# ASHET ORAL HISTORY PROJECT

## TIMBER TRUSS BRIDGES OF NSW

## TRANSCRIPT

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| Interview with: | **Brian Pearson & Ray Wedgwood** |
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| Interviewer: | Frank Heimans |
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**START OF DISC No. 1**

(Duration 69:27)

## CD 1 TRACK 1

0:00 Disc identification.

**Frank :** *Let's start with a little a bit of background about each of you and I'll ask you a question first, Brian - tell me a bit about your background, where and when you were born and your career as it developed.*

0:41 **Brian:** I was born in Epping in January 1927, so in about two months time I'll turn eighty-six in age. I was educated at Sydney University and I finished my studies in 1947 and then joined the Department of Main Roads, known as the DMR, at the end of 1947. From 1949 to 1953 I was stationed at Port Macquarie, firstly as the Assistant Engineer and then as the Officer-in-Charge of the area and my main work up there was the reconstruction of sections of the Pacific Highway and the maintenance of the Pacific and Oxley Highways. I did a little bit of work for the local council on behalf of the DMR because I was the only engineer in the town of Port Macquarie: at that time it was a sleepy little village, now it is almost a city. It has a population to be determined as a city and there are many engineers and many other professional people there now, of course.

2:00 I worked then in the Divisional Office at Deniliquin for a couple of years and then resigned to get some overseas experience with consulting engineers. The experience was gained in the heart of Africa, the Union of Rhodesia and Nyasaland, where I had to look after the construction of about a dozen reinforced concrete bridges on a new road that was being built.

After that experience I came back to Sydney and the DMR was looking for an engineer to supervise the major bridgework that was to be undertaken in the

metropolitan area, where new bridges were going to replace old bridges that were inadequate for the traffic growth and the first of those jobs actually was to remove the tram tracks from the Harbour Bridge and to replace the tram tracks with two eastern road lanes. We had twelve months in which to do the job and we finished that on time and then came the construction of Gladesville Bridge and Captain Cook Bridge down at Georges River mouth, Fig Tree Bridge, Tarban Creek, Roseville Bridge and quite a few others. I think at one stage we had twenty-four bridges operating, under construction, mainly by contract and we had quite a large supervisory staff, mainly of bridge foremen to look after the construction of these works, plus Resident Engineers on the larger bridges.

3:54 After that experience I was sent to Bega Division on the South Coast and there were more bridges down there, I think a dozen. I was only there for twelve months and I was brought into the Bridge Section then, and I rose then from being a Supervising Engineer in the Bridge Section to being Chief Engineer, Bridges. I saw the Operations Area before I was appointed Chief Engineer. As Chief Engineer I was responsible for the construction and maintenance of all road bridges and that included, of course, the timber truss bridges that were dotted throughout the State.

## CD 1 TRACK 2

*Now Ray, can you tell me something about your background and your career?*

0:05 **Ray:** I was born at Dorrigo on the North Coast of New South Wales, grew up in Bellingen, and went to Primary School in Bellingen, went to High School in Coffs Harbour. We used to go down and catch a bus down to Raleigh Station and catch a little four-carriage train to Coffs Harbour. The train was named 'Misery' because it was a 13-class engine running backwards and that was used for shunting at Coffs Harbour station during the day.

0:31 At high school I got a cadetship with the DMR and they allowed me, before I went to Uni here in Sydney, to work in the Grafton office. Each holiday I went back and I worked in the Grafton Division. The first year out of Uni – well, before I even

went to Uni, I spent some time in the Drawing Office, practising printing, learning how to print. The second year I was involved in some surveying work around Coffs Harbour, north of Coffs Harbour, the third year I was on bridge construction on the Grafton-Glen Innes Road, the Mann River at Jackadgery. The third year, which was our long break, I worked at a place call Billinudgel, which is the closest DMR office to the Gold Coast, just north of Brunswick Heads. When I got through Uni I came down to see where they wanted to send me and they said, 'You can go to the Bridge Section,' so I was in that Section for about a year.

1:40 In that year that must have been my first contact with Brian. That was the year that Gladesville was being built and as a young engineer out of Bridge Section I was seconded to help another bloke who was supervising the jacking of the arch at Gladesville, they wanted a helper for him, so I was the helper. We had a little hut on top of the arch and over three nights - there were four banks of flat jacks at each quarter point - and over the three nights they expanded the jacks and the arch was eventually lifted of its falsework, and they were able to move the falsework sideways to be able to start the next arch.

2:25 The next year they were looking for an Resident Engineer to go to Captain Cook Bridge, which Brian was supervising the construction of, and I went out there and finished that job, it was about half-built when I went out there, so that was my first real contact with Brian. Subsequently I came back to Design and was involved in various design jobs and then construction jobs. Spent time relieving up at Harwood, the bridge over the Clarence River at Harwood. Subsequently I got involved in the design of the new bridge out at Camden, which we designed using a pre-cambered principle over about five hundred and twenty feet, the bridge spans were set about five foot in the air and then they were lowered down. That was to relocate, re-arrange the bending moments more suited to the capacities of the composite section of the deck.

3:26 Then I started to get involved in bridge codes and Brian was running a committee with the Heritage people and I got in on that committee. Then I

eventually succeeded Brian in 1987, I think it was, and started my career as Chief Bridge Engineer. The title changed, Brian was a Chief Engineer (Bridges) but I became Chief Bridge Engineer. They did the same to the traffic guy as well, they lowered our status a little bit.

*Switched the names around. When did you actually retire, Ray?*
In 2004, when I was sixty-two.

*And you, Brian?*
4:06 **Brian:** Well, I'll answer the question backwards. After I resigned from the DMR I joined a firm called Technical Assessing, which involved me in bridge problems and structural problems generally and I stayed with that firm for a further twenty years. So I had forty years experience on bridge works roughly, and twenty years on a mixture, so that brought me back to about three years ago and that was my final retirement date. I am still associated with the two firms, Technical Assessing and another firm in occasional work on a consultancy basis.

*Not too many people can claim to have a sixty year career, can they?*
5:00 **Brian:** It was helped by reasonable health, I suppose. My doctor said after I had finished with the DMR that if I didn't get something else to do he'd bury me in six months, so that hurried me up to get something else to do.

## CD 1 TRACK 3

*Now Ray, what has been your continuing interest in bridges since your retirement?*
0:04 **Ray:** Well, after I retired I still retained a contact with the AustRoads Bridge Group, the Australian and New Zealand Road Authorities, their bridge group, and I went to a couple of their meetings. Late in 2004 I had a minor stroke and that put me out of action for a little while and then Brian got me back involved with this bridge at Tharwa. His son was living in Canberra and said, 'Dad, you'd better come down and find out what it is going on at Tharwa with this old four-span Allan Truss bridge over the Murrumbidgee River, south of Canberra.' Brian wrote a letter to the Prime Minister and got me to sign it, wrote a letter to the *Canberra Times*, got me to sign it,

and they had a bit of an Engineering Heritage conference about it and the ACT Government was in charge by then. The bridge at Tharwa had been Public Works, then it had been Commonwealth Public Works, it had been looked after by the DMR, and eventually was being looked after by the ACT Government. It was closed on advice from DMR engineers. They called tenders for a replacement single-lane bridge in pre-stressed concrete but the locals didn't want that, they wanted to retain their old bridge.

1:33 The local guy, he told me that he didn't have the technical back-up but when he met Brian, when Brian went to see him, he said, 'We can win this,' and they did. They turned the ACT Government around and they decided that they would stick with the heritage bridge and they spent a lot of money to do that, but as it has turned out it has come up very well. The bridge at Tharwa was adapted , as done at Dunmore too, and Hinton – there were four things they did to improve the strength from the 16-ton live load that it had been designed for, even before there were semi-trailers, to be able to carry a semi-trailer loaded, which is about forty-four and a half tons. They put a steel plate inside of the bottom chords, full length, to take the tension force, replaced the timber cross-girders with steel box section cross-girders, painted them to look like timber. They replaced the four layers of timber deck and the three interfaces of timber, which can always be the places where water will collect with what they call Stresslam, stress-laminated timber deck, which consists of little timber laminations, about an inch wide at the top and eight inches deep, placed side-by-side, stressed sideways and re-stressed sideways, and then re-stressed again sideways to take all the creep out. The final thing they did was to replace the railings, the timber ordnance fencing, with steel look-alike railing.

*So this is sort of a mock bridge, is it, a sort of a mixture?*

**Ray:** Well no, it is what the Heritage people have accepted as being a heritage-sensitive way of retaining these old bridges but still leaving them useful and adequate to take current day loads.

