy. He wrote  
67 "Bridges that flow out of tree-lined banks do not intrude into the  
environment, they complete it". He must have been looking at this  
illustration when he wrote it. You can do better than that by  
coming down off the highway from time to time to enjoy the sight  
68 of the bridge you will not see from above. Like the steel arch  
69 at Hamilton, or just the modest structure at Helmore's Lane.

At the beginning I mentioned man's need to find and to  
recognise beauty in the works of man quite as much as in the face  
of Nature. The majority of us spend the major part of our lives in  
an urban environment. May we not be inspired by the works around  
us? , like the people of Albi, even though we may not yet aspire  
to the heights reached by the Gentlemen of Verona. Stone by stone  
they retrieved Ponte Pietra from the Adige and replaced it in all  
its glory, and they did the same thing with stone and brick with  
Scaligeri bridge. Perhaps we will not reach this pinnacle until  
we too have a history of a thousand or more years. People who  
inherit beautiful bridges build beautiful bridges. The Adige at

Verona abounds with them, *Ceres's three bridges conform to tradition* and so does the Tiber at Rome, which  
makes Ponte Risorgimento almost inevitable. Spanning 100 metres

(328 feet) built of reinforced concrete, it was designed by  
Hennebique and was completed in 1911. I suppose we lack the  
tradition for this kind of work. And yet .... let us not forget

Grafton bridge in Auckland. Spanning 100 metres (328 feet), built  
of reinforced concrete, it was designed by Hennebique and was completed  
in 1910. So perhaps it was not what happened in New Zealand before  
1910 but what has happened since that has conditioned our thinking.

Do we think highly enough of the works of man to spare enough  
thought for them? Or shall we just go to Europe for that sort of  
thing?

78 79 80 *Pont du Gard.*

You don't have to be the fanatic that I am, but I hope that  
each of you will agree that there is something about a bridge.