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AN ORAL HISTORY OF BRITISH SCIENCE

Professor Ron Bridle

Interviewed by Dr Thomas Lean

C1379/75

## **IMPORTANT**

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**The British Library****National Life Stories****Interview Summary Sheet****Title Page****Ref no:** C1379/75**Collection title:** An Oral History of British Science**Interviewee's surname:** Bridle**Title:** Prof**Interviewee's forename:** Ron**Sex:** Male**Occupation:** Civil Engineer**Date and place of birth:** 27 January 1930  
Talywain, Wales**Mother's occupation:****Father's occupation:** Steel mill roller,  
bookmaker**Dates of recording, Compact flash cards used, tracks (from – to):**

10 April 2012 [1,2]; 26 April 2012 [3,4]; 9 May 2012 [5-7]; 15 May 2012 [8-11]

**Location of interview:** Interviewee's home, Kemeys Commander , Gwent**Name of interviewer:** Dr Thomas Lean**Type of recorder:** Marantz PMD661 on secure digital**Recording format :** WAV 24 bit 48 kHz**Total no. of tracks** 11**Mono or stereo:** Stereo**Total Duration:** 8 hr. 26 min. 05 sec.**Additional material:****Copyright/Clearance:** Interview Open, Copyright to BL**Interviewer's comments:**

[Track 1]

*I'd like to start today by just asking you to briefly introduce yourself.*

Well, my name is Ron Bridle and I was born in the Welsh valleys, a place called Talywain, in a little hovel on the [incomp] mountainside and we finally moved from there to a place called Manor Road, which was a more salubrious house altogether. But I went to West Mon Grammar School, so I was a member of the lucky generation, having been born in 1930 I'd missed the 14-18 war and I was too young for the Second World War. I got grants to pay for education and I feel indebted to the socialist government who passed all the necessary legislation. My father was a valley bookmaker.

*What was his name?*

Ray Bridle. And he was the only working class Conservative between Newport and Blaenavon. One of his favourite sayings was, 'If a man is starving you pray to God to send somebody to exploit him'. [laughs]

*What was his personality like?*

His personality was outgoing, to say the least. And... but he did play rugby in his day but he broke his ankle in six parts or something like that and had to give up from there on. My other uncles all played rugby, I played rugby. In fact, you couldn't escape playing bloody rugby!

*What did your father do again, sorry?*

He was a roller in a steel mill and he was roller at nineteen, in charge of the steel mill where the men got paid according to a sliding scale on the output of the roller. The roller was in charge of the mill and if you had a certain tonnage you got paid well, so men used to fight each other to work for my father. In addition to that he had runners up and down the valley taking bets over the counters of pubs and... in fact he was one step ahead of the police most of the time.

*What sort of things interested him?*

Horse racing and politics. He didn't really think too much of politicians and his father actually worked for him at one time. But both my grandfathers were heavy into politicians. My grand... one grandfather spent four years in the trenches in the First World War and he came from the Channel Islands, Guernsey, St Peter's Port, and he and his brother were orphaned at an early age and uncle Tom, well done uncle Tom, went to America and Canada and founded a dynasty. My grandfather came to South Wales looking for his fortune and I'm hoping that kind of judgement doesn't run in the family.

*When you said your dad was a conservative, what did you mean by that?*

He felt that every man had to do his own bit and look after himself, the society wasn't going to look after him at all. And fairly, a fair amount of bloody evidence for that up and down the valley. There's an old Cockney song which says, 'It's the same the 'ole world over, ain't it all a bleedin' shame. It's the rich what get the pleasure but the poor what get the blame'. I was convinced by my grandfathers, I thought that they had more to say about society and they were against nationalisation, only changing one boss for another. And they felt that, they felt very much that co-operative – my, well one grandfather was in the co-operative movement and on the board of, what the local board was, and the other grandfather was religious, which wasn't suitable to my father at all. [laughs] They used to argue like the dog and... a dogfight.