## CD 1 TRACK 4

*Now, I want to start talking about timber truss bridges now, there are quite a few types and many designs, and so on. So how did they come into being, timber truss bridges, and what gave rise to their construction?*

15:00 **Ray:** Well, in the early days, of course, in the colony the main transport was by water craft and even produce from Hawkesbury, from Windsor, would use the Hawkesbury to come down and out to Broken Bay, and down the coast and up the harbour into Sydney, that is how they'd transport their produce, both grain and livestock. Then the railways came in and there was a government decree through that early to middle part of the 1800s that any steel for bridges had to be used for railway bridges because steel had to be imported and it was very expensive, so the local bridges had to use local materials, and that was a combination of either stone or timber. Thomas Mitchell, when he was appointed Surveyor-General in 1826, he was also appointed Surveyor for Roads and Bridges in 1827. In 1833, I think, he was in Macquarie Street and he saw this stonemason building a wall and he thought what he was doing was pretty good, so he approached him and found out that he was free settler, not a convict; he'd worked on masonry bridges in England. His name was David Lennox and he appointed him Superintendent of Bridges in the colony, so Lennox, of course, is famous for the stone bridges he built.

1:40 But then they used to build timber bridges, they'd put timber logs side-by-side with some earth over them as a covering and to get extra span out of them they'd put a brace from the mid-span, or about the third span, down to a block on the face of an abutment, or a pier wall to support the load, to get extra span length out of them. Then they wanted to get longer spans and the rivers, of course, had to be crossed, there were gold rushes on in the 1850s and 1860s and that gave rise to the need to get access over rivers, the bigger rivers. There was the produce that came out of the Hunter Valley, the Australian Agricultural Company were building a whole lot of bridges to get their produce over the Paterson and Hunter rivers into Morpeth to bring it by boat, once again to Sydney. The first guy who was involved in the truss bridges, he used an Italian form of truss that was developed in about the

sixteenth century, that is what we now call the Old Public Works Truss, that was William Bennett. That's how the trusses came into being.

*Now Brian, have you got something to add to that?*

2:55 **Brian:** Well, Bennett produced these basic trusses for about ten years or so and they became known as the Old Public Works Truss, Old PWD. They were a very simple design with solid timber in the top chord, and by the way, the top chord is a technical name for the horizontal member at the top of the truss, and the horizontal member at the bottom of the truss is known as the bottom chord. Top chord is in compression and the bottom chord is in tension - that means the truss is stressed out by the load on it, and the top chord is compressed by the load on it. So these top chord members that Bennett used in his Old Public Works design were solid timber and the bottom chord was, I think, in three sections, three flitches. That was all right for the time being because timber was plentiful, as Ray said, but it gradually became less plentiful because of other uses. Besides bridges it was used for wharves, the hardwood timber of the North Coast was very good for wharves, and the Turpentine type of hardwood was excellent for pilings, so Turpentine was used in piling for bridges and wharves.

4:29 Ironbark was the main timber preferred by Bennett for the main chords of the bridge because it was the strongest timber known, and that was verified subsequently by tests at Sydney University undertaken by the first Professor of Civil Engineering (W H Warren). That information was badly needed by the designers so that they could, subsequent to Bennett, modify the designs using less timber and carrying higher loads all because of this research work that was undertaken on our hardwood timbers.

## CD 1 TRACK 5

*Now we are talking 1859, aren't we, and Bennett was Commissioner of Roads, wasn't he?*

0:06 **Brian:** He was the Commissioner of Roads and also responsible in that position for bridges on the road works. As I mentioned, there was a great need to build bridges because of this invasion of the population, or movement of the population from the cities into the country, looking for gold. Gold had been discovered, in I think about 1851, which was a very important year in the history of New South Wales.

*So how many bridges were actually built in New South Wales?*
Well, the total number of timber truss bridges is four hundred and seven.

**Ray:** But the Old PWD bridges is one hundred and forty-seven, the Old PWD bridges, they were between 1861 and 1886.

*Now that is the very boxy-looking design, isn't it, that Old PWD?*
Yes, it is fairly flat along the bottom chord and then it rises.

1:08 **Brian:** It was over-designed, mainly due to the fact that the designer didn't know exactly how strong his timbers were. He knew they were strong, but when the research work was undertaken they were proved to be very strong indeed, better than any other hardwood timbers in the world.

*What sort of testing mechanism would they have used in those days?*
1:31 **Ray:** Testing wasn't done until 1880, in to the 1890s, it was done by Professor Warren at Sydney University, so the testing was done in conjunction with Allan's truss designs. Before Warren there was John McDonald - he improved on the Old Public Works Truss and the truss that was named after him was an improvement, but it still used big section members in the top chord in the period 1884 to 1894, over ten years, there were ninety-one of his trusses built. What were the features of the McDonald Truss, Brian?

2:07 **Brian:** Well, the main feature, I think, was that he eliminated the double member that occurred in the top chord of the Old PWD Truss and he split the end sloping member, known as the Principal, into two pieces. He also introduced metal hangers for the tension components and all these adjustments, improvements, lightened the truss and allowed it to carry a heavier load too. It uses less timber in

effect, but it was still a relatively crude truss, compared to the Allan design, which followed.

*Was McDonald's design able to carry greater loads than the previous Bennett design, the Old Public Works design?*

**Brian:** It would have been able to carry greater loads, but its design loading, that is the loading that it was to carry as a live load, a moving load, was still the same, though the dead load of the truss was lighter, was less. That is the weight of the truss itself.

*Now I believe that the John McDonald design also used more metal and used composite construction materials, is that right?*

3:37 **Brian:** Well, he actually designed a bridge at Cowra that had a span of actually a hundred and sixty feet and it had a metal bottom chord.

**Ray:** That was Allan, wasn't it?

**Brian:** No, McDonald designed the Cowra bridge. Allan designed a bridge of similar span to go over the Macleay River at Kempsey, that is about a hundred and sixty feet. Both these bridges have gone now, but McDonald did use a metal bottom chord occasionally, Allan never did, and he has been criticised for not carrying on with the McDonald idea because the bottom chord, being the tension was pretty highly loaded in any truss. But I think the reason why he didn't change was that he was quite happy continuing with the hardwood material and that satisfied his design requirements.

## CD 1 TRACK 6

*Now the next bridge designer was Percy Allan, wasn't it? Tell me a bit about him, what was his position?*

0:08 **Ray:** Well, he was a third-generation Australian and both his father and his father's father had worked for the government, not in Engineering but in administrative areas, and when Percy told his father he wanted to do Engineering his father wasn't very happy, he wanted him to work as a labourer, I think. Anyway,

Percy could, or had to say that at least he got a job where he could design things for labourers to build to satisfy his father. He was a brilliant man, had brilliant insights to what he saw. He had been involved in maintaining the old bridges, the Old Public Work Trusses and the McDonald Trusses, so he knew a bit about where the flaws were because they were starting to deteriorate. He had been working with this Professor Warren at Sydney Uni about the strength of the timbers and so he had that information. He had a bit more, I guess, mathematical ability to be able to calculate the forces in the trusses and so what he did, he produced a design that lasted much longer than they should have. In fact, a number of his designs were actually used to replace worn-out Old Public Works or McDonald trusses, particularly Old Public Works Trusses. They wanted to re-use the old stone piers that they had, or the cast iron cylinder piers that they had (for the older truss bridges) , so they made them the same span, which was roughly modules of tens of feet, seventy, eighty, ninety, a hundred feet spans, and he did a fair bit of improvement to the design. All his members were assembled from relatively smaller bits of timber, spliced at regular intervals on top of bottom chords and paralleled in pairs, so there were twin members, not single members.

*He used the American Howe Truss design, didn't he? Does anyone know anything about that?*

2:18 **Brian:** That is reported, that he did, but I don't think the Americans influenced him very much. I think he was just basically a brilliant designer, a natural designer. What he did in the advancement of the design of the trusses was amazing. Each truss had duplicate members, so the members themselves were lighter, which meant that there was a considerable saving in timber and you didn't need such a large tree to get members cut out of it because they were smaller in size. These members could be replaced under traffic; the bridge didn't have to be closed to traffic. Of course, traffic was pretty light in those days, you wouldn't be able to replace one of the members now, where the traffic is very heavy on the bridge, you'd have to put up Bailey bridging, for instance, to support the truss while you took it to bits to replace whatever was needed.

## CD 1 TRACK 7

*Now the joints - there was a problem with those bridges, wasn't there, with water collecting in the joints, tell me a bit about that.*

0:08 **Brian:** Well, Allan got over that to a large extent by developing what we call shoes, which were cast iron metal components so that the end faces of the members could bear in to these shoe components and that largely protected that area from water penetration; not completely, of course. That also put a high stress on the shoes, so a lot of the shoes failed over the years and these shoes now are being made, not from cast iron, but from spheroidal graphite iron, which has a much higher tensile strength and gives a very good-looking shoe, similar to the originals, in preference to building the shoe out of welded mild steel components, which doesn't give as good an appearance as the original, or the spheroidal graphite cast iron.

*Was the Allan Truss bridge capable of carrying a larger load than the previous bridges?*

1:20 **Ray:** Probably not, because it was designed for the same design load but it just used lighter section members, so it has lasted longer as well because of the innovations of what he has done to stop the water traps developing and by putting access in to get at the water and remove it, if it gets there.

*I have got some notes here that say that that particular kind of bridge, the Allan bridge, was able to carry fifty per cent more load than its predecessors. Is that not correct?*

2:02 **Brian:** Well, as I said, it was still designed to the earlier live load design and the dead load component of the total load would have been a bit lighter. It is probable that the ultimate carrying capacity of the bridge was greater than the earlier designs for the same span. Would you agree, Ray?

**Ray:** Yes.

*What's the difference between a dead load and a live load?*

2:38 **Ray:** The self-weight of the bridge is the dead load, including anything you put on it, like a deck, but the live load is the traffic that goes across.

*That's what I thought. Apparently, with the Allan Truss bridge it took less time to replace an affected member, would that be right?*

**Ray:** That's right. That's because of these half widths, the use of two half members side-by-side, so that if one member was affected you could pull it out, but you didn't have to dismantle the truss because the other half member would keep holding it up. Even, as Brian said, in those days you could even take some minor live load across the bridge, which was an improvement on the previous truss types.

*Now the Allan truss bridges - what was their time frame? When were they starting to be built and when did they stop building those?*

3:31 **Ray:** 1890 through to 1927 and a hundred and five of them were built in that period. I suppose the main go was about 1890 to 1910. I guess during the war they didn't build many and then they started again after the war. But by then De Burgh and Dare had made their contributions as well.

## CD 1 TRACK 8

*Brian, tell me a little bit about De Burgh, who was he and what his contribution to timber truss bridges?*

0:05 **Brian:** Well, he was an Irishman. Irishmen make good engineers, actually, from my experience. We had quite a few on our staff when I was there and they were excellent engineers, practical types. But in their own country, if you meet an Irishman and you ask him which way is such and such it takes him half an hour to tell you. He was a MICE, which is an English grade, it means Membership of the Institute of Civil Engineers. Actually, that was awarded to Allan, although Allan had no professional qualifications, as I mentioned. He was awarded that because of his brilliant design work, nevertheless.

0:58 De Burgh came out and joined the Public Works as a bridge designer and became Head of the Bridge Design Group, so he was Chief Bridge Engineer in effect. But he only produced his bridge designs for about a decade or so, that was the 1900s decade.

**Ray:** 1900 to 1905.

1:27 **Brian:** Then he went into, I think, dam design, water supply design. He even designed, or looked at the water supply necessary to keep Canberra, or get Canberra going.

*What was the basis of his design? What design principles did he employ?*

**Brian:** It was a different type of truss altogether. Instead of having the sloping end principals it had verticals at the end and it looked in effect like a rectangle in elevation with vertical members of timber and diagonal members of metal rods.

**Ray:** The bottom chord...

2:16 **Brian:** The bottom chord was metal. It was a copy of an American design in effect and I do think that that is correct, that he did look to American influence, but he also designed a similar truss, or a truss of similar span, to the maximum spans that McDonald and Allan had achieved - around about a hundred and sixty feet. These trusses of a hundred and sixty feet were in the De Burgh Bridge over the Lane Cover River, which was named after him, doesn't exist now.

**Ray:** Got burnt in a bush fire.

*Were they?*

**Brian:** Yes.

*I believe they used steel pins to keep things together.*

3:04 **Ray:** I understand why he would want to. Mind you, in my view he would be trying to be pure with his design, but it turned out that those pins were one of the problems with the truss, that they tended to rust up and not work as efficiently as he had hoped. I think that is why they didn't proceed with it. But he went on to become the head, as Brian said, of the Water Board and he was a brilliant man.

*So his bridges only lasted a six-year period?*

3:36 **Ray:** Yes, a six-year period, but some of them are still standing. I mean there is one down at Goulburn we just saw the other day, Landsborough Bridge, it is a De Burgh Truss.

*So are they solid, those bridges?*

**Ray:** Yes.

*Even notwithstanding the problems with the steel pins, you mean?*

**Ray:** Yes, notwithstanding those problems on minor roads, probably not on major roads. The bridge at Tabulam is a De Burgh Truss, isn't it?

**Brian:** Yes, that's the five trusses from memory, I think, Tabulam Bridge. At the moment that is the largest of the timber truss bridges still in existence. The largest Allan Truss is the one at Tharwa that we were associated with, that is in the ACT. But De Burgh's Tabulam Bridge is designed (determined) to go, eventually.

**Ray:** It is not going to be part of the new strategy.

## CD 1 TRACK 9

*Now what can you tell me about the next design to come along, the Dare design? Who was Dare?*

0:04 **Ray:** Well, Dare was a brilliant mathematician (and a contemporary of Bradfield, one of the early graduates from the University of Sydney). In fact his original job title was as Computer, as a person he was a computer. He got out of that mould and eventually became Head of the Water Conservation and Irrigation Commission after about a ten or twenty-year period, working on bridges. All he did was to improve on the Allan Truss by putting steel members in the bottom chords. What else did he do, Brian?

0:38 **Brian:** Well, as you mentioned he was a brilliant designer, I think one of his most brilliant designs was the lift span with the rolling weight, which rolled down the back of the lift span frame to balance the lift span as it went up and down. Its initial position would be up on top of the tower and then the lift span in that position would be carrying traffic. Then as the weight rolled down it lifted the lift span, so that vessels could pass underneath. He had to do quite a detailed calculation to get the right profile for the rolling action so it was balanced all the time. Credit wasn't given to Dare as being a Chief of Bridge Design in the first of the manuals produced by the DMR, that was *Manual Number Six,* which was entitled 'Bridge Maintenance'

and that was produced for the use, mainly of foremen and local government councils for the maintenance of the timber truss bridges. In the back of that book the work of Bennett's Old Public Works design, McDonald's design, Allan's design and De Burgh's designs were described in detail and methods of repair of different members of these trusses was also described so that the foremen who were undertaking repairs could follow those methods, but Dare wasn't mentioned.

*His is one of the most successful designs, I believe, of truss bridges. I wonder why they overlooked him?*

2:22 **Brian:** Well, I've got my own views on that. He did design and had built something like forty-four truss bridges, which is quite a large number for one designer.

**Ray:** But that was in the period 1906 to 1936, so maybe he was a bit late for that manual.

**Brian:** That manual was produced in 1962.

**Ray:** Well, okay.

**Brian:** I think that because Dare took the Allan design and modified it in a minimum sort of way, that is mainly by using metal bottom chords instead of timber, and Allan was still in existence as the Engineer-in-Chief of Public Works then, I think in effect Allan kept his eye on Dare and said, 'Well, you're still using my design, so you don't merit a separate design for yourself.'

*Well, he has been overlooked by history. He eliminated those pins, didn't he, that De Burgh used?*

**Ray:** Yes, he used the Allan shoes and plates.

**Brian:** In effect, the De Burgh design was a completely different design to the McDonald/Allan/Dare group of trusses.

3:44 **Ray:** Actually, speaking about lift spans - this is completely irrelevant - but down on the Murrumbidgee River, there used to be lift spans on the Murrumbidgee to allow the boats to get through and the three lower towns on the Murrumbidgee, Balranald, Hay and Darlington Point - at Darlington Point there is one of these spans

with the bascule rollers that Brian spoke about; at Hay there was a swing span and at Balranald there was a lift span, so they are all pretty individual bridge designs, those.

*There are also a few of those lift span bridges along the Murray River, aren't there, near Robinvale and so on.*

**Ray:** At Mildura, the Mildura Bridge was replaced in the 1980s but they have just built a new marina upstream of the replacement bridge and they have pulled out of storage the old lift span of the old bridge and put it in as decoration, on a token bridge that they have built as an access to the marina.

*What was the survival rate of the Harvey Dare bridges - was it better than its predecessors, because there are more of them still in existence, aren't there?*

5:03 **Brian:** I would think it would have been better because the metal bottom chord would have saved it to a large extent, although the general mechanism of failure, I think, is mainly through the cross girders.

**Ray:** Yes, the weak point in all of the trusses were the cross girders, where the girders would sit on the trusses and transfer the load from the deck through the stringers and planks to the cross girders, and then on to the trusses, that is where they tended to fail, because of the heavier modern axle loads.

## CD 1 TRACK 10

*How long would it have taken to construct one of those Dare bridges, do you think, in those days?*

0:05 **Brian:** Quite often the contract was executed in about twelve months. If the bridge is single or double truss, that is two spans of truss, or one span of truss, the contractor would get the bridge built in about twelve months. Quite often the whole family, his family, would be engaged in the construction with minimum equipment, and yet they managed to put the trusses together using hardwood that hadn't been seasoned. As soon as it was cut down it was cut to shape and put in to the truss where it fitted and the truss was handled and landed into its position on the piers and the bridge was finished in twelve months. In fact, I was mentioning to Ray that there are three major bridges that have been recently reconstructed up in the

Hunter Valley area. The first one was built at Morpeth in 1898 and it comprised three truss spans of 110-foot span trusses. The second one was over the Dunmore Bridge over the Paterson River, which was built in 1899 and it had three 100-foot trusses, plus a lift span. The third one was the Hinton Bridge over the Paterson River, built in 1901, it had two timber truss spans of 90 feet, plus a lift span. These bridges had approach spans too, just simple beam spans. One contractor built those three bridges in that period of five years, he was successful with each tender and he happened to be in the area at the time, but that was amazing because they are major bridges. Morpeth Museum has details of this contractor, that is where I read the details with great interest because that, in effect, supports my view that the trusses were built very quickly, particularly as the designs were improved with the years by the different designers, they became easier to build.

*Now they were single lane bridges, most of them, weren't they? You couldn't have two cars passing each other. Was there no way they could have made them a little bit wider?*

**Brian:** That's a point of discussion at the moment. Ray is very keen that should happen.

3:00 **Ray:** The vehicles of the day - they were probably just for cattle. Cobb and Co coaches came along occasionally, or the wagons that they'd cart wool on to railheads, or riverheads, in the older days. It is interesting that one of the guys who was working for Public Works had been calling for many years to make the tyres, the wheels, wider on these wagons because they damaged not bridges, but the roads. The wheels were thin - wheels with steel around them were just biting into the roads and chewed them up.

*Some of those bridges, I've seen some along the Murray River, they carried railway carriages and locomotives. The one near Robinvale did.*

**Ray:** But that would have been the steel one, wouldn't it?

*No, its timber. So the technology might have been there to make them a bit wider, do you think, because a locomotive...*

4:10 **Ray:** You could always make them wider. In fact, that is what Brian was saying, the crew at Dunmore Bridge are now going to move to Clarence Town and

Clarence Town is one of only two of the original PWD Trusses that are still going in New South Wales, the other is up at Monkerai. My proposal for there, although no one listened to me...

**Brian:** I did.

**Ray:** .... is that why not make the trusses wider, make them further apart to make the deck wider? The council that is responsible for Clarence Town is proposing to build a housing estate on the side, away from the town, across the river, why not just make the trusses wider, make the trusses further apart, make the cross girders wider and go for two lanes of traffic? It is easily done. I did some sums on it, actually, yesterday and it is a relatively minor increase in the sizing that has got to be done to make that sort of thing work.

5:18 **Brian:** I want to follow up Ray's comments. The main reason why they are single lanes is there was very little traffic when they were designed, so a single lane would carry all the traffic without any hold ups at all. But of course, the traffic situation today has just completely changed, there is an enormous amount of traffic on these roads that carried very little in the times the bridges were built.

5:46 The other point: all of these bridges were built square to the river crossing and the road approaches followed the line of the river and they had to do a sort of dog-leg turn to get over the bridge, to get on the other side. Well, that doesn't suit modern traffic and that is another reason why these bridges have disappeared.

## CD 1 TRACK 11

*Were there many accidents on those bridges? Did they collapse, or did people fall off them, or vehicles?*

0:07 **Brian:** They collapsed under heavy loads, abnormal loads. It was the practice to put load limits on the bridges rather than try and strengthen them, although that practice has stopped now, really.

*So what was the load limit, design limit, for those bridges when they were built, how many tons could they carry?*

**Brian:** They were designed for the sixteen-ton farm tractor but they could carry a lot more than that. As deterioration occurred in the timber, that reduced their capacity to carry live loads, moving loads, and load limit signs were erected. The bridges were inspected and bored, the members were bored so that any piping in the beams could be determined and from the loss of timber the reduced load carrying capacity could be calculated and a load limit applied to the bridge. But the locals, particularly in farming areas, didn't like load limits on bridges and they just carried on putting very heavy loads over them and a lot of the bridges collapsed. Some were wilfully destroyed by fire, because if you destroyed your bridge you had a chance of getting a much better one in place of it.

*Let's talk a bit about the heritage aspects of these bridges, twenty-nine bridges are still on the State Heritage Register. Can you talk a bit about that?*

1:45 **Brian:** Well, a bridge to be put on the Register has to be a very important structure historically and some of the bridges didn't warrant that sort of classification at all. Once it got on the Register it was the legal requirement of the owner of the bridge to maintain it. That puts a great strain on local government finances if the bridge is the responsibility of the local government authority and not the road authority of the State. There are good and bad reasons for going on, or not going on the State Register.

*So why are these bridges so significant from a heritage point of view?*

2:40 **Brian:** Well, they are unique to New South Wales, they are not a type of bridge that is found around the world. They are unique in that the designs are unique from Allan onwards, and the hardwood timber, as I mentioned earlier, is the strongest hardwood timber in the world, so for that reason the designs were developed and improved by the different designers. They became tourist attractions, quite often you'll find that near a bridge there is a picnic area and the tourists can picnic and examine the bridge. There was a scheme started by the RTA for putting a classification sign against these heritage bridges so that people would understand that they are very important bridges historically.

3:48 **Ray:** Actually, when we were doing Tharwa it was said, and we agreed with this, that there is more Australian heritage in the Allan Trusses, or any of the trusses, but particularly the Allan Trusses, than in the Harbour Bridge, in that the Harbour Bridge was a copy of an overseas design. I mean, it was a design that was used around the world, but it was a copy of an overseas design and so that is one that is shared heritage. But the Allan Trusses used local materials, local designers, local construction methods and it is really unique, not just to Australia, but it is unique to New South Wales, like the stump-jump plough and the Hills Hoist.

## CD 1 TRACK 12

*What is their place in Australia as far as significant features in the landscape are concerned?*

0:07 **Ray:** Well, I think generally they stand out in the landscape because they sit above the crossing. At the moment we tend to paint them white, which makes them stand out, white for the timber and black for the steel bits, the steel joining bits. I think it gives a feeling of great pleasure, to see an old timber truss bridge.

0:37 **Brian:** Ray is correct in that the main significance is the fact that they stand above the deck level. That was not so with the De Burgh Bridge across the Lane Cove River, which was an underslung structure, so that the deck was sitting on top of the trusses. Also at Pyrmont numerous Allan Trusses support that bridge, but all the public notice, because the Allan Trusses are underneath the deck, supporting the deck, the public only notices the swing span. All the other bridges scattered around the State, the truss bridges, have their trusses above the deck and that is why they are so prominent, particularly when they are painted white and that should be the standard colour for all of them.

*So there are no similar structures elsewhere, timber truss bridges, in other countries?*

1:35 **Ray:** There are, but they are not road bridges. They have timber truss bridges for railways in America, probably some road bridges, but not to the same extent as in

Australia through that period they were being built, through the late 1800s or 1850s through to the early 1900s.

1:53 **Brian:** American timbers were not as durable as the Australian timbers. The trusses that are still there generally have roofs over them for snow dispersal.

*You said that they were designed to carry a sixteen-ton tractor - now the current excess limit is forty-two and a half tons on these bridges, so were they able to withstand a lot more than their design load?*

**Ray:** Yes, that's right, but that would shorten their life by taking those loads. In fact, Tharwa was subject to sixty-ton loads during the period when a lot of the development work was going on to build in Canberra through the 1960s and 1970s. They used to haul sand out of a sandpit and take it across the bridge and there were trucks that have what they call cheater boards, which then allows a heavier load to be put on the truck, just little side boards they put on the side of the truck tray, that is what they used at Tharwa to take probably up to sixty ton loads over that.

*Now can these bridges be upgraded to carry heavier loads than forty-two and a half tons?*

3:15 **Ray:** Well, I reckon that they can be. At the moment they are going from forty-two and a half to forty-five and a half and the RTA says that is not possible. It seems to me that it is only a minor increase in some of the sizing of some of the members to achieve forty-five and half tons, that wouldn't be a problem.

**Brian:** I'd agree with Ray on that point.

**Ray:** To carry a B-Double: B-Double lengths is around about sixty or seventy feet, I think, they can get on one span, say a ninety foot span, but even then you could still do it, you could still increase the member sizes. The four things you do, the steel plate along the bottom chord, the cross girders, the Stresslam deck wouldn't change and the barriers wouldn't change, it would just be the thickness of the steel plate on the inside of the bottom chords and the size of the replacement for the cross girder.

*Now for those timber bridges that haven't been upgraded, what is the effect on them of the modern loadings of, say, an average B-Double going over it? Would it be able to withstand that?*

4:29 **Ray:** The one at Tharwa would and I think that is why a number of the bridges in the country survive, because they're either not on B-Double routes at all, or they only get an occasional semi-trailer that weighs forty-five and half a tons, or forty-two and a half tons over them and those intermittent loads mean that they are mainly used to carry lighter vehicles and the heavier vehicle it can handle. To have a B-Double on, say, the Hume Highway where you are getting repetitions of loads you would start doing some severe damage pretty quickly.

## CD 1 TRACK 13

*How do timber bridges restrict the road network in other ways? Do they form bottlenecks somehow, or what happens?*

0:08 **Ray:** Well, if there is bracing - occasionally timber bridges will have bracing across the top chords, that would be a height limitation. The width is a problem because of the fact that they were built narrower, and as Brian said, the alignment is such that generally they were built square to the stream and these days with bridges you try and have a curved bridge and then you will make the bend on the end of bridge less acute than it is for those sort of bridges.

*How did those bridges withstand the effects of floods, fires and other natural disasters?*

0:48 **Brian:** Oh, not very well, fires in particular. If a bush fire is occurring in the area of the bridge and reaches the bridge, the bridge will go up, whereas a concrete or steel bridge will have better natural protection. Floods: well, all of these timber truss bridges were built to be above known flood level, so the deck was above the natural known flood, but to achieve that they had to be on high timber trestle piers. Of course, a timber trestle pier doesn't withstand flood forces very well, it tends to get washed out, or to collect debris, and again, when the debris builds up the force against the pier is very high and so a lot of bridges were lost that way, not due to the flood overtopping the deck, but due to the flood washing out the piers and then the bridge comes down.

1:58 **Ray:** In fact, at Tharwa in the 1930s they must have been concerned about the piers because there were actually timber trestle piers about twenty metres high and they replaced those piers with a reinforced concrete pier. To do that they had to cast the concrete around, or within, the timber of the pier so that the wall of the pier was only a foot thick. It goes up, but then there are buttresses either side to provide the stability back and forth. That was in the 1930s. I think at that stage they must have thought that Tharwa was going to be a much more used bridge because subsequently they increased the size, the width, and replaced the approach spans, the timber approach spans, with reinforced concrete piers, steel girders and a reinforced concrete deck as well, but it never eventuated.

*How deep would the pilings be embedded in the river, let's say to carry those piers - how many feet would they go down?*

3:06 **Ray:** It depends on the foundations but at Tharwa they went down about twenty feet. That was a problem for us at Tharwa because we couldn't be sure that the timber piles were going to be good enough to withstand another hundred years, as we hoped the rest of the superstructure would last. In the end we decided it was worthwhile to spend an extra few million to put what we called micro-piles of seventy-five millimetres diameter, seven inches diameter, with a steel rod down the middle. Just put them in around the perimeter of the pile cap and connect them to the pile cap to take the load, so that the timber piles wouldn't be overloaded. Even though we were pretty sure that the timber piles were okay, but the engineering investigation to confirm that they were all okay would cost you more than the replacement of the piles.

## CD 1 TRACK 14

*Are some of those piles still standing after, say, a hundred and fifty odd years, because most of them were built before the turn of the twentieth century?*

0:10 **Ray:** A lot of the piers are either in cast iron or masonry. Now the timber trestle piers that Brian was talking about before, as I say, the one at Tharwa was replaced in concrete. The timber trestle piers at another big bridge over the Manning at Killawarra, it has now been pulled down, but it was one of the problems of that

bridge. The cast iron cylinders (we are getting a bit of a problem now with a phenomenon called graphitisation) in the sense that they try and re-use the cast iron cylinders. In fact, there are two bridges near Goulburn that were built on masonry piers which were then re-used to put Allan Truss...Old PWD Trusses were on them originally and they were re-used to put Allan Trusses on and added on the same piers. So those sorts of piers are very stable.

*Now let's talk a bit about the timber again that was used, you have already mentioned Ironbark was probably the best material - did they use any other timbers as well, was Turpentine used, and so on?*

1:23 **Ray:** Turpentine was used for piling because of its resistance to Teredo. In Queensland Turpentine is known as Satinay, which is the same timber, but with a different name.

**Brian:** Blackbutt was used and Tallowwood, Brushbox, and these (other species) are becoming more common now because the Ironbark for replacement is very scarce indeed. In fact, the only good Ironbark timbers are located in inaccessible valleys and the cost of getting them out would be enormous, so the road authority has now to accept other timbers than Ironbark. Ironbark is rated, and the stress rating is F27, which is a very high rating - that means that its maximum allowable design load is about 27MPa. Then these other timbers are a bit lower than that, F22 or so. Quite often the Road Authority has to accept slightly poorer quality timber to keep the repairs going, rather than to wait until the Forestry people obtain the better quality material and the time factor there would have been unknown, so it is better to carry on and make sure that the timber is properly seasoned before it goes in to the bridge.

*Now, Professor Warren, whom you have already mentioned, started his scientific testing in 1890. How scientific would it have been in those days?*

**3:13 Ray:** His machine is probably still there at Sydney Uni.

**Brian:** It is still there, yes. Well, Sydney Uni is somewhat unique with its Professors of Civil Engineering - it had three professors in ninety-nine years. Warren was the first, I studied under the second, William Miller, who was a dour Scotsman, and Ray studied under the third, (John Roderick), so three in ninety-nine years.

*So you could still use that same technique to test with?*

**Ray:** Yes, because that little sample of timber, they just measured the compression strength, then they pulled it apart, measured the tensile strength and other aspects of the characteristics of the timber, that would be the main thing for design purposes.

4:06 **Brian:** Another matter that they tested also, particularly for Allan, he was a bit concerned about the use of splices. That is, you join two lengths of timber together and you have to make sure that that joint is as strong as the timber it is joining. He had no way of doing that, he could do it theoretically from the information he had, but he wasn't convinced that that was correct, so Warren helped him out by doing a heck of lot of work on strength of splices. That meant that instead of being one continuous piece of timber he could splice two pieces together and so on, to get whatever length he wanted.

## CD 1 TRACK 15

*None of these guys ever went to America and looked at the way they did it over there, or to England, did they? How would they have got the knowledge to do all those things?*

0:09 **Brian:** Well, they wouldn't go there because the only way to get there would have been by sailing boat and steamships going up the river. There were no aeroplanes to take them over and back quickly, so they couldn't leave their posts for six months at a time.

*So it was all innovation?*

**Ray:** Bennett had been to South America and New Zealand on his way to Australia. I don't know where he picked up his information about the Italian trusses, probably back in England anyway. Actually, it turned out that the timber that had been bought for the Tharwa Bridge was being stored in a big shed in Wagga and it wasn't being kept at the correct relative humidity and it started to show some checks, which are like shrinkage cracks in timber. The other guy who was on the Peer Review Group with us, a fellow called Gary Barker from Duntroon, he knew a professor of Timber

Engineering in Western Australia whom they brought in. He suggested some ways to actually improve the timber - by changing the humidity he actually reduced the size of the checks to make it more durable in the job. In fact, the RTA have now changed their specifications to incorporate this process for their timber storage.

*So was shrinkage a big problem in these bridges?*

1:50 **Brian:** In the early bridges when they were first constructed green timber went in to achieve the twelve-month construction period, or thereabouts. Allan had incorporated in his design provision for shrinkage to be taken up, so it didn't worry them. These days in the repair of the bridges of course, shrinkage would be a big factor, so the timber that goes in has to be of a proper moisture content, which is round about twelve per cent, whereas it is much higher when it is green.

*Now there was obviously lots of timber in those days to build these bridges. As you said, there was Ironbark and all kinds of woods. What about now, having regard to the logging of old-growth forests and the questions about that, is there a question mark now over the supply of suitable timber for maintenance of these bridges?*

2:51 **Ray:** Well, as long as it is planned. I think the railways have led the way on this rather than the Main Roads, but they have arrangements with sawmills around the North Coast and they've actually got trees picked out that they will use, even for sleepers, or for bridges, bridge repairs, and the RMS is starting to do that now as well. They negotiate with the local loggers and they will go into the bush with them and pick out a tree and say, 'We'll use that one,' or 'those ones', and with planning I think it can be achieved, but it's not something you can just buy off the shelf.

END OF DISC No. 1

**START OF DISC No. 2**

(Duration 47:49)

## CD 2 TRACK 1

0:00 Disc identification.

*Okay, we'll get onto the subject of maintenance of the existing bridges. What are some of the issues relating to maintenance and conservation of these bridges?*

0:17 **Ray:** There are three things about water (and truss bridges): keep them dry, don't let them get wet and keep moisture away from them, well, that is what we used to tell the bridge guys. Termites are a problem and that can be a problem in any sort of timber bridge or culvert, any timber that is around and available is susceptible to termites. Dry rot can be another problem; it doesn't happen very often. Quite often a lot of the timber that came out of Tharwa and even the timber that is coming out of Dunmore will be sound enough to be re-used. Generally the timber members in the truss bridges tend to deteriorate down near the shoes, at the ends, so you can't use the full length, but you can use about seventy or eighty per cent of the length. We did try for a while to use epoxy resins to try to build up the ends of the existing members but it proved to be impractical, but that is one of the ideas we had back then.

1:26 **Brian:** Bridges have to inspected every twelve months, normally it is just a visual inspection and there is a very careful slow walk-by, every component has to be looked at and no physical work other than a visual inspection is required. But after twelve months, I think at three-yearly intervals, the bridges are supposed to be bored, that is at roughly twelve millimetres, or a half inch (size borehole), a borehole is put through a member at different spots and these spots are nominated in the

(inspection) forms. If any deterioration inside is found, such as rot, or cavities of any sort, then further boring is taken and if necessary the member is replaced. So these boring inspections are carried out at about two or three year intervals.

*Now maintenance of these bridges would require quite a bit of money, wouldn't it? What is the funding situation like for these heritage bridges?*

2:40 **Brian:** It has never been any good. It is illustrated now by the fact that the RTA has about four dozen bridges left and is planning to retain indefinitely only about half that number because of the funds position. They are costing proportionately too much to maintain, compared with concrete and steel bridges. Steel bridges have to be repainted periodically and the new painting regulations require that the red lead be collected, which is a very expensive operation – nevertheless, once they are repainted they carry on indefinitely, whereas the timber bridges, of course, have limited lives.

## CD 2 TRACK 2

*Ray, can you describe a typical maintenance pattern of these bridges? What would be required?*

0:07 **Ray:** It is all about inspection rather than maintenance. Inspecting regularly and acting on the results of the inspection. You pick up defective members and then you can plan how defective they are, what period you expect them to last for, and then you can organise a crew to come in to do maybe a dozen different members in a long bridge, replace those members, and then you go back to inspecting again, and go to another bridge.

*Now, I am sure that the skills of a bridge carpenter are rather different from those of an ordinary carpenter. What skills do they need and what tools do they use?*

0:56 **Brian:** The timber is cut to size these days, but then once it arrives on the site it still has to be worked so it fits together, that the shoes fit. The adze was the common tool, which is like an axe with the head turned around through ninety degrees, so it is a chopping action. The skilful use of this item in the hands of an experienced man would give a straight line and is very similar in its straightness to what would occur when the member is put through a circular saw. They are very good with their tools.

Other than that, felling the trees, of course, was done with two men with a long saw, a handle at each end. These days it is done differently, it is done with a machine. Everything is done by machine, so much of the physical manual work has been eliminated by machinery that occurred a hundred years ago, that was necessary then.

2:14 **Ray:** I think the bridge carpentry is different from most carpentry in that the members are of a much bigger size, the span is much bigger and the conditions are much more..... well, a lot of them enjoy the life, the outdoor life, rather than working on a building site.

*Was there a sort of family tradition in maintaining these bridges? Would carpenters typically train their sons to do the same thing?*

2:44 **Brian:** Oh yes, that did happen and it is still happening. It was fairly common for a bridge foreman to have one of his sons working in his team. The fellow that is the main foreman now for the RMS as it is, is Foreman Walker and there were a lot of Walkers from the family working in the Walker teams.

3:08 **Ray:** His father, Pat, was originally in charge of the bridge maintenance gang, sons Larry and Bill, and Larry's son is also in the bridge maintenance gang.

*How did they develop their skills, was there any training for them? Did they go to the equivalent of a TAFE college?*

3:24 **Ray:** There is a Bridge Wharf Carpenters Apprenticeship Scheme that I think is still running. They go to TAFE and, as I say, it is a bit more robust than carpentry and joinery, but bridge carpentry is a recognised course that they do.

**Brian:** That's correct. I had a foreman, George Parsons, working for me up the North Coast and at least one of his sons was in his team. In that situation I doubt that he would have been able to get to one of the TAFE courses, although I think they existed in those days; because of isolation it is very hard for them to do it. DMR had a program going for them - put the boy through the course if he can find accommodation, then he joined the team.

*But a lot of the knowledge that these bridge carpenters had: was it through experience?*

4:30 **Brian:** They were taught by rote.

*What is the availability of the trade skills today? Are there enough bridge carpenters still to maintain the bridges that are there?*

**Brian:** I think there would be.

**Ray:** There's bridge and wharf carpenters, they need the same sort of skill.

## CD 2 TRACK 3

*Okay, we are going to get on to the Maintenance Handbook. We've talked a little bit about it already - it was produced, I believe, in 1987. Did either of you gentlemen have any part in producing that?*

0:12 **Brian:** Yes, I did that. The original Maintenance Handbook was called *Manual Number Six,* which was produced by the DMR in 1962 and it was entitled, *'Methods to be followed in the Inspection, Testing and Maintenance of Bridges, prepared for the use of Department of Main Roads Bridge Maintenance Foremen and recommended as a guide to Municipal and Shire Councils.'* I think pretty well every council not associated, or not located in the Sydney Metropolitan Area had some timber bridges to look after. So that was the first Manual. It was purely a Manual for bridge foremen and it set out the methods to be used for repairing bridges, particularly timber truss bridges. It doesn't mention the Dare Truss, it doesn't acknowledge the Dare Truss.

1:20 About three years ago I had the privilege of addressing ASHET on timber truss bridges and that was one reason why I decided that the Bridge Maintenance Manual should be revised and amplified, so the 1986, or 1987, edition, I am not sure of the year, came out. I wanted to include in it the location of all the timber truss bridges, which *Manual Number Six* didn't give. I thought we should know where they were and how many there were, and we should update that knowledge because we were losing them. I also wanted more of the history of these bridges put in to the Manual, so that was one of the main reasons why we brought out the new Manual.

2:16 I recognised Dare Trusses in that new Manual, and then subsequently I had a different view on Dare. This was brought about by a request from the RTA to decide

who should be acknowledged as the designer for the historic bridge at Echuca, which wasn't a timber truss bridge. A lady had written in and said her nephew designed the bridge, so I had a look at that. I also consulted a legal man on the definition of 'designer' and he said that the legal definition of a design is a scheme or plan conceived in the mind of man, in other words, the designer doesn't have to produce the design himself, he has got to prepare the basic proposals for the design to be considered as a designer and then the stress man goes ahead and calculates all the stresses and completes the details of the design. So this was interesting and this decided on who designed the Echuca Bridge, this legal basis, and it also gives emphasis to the people who believe that Bradfield designed the Harbour Bridge, because under this legal definition he definitely should be given credit as the designer of the Harbour Bridge and not Ralph Freeman, the English consultant, who in effect was the stress man.

3:58 So because of this I felt that Allan was Dare's designer and that *Manual Number Six* was quite correct in not giving credit to Dare as the Chief Bridge Engineer. So I was possibly wrong in giving him credit in the revised Manual of 1986 or 1987. Nevertheless, I think Dare did a wonderful job.

4:27 **Ray:** While we're talking about that, when Allan retired in 1923 they had a function for him and it was recorded in the *Herald* that Bradfield spoke, among others, and he said but for Allan's tutelage he wouldn't have been able to achieve what he'd achieved, that was a real positive thing that he said about Percy Allan. What I was saying, in the Drawing Office there would have been Percy Allan and De Burgh, with Dare and Bradfield, sitting in the corner.

## CD 2 TRACK 4

*What's entailed then, documenting procedures and practices in this handbook? How do you go about that?*

0:10 **Brian:** Well, I wanted the procedures and practice copied from *Manual Number Six*, I wanted those incorporated in the new Manual because they are still appropriate for repair operations, although a lot of machinery now replaces the

manual work specified in *Manual Number Six*, and the introduction of the Bailey bridging system, which is a war time invention enabled trusses to be supported by the Bailey bridging so that the truss itself could be removed and repaired, the whole truss could even be taken out if the Bailey is holding that side of the bridge up. That didn't exist when *Manual Number Six* was incorporated, it did exist when the 1986 Manual was brought out. I am not sure to what extent I brought the Bailey bridging into that, it's probably only a mention, because there are specific books on the Bailey system which are available openly and can be used. It is no use reproducing what is already there.

*Is that Manual used today as a teaching aid?*

1:33 **Brian**: No, it has now been replaced by a new Manual, which I think was brought out about two or three years ago, it is not widely distributed yet. It was produced by the RTA and it is a Design and Maintenance Manual, so it deals with various design operations, it deals with the upgrading of a timber truss bridge to take a forty-two and a half ton loading, which Ray has described, and it has a much greater input than the Manual I produced, naturally, because being also a Design Manual it needs a lot more material in it. It does also deal with matters not connected with timber truss bridges, such as concrete deck overlays on timber base, former timber substructures.

*Let's talk a bit about conservation of these historic bridges. What are some of the issues related to the conservation?*

2:44 **Brian:** Well, first of all now, if a bridge is going to be upgraded a Conservation Management Plan is prepared and that is a detailed document of what is proposed for improvement and how people are going to go about it and execute these operations, what are the advantages of them, what maintenance has to be undertaken in future on them, so a proper Maintenance Program has got to be included in the Plan. It took Ray and myself several months to prepare one for Tharwa Bridge and then that had to go to the various authorities for approval before any work could start on rehabilitating the bridge. That happens with all these

upgradings these days, that a CMP, Conservation Management Plan, has to be prepared before anyone strikes a blow.

## CD 2 TRACK 5

*Now I understand that many of the bridges can only be conserved if they are upgraded to the present day loadings. What does upgrading entail?*

0:09 **Ray:** Well, I described it before: the plate along the bottom chord, the steel cross girders, the Stresslam deck and the ordnance fencing barriers, and now these SG cast iron shoes. One of the difficulties with the upgrading is with the bearings. The modern Neoprene bearings, which will have steel plates inside them to give the strength, they will rock (deform). It takes less force to move them, to allow movement to occur than the old steel bearings. At Dunmore Bridge, which was the one that they have just done recently they used Neoprene bearings to reduce the horizontal forces on the piers, so that is all part of the process of improving the load capacity and minimising the design requirements.

1:10 There is one bridge, the Victoria Bridge, at Picton which has got enormous big barriers across the top of it, so only cars can get through. They are not going to upgrade that at all, they are just going to leave that there and it will be like an original. That is also a valid thing to do if you take the care to ensure that you don't let trucks get through.

*And how does the cost of maintenance and availability of funding affect the conservation of these bridges?*

1:45 **Brian:** It does affect the conservation of them in that only half of the present number will be conserved and that is a very sad situation in a way. The other half won't be upgraded to the extent that Ray has described, they will just be left to die, left to die under traffic. They won't die completely, otherwise they collapse before a new bridge is built alongside them, that's the plan. It costs less - depending on the size of the bridge - but generally speaking it costs less to replace the bridge with a new concrete bridge than to rehabilitate the bridge. That is one of the sad things

about the timber trusses because the high cost has an enormous effect on their numbers.

## CD 2 TRACK 6

*Now over about the last ten years the RTA, or the former RTA, developed a proposal in conjunction with the Heritage Council to review its portfolio of timber truss bridges and to determine a set of bridges for long-term conservation, and this has recently been approved. Can you elaborate on that?*

0:20 **Ray:** The two guys on the Heritage Committee, a Subcommittee of the Heritage Council, who were charged with doing this review actually spoke to Brian and I about it and got our ideas and included some of the ideas. I always used to try and rationalise things that obviously a truss bridge on a highway would be difficult to argue a case for, but a truss bridge on a minor road, or a back road, or the Tharwa-type road, then it may be possible to achieve some benefits by retaining the old bridge. I think you've got to use that as a background to the strategies that are developed and I think that is what has happened in case of the strategy that has been developed by the interplay between the RMS and the Heritage Council. They've agreed on a group of bridges that will be retained and have work done on them and be looked after.

*Now this was apparently only as recent as September of this year, 2012, so what does it actually propose, that strategy?*

1:41 **Ray:** Well, I think there are twenty-seven bridges, they are different types of bridges. There's the two Public Work trusses they are going to do work on and then there are about five McDonald trusses and a number of the Allan trusses and then the Dare and the De Burgh trusses. They were going to try and maintain a representative grouping of those on roads that can allow for that to happen.

*How do you balance the heritage value of the bridges and the needs of the road network?*

2:20 **Brian:** That's a curly question.

*Is there an answer to it?*

2:25 **Brian:** All of these bridges have heritage value, it is very difficult, as Ray indicated, to have a heritage value rating. It has been attempted by the RMS, the ex-RTA, it has been attempted by consultants that have been engaged by the RTA over the years to look at that problem. One consultant was engaged for the McDonald bridges that still existed and he, using various factors, gave a heritage rating listing for McDonald bridges. Then someone else was engaged for the Allan Truss bridges and a similar exercise was undertaken.

3:21 **Ray:** Actually, McMillan, Britten and Kell attempted this and they used factors like visibility, importance to community, nearness to towns, a whole lot of factors that you could use to rate and score different features of different bridges and whatever had the highest score came out on top, which was Dunmore Bridge, wasn't it?

3:50 **Brian:** Yes. Well, we did the same thing for Tharwa Bridge, we used the similar factors that were used by the consultants and we got Tharwa right up near the top of the list.

## CD 2 TRACK 7

*How do some of these communities react if you tell them that their bridge is going to go, their historic old bridge?*

0:07 **Brian:** Some cry, and some laugh and cheer. Tharwa is an example: the community were ready to declare civil war on the Canberra government if they took their bridge from them and put a concrete bridge there instead. We understand from comments made by the RMS during Heritage Committee meetings that in travelling around the countryside the RMS people met various reactions from the locals when they put to them that they were going to take their bridge from them. Some wouldn't agree at all and some did agree in different villages, so it is very hard to answer the question.

*What criteria do you use in deciding which bridges have to go?*

1:03 **Brian:** Well, that is one of the criteria - does the local population wish to retain the bridge? The other criteria relate to the state of the bridge, how much money has

to be spent on restoring it if it hasn't already been done and how much money has to be spent on bringing it up to the forty-odd ton loads that it is expected to carry, that it will be carrying.

The other criteria are the siting of the bridge: is it a bridge that won't be able to stand up to modern traffic loadings because of its orientation? Bad approach roads to it and it will have to go. Heavy traffic warrants its removal. There are all sorts of factors.

*Will the RMS consider keeping trusses and other bridge components as tourist attractions?*

2:03 **Brian:** Yes, that's a big factor.

2:07 **Ray:** They had a heritage bridge trail (brochures were prepared and distributed to local tourist agencies) in the Hunter, this was both timber truss bridges and steel truss bridges, and I think they put up budgets for that and I think the RMS are thinking of preparing a phone app, so you can go to a site and have the phone app describe to you what the history of that particular bridge is. It is probably a limited range of interest but there are people around who would appreciate that sort of thing.

*Have any of those bridges been moved elsewhere as tourist attractions, maybe to the towns?*

2:46 **Brian:** Yes, there have been..... the Cowra Bridge was demolished and a span was placed up in a park as a tourist attraction and that lasted for quite a few years until it deteriorated because the council couldn't afford to keep it going. The bridge components were removed and the timber was used in modernising one of the council chambers, so they've kept the bridge. There's another bridge, I think you mentioned it, on the Murrumbidgee, where there was one of these bascule bridges with the rolling weight and the bascule span, which was a steel tower, was removed and placed in a local tourist area, mainly a caravan park.

3:51 **Ray:** That has happened at Balranald too, the lift span at Balranald has been relocated to a caravan park. At Hay the swing span has just been located into a park down by the river.

**Brian:** And I think you mentioned Mildura.

**Ray:** Mildura, once again, it has been used on a fake bridge.

## CD 2 TRACK 8

*Now, is the location and the history of the bridges that are removed going to be recorded in some way, or marked by some plaques, or something like that?*

0:08 **Brian:** Yes, it has been of the Cowra span, there is a plaque on it by the Institution of Engineers. The bridge was removed by a student body from The University of New South Wales who went down during holidays and worked on the bridge to get it out.

*Now I believe that there are about twenty-three bridges that are going to be replaced in the next fifteen years, and twenty-five bridges to be retained. Do any of you gentlemen have any idea how much this strategy is going to cost?*

0:50 **Brian:** No, I don't think any one would, you could only put an average figure on those. That rate of replacement, rate of reduction, rather, is very similar to what has been the situation over the years. I might be able to give you some figures on that. There were ninety-seven bridges remaining in 1986 and sixty-five in 2007, so that is a difference of thirty-two in twenty years, which is a rate of a little bit more than one and a half a year. There were forty-eight remaining in 2012 and that is a rate between 2012 and 2007 of seventeen in five years, so the rate has lately doubled from about one and a half bridges to three bridges a year. That three bridges a year is probably what the RMS is working on with the bridges it doesn't intend to keep.

*The RTA website on timber truss bridges mentions a figure of four hundred and eighty million dollars over the next fifteen years to replace or upgrade the bridges, does it look like that it is the right kind of figure?*

2:23 **Ray:** That is thirty million dollars a year over fifteen years.

**Brian:** Sounds a bit high.

**Ray:** It could be. It depends on each bridge because there will be long bridges, short bridges, it just depends on the situation.

2:42 **Brian:** It sounds a lot of money to me but I was brought up in another period and we didn't speak of so many dollars in that period, although the dollar has decreased in value now to what it was.

## CD 2 TRACK 9

*Now tell me something about the RMS's Heritage Committee, which you are both members of, I think. What is its establishment and influence on RMS decision-making now?*

0:09 **Brian:** Can we talk a bit about its establishment first? Well, I was behind the commencement of the committee in the DMR and in those days, going back over thirty years now, there was strong opposition from the National Trust to anything the DMR wanted to do. The National Trust would go, 'This is a heritage item' so the National Trust put strong letters in to the DMR, and the DMR replied with equally strong replies and the situation was getting worse. One day I got a phone call from a lady named Judy Birmingham, who was the Chairperson of the National Trust Committee dealing with bridges, Industrial Heritage it was, Industrial Archaeology. She asked me to come along and join in one of their committee meetings and give them a brief talk on the DMR's attitude to heritage items, particularly bridges.

1:23 So I went along and found they were all normal people after all, in fact they were just like myself, I suppose, we had an interest in bridges and they did too because of the discussions that they had. So Judy Birmingham said, 'Why don't we form a joint committee?' and I thought that was a good idea. She said she'd find out what members of their committee were interested in joining with the DMR in a joint committee situation. There were some very prominent people now who are members of their committee, there was Professor Richard Mackay and Don Godden, who is an architect, and Tony Prescott from the Heritage Council was on their committee, so he came along as well. Sue Clarke was a member and she came along, and she is still a member, Margaret Doring, Tony Brassil, he is still a member.

**Ray:** Colin Crisp.

2:30 **Brian:** Colin Crisp was another one, yes. So they presented themselves and we presented not many, I don't think, there was only a handful of us.

*What organisations did those people you have just mentioned represent?*
**Brian:** I didn't know what organisations they represented, except that they represented the National Trust, being on an Industrial Archaeology Committee of the National Trust. So we decided we'd meet every couple of months and meet over sandwiches and white wine and orange drink, and we'd meet late in the afternoon and carry on until our agenda was finished for the meeting and it became a great success. In fact, it branched out from bridges to roads and other items, so our side of things had to be amplified because whenever a decision was reached by the committee connected with roads I'd have to go to the road bloke and say, 'This is my draft, would you mind signing it?' and he might want to change it, so it was better to get him on the committee too, so we had a mixture of bridge people and road people.

3:45 Now when I resigned Ray took over running the committee. We alternated in the Chairmanship, if we were holding a meeting at National Trust a National Trust person would chair it and vice versa at the DMR. So Ray carried it on, and carried it in through to the RTA. The balance is a bit different now, the scale has swung the other way, there are very few outsiders and a lot of insiders on the committee, and of course every meeting is in History House and the chairman (from RMS) is the same.

4:25 **Ray:** But it is not as pro-active as it was either, is it? People won't come away from those meetings knowing that decisions have been made which are going to be binding. The representation is two National Trust members on the RMS Heritage Committee, there is a rep from the Institution of Engineers Heritage Group, a rep from the Heritage Council, another rep from History (NSW), Ian Jack. The Chair is the General Manager, Environmental of the RMS but it just doesn't seem to have the clout that it used to have.

## CD 2 TRACK 10

*What are some of the benefits and achievements of the committee over the life of the committee so far, do you think? What have been some of its greatest achievements?*

0:10 **Ray:** Well, the Harbour Bridge ninth lane, which never happened. It was a very strong process. There were a couple of guys from the National Trust, Wal Whittaker was one of them, he was very difficult to convince. We actually got a better design from making sure that he was going to be satisfied than if we had just gone ahead and done it in our own right. It was quite a workable design in the end, but in the end it never happened, the Minister got up one morning and said, 'We'll have a tunnel instead.'

0:48 **Brian:** I think that point you made, Ray, is very important, that that was one of the major outcomes. We tended to achieve better solutions design-wise because of the Trust's influence. There was no negativity that existed before, if they wanted to put up something we listened to it intently and if it had merit then we agreed with it. I think that was a major outcome, in that it changed our attitude completely.

*Did the committee have any influence on the RMS decision-making process? Over the period of the RTA and the RMS, did it influence their actions on anything at all? Was the committee instrumental in making some changes, perhaps?*

1:41 **Ray:** I think as the committee works currently - I think it is more information to the Heritage groups, but they are not really getting feedback from the Heritage groups.

**Brian:** That's true. We are not sure what we might recommend. It's considered at the committee stage but whether it is considered after that, we don't know.

*What's the attitude of RMS towards timber truss bridges - do they see them as a problem?*

2:17 **Ray:** I would say so, probably, the money men do. Once the bridges have got a heritage status they are committed to put money into the ownership of them. They have got a legal requirement to do something about it, otherwise they are going to get them de-listed. That is part of this recent deal between the Heritage Council and the RMS, the listing and de-listing of bridges that they have agreed to. One way, (for

the ones listed) they've got to spend money on them, the next one (not listed) they are not.

*So has their appreciation of the heritage value of these bridges increased?*
**Ray:** I don't know.

3:08 **Brian:** It is very hard to answer that question, we couldn't tell. All we can say about this new listing is that Ray and I got together and we agreed on what changes we would recommend to the original proposal by the RMS and then we met at the request of representatives of the Heritage Council. They had their own views, they also, we understand, travelled round and looked at quite a few of these bridges, which we didn't do at the time because we had had dealings with them over the years anyway. They prepared their own list, they agreed in principle that things had to be done to save the bridges, and save the bridges that were more important in their view. They prepared their own list, which again incorporated some of our suggestions, but they had their own as well and the RMS finally agreed with them.

4:19 **Ray:** I think the situation from the heritage point of view is that RMS recognises that there are some pretty formidable people on the heritage side of things so that they can't get away with doing nothing about heritage. So they've got to rationalise and make the best of the situation that they are in and as a government agency they can then use it to their advantage in publicising the fact of what they have done. I think that is one of the heritage pluses that has come out of the Heritage Committee in the situation that is going on at the moment.

## CD 2 TRACK 11

*So what effect do you think that ministerial or political decision-making will have on the way at least a reasonable percentage of these bridges can be retained in the long-term?*
0:12 **Ray:** Oh, I reckon there is a good chance that that is going to happen. I think the work they are doing, and as long as they keep the maintenance inspections up these rejuvenated bridges are going to last many years.

**Brian:** It could go another hundred years.

*Still have timber bridges in service, do you mean?*

**Brian:** Yes, we're hoping what we have done at Tharwa will see another century of life in it.

*Now there were four hundred and seven timber bridges built in all, in New South Wales. How many of those remain now today?*

0:52 **Brian:** About four dozen. Council has got some too.

**Ray:** Probably be about sixty.

**Brian:** About sixty, yes, I've probably got the figure for you.

*I've got it here actually, sixty-two.*

**Brian:** There you are, Ray's right.

*So are they now an endangered species, these bridges, in some form or other?*

1:17 **Ray:** Well, less endangered than they were. I reckon it is probably a good outcome.

**Brian:** The agreement is, I think, for fifteen years and then it will be looked at again.

*What happens after fifteen years when this strategy runs out?*

1:31 **Brian:** It is hard to say. All the committee can do is keep pressure on the RMS to keep the bridges going.

*Do they have any tourist value as well, those bridges, for the local communities?*

**Ray:** I think they do. As I mentioned, there is some heritage bridge trials around and they are not just truss bridges, some of the old stone arches, of course. There is even a heritage cruise brochure to use along the Parramatta River, just the bridges along there. None of them are timber trusses, but there are a lot of interesting bridges. I think the RMS see that they are getting good publicity out of those sort of activities and as I say, the phone apps is another good idea. You know Vince Taranto and his oral histories for the RTA. I think there is a group of people who will be interested in that sort of stuff.

2:41 **Brian:** There's a bridge walk around Sydney, I don't know how many bridges are involved but my daughter has been on it, she's a great bushwalker type.

*A timber bridge in Sydney?*

**Brian:** No, no, all the bridges, no timber bridges (except for Pyrmont Bridge) but all the other bridges.

*There aren't any left in Sydney of course?*

**Ray:** Except Pyrmont.

**Brian:** Pyrmont and Glebe Island. Yes, it is a McDonald Bridge, and there's Galston Gorge, that's another one. You can't very well get out and look at it there because it is on a horseshoe bend, you've got to keep moving with the traffic.

3:21 **Ray:** We have been working with a gentleman who is an ex-RTA bloke who now lives down near Marulan and he's got his plan for a heritage bridge trail in the Canberra/Goulburn area. The idea is that Canberra will turn a hundred next year and Goulburn City will be a hundred and fifty next year, so the centrepiece of the bridge trail will be Tharwa, the bridge at Tharwa, and there are about three or four bridges around Goulburn. Then they will travel down on the way to Tumut and all those bridges will be included as part of the trail, and the Victoria Bridge at Picton as well.

*I have just about run out of questions for you two very knowledgeable gentlemen, but is there anything else any of you would like to add to this interview?*

4:10 **Brian:** I would like to add one point that we didn't bring out during the discussion on the Allan Trusses: that Allan had two types of design. One type was called the Pony Truss, which was for bridges up to about the ninety-feet span and that was an open truss. In other words, there was no top bracing, but the bracing was supplied by extending the cross girders and then putting a metal bracket down from the top chord down to the end of the cross girder.

**Ray:** Beyond the deck.

4:52 **Brian:** So that was the Pony Truss. The other type of truss was a longer span one, about a hundred and ten feet, and I think it was enclosed at the top, but the truss had to be so high, of sufficient height, to allow a trailer loaded with wool bales

to go through and that required a clearance of about four metres or so. Now a good example of that is the bridge at Morpeth, it is a cross-braced bridge and it has trusses of a hundred and ten feet span. So they are the two types of trusses that are in the Allan family, the Pony and the big one.

*And Ray, do you have anything to add to this? Something we haven't spoken about, or overlooked, perhaps?*

**Ray:** No, I doubt it, I don't think so.

*Well thank you very much, both of you. This has been a very illuminating interview for me, I've learnt a lot more about timber truss bridges. Thank you very much indeed on behalf of ASHET.*

6:23 END IDENTIFICATION AND END OF INTERVIEW