[05:00]

*What was your mother like?*

Tolerant. [laughs] But she was, she went to the local secondary school, played hockey and was one of the outstanding sort of personalities of Abersychan. My grandfather was on the board of... on the board for Abersychan Secondary School and he was keen to make sure that touting didn't work, because teachers who were out of work would come along and seek their vote and he didn't think much of that. So someone who came along and said, 'I didn't want to come but I'm forced to do it because...' they got the job. [laughs] For his honesty.

*What was your mother's name?*

Dorothy. Doll, to the family.

*Could you describe what her personality was like to me?*

She worked hard. She looked after the money, which my father didn't, and did all the books. And she worked in the Co-op anyway before she got married and during the war she worked in Griffithstown Co-op. And she got lung cancer through smoking, so she died earlier than I would have liked, so I missed her quite a bit and my father lived on in the same old house, which was my grandfather's, and my father bought, when my grandfather couldn't afford the mortgage any more. So it was a full house. Not everybody rubbed along together so easily. I had two aunts who later got married, who were both schoolteachers, and they helped me to get the eleven-plus.

*Did you have any siblings?*

No, I was the only one. Apparently I kicked the other to death, I was twins. [laughs] So the story went, that I kicked the other one to death.

*And did you all – so two aunts, grandfather, mum and dad, all live together?*

All lived together in the same house.

[07:46]

*What was the house like?*

As part of rows here and there, you know, people living together found it a bit difficult on occasions and especially with a grandfather who didn't think his daughters ought to be out late at night. And I mean you get to be a bit robust. And we had tiled floors, old quarry tiles, and they had to be scrubbed every day, which my aunts did. And I was refused tuppence or something for sweets and I kicked a bucket of water all over the tiles, for which I suffered later.

*Were there any other...*

Still, it was an upbringing which gave me resilience. And I was, if I was bullied I was supposed to fight back. And my grandfather was there with his walking stick in case I didn't. He used to fetch me from school when I was young and so, 'We'll make a man of him yet'.

*Do you think this sort of mix of Conservative working class father on one side...*

Full of debate. Full of debate.

*I was going to say, what do you think the impact of all those different sorts of personalities around you was? Sort of describe the...*

To be ready to debate things and try and see what was meant and who was putting forward a rational case. Because politics were talked about a lot, about insurance companies and they were hard up against it financially and economically. I mean the thirties was a bad, bad austere time and I remember they were kind to people who were having a bad time, as you know, people were living rough, would be fed. And my school's classroom was a soup kitchen. So I was lucky to be in the in between bit; not down and out and yet not rich either.

*When were you born exactly?*

1930. Twenty-seventh of January 1930. [10:40] And I went to Victoria School and I enjoyed school work. I wasn't at all lazy.

*What were your favourite subjects?*

Arithmetic and English and art. And I've painted since I was twelve.

*Why do you think maths, English and art appealed to you?*

Actually, it's a bit of a bore learning your tables by rote, but in retrospect you begin to understand the principle. So as with many things, you come up against the first wall, look at it and wonder what it's all about and then suddenly it all dawns upon you, but on reflection. So reflection is always what are you doing, reflect upon it and see if you can improve it. So it's the same for games, you practise more.

*Which schools did you go to again, sorry?*

Sorry?

*Which schools did you go to, again?*

Victoria School Elementary and West Monmouth Grammar School. I got reasonable A levels, matric, reasonable number of subjects at matric, and then at Higher School Certificate level to make me a favourite of the masters.

*Did you enjoy school?*

Yes. As Bicknell was physics master I enjoyed physics and maths. I do maths. I've actually been writing to my grandson in Australia who's trying to learn differential calculus by just recalling the formula by rote and I've been persuading him to draw the equation and derive – and it sticks more in the mind as you can see and I believe that thinking and seeing are much the same thing. So if you can see clearly, it's easier to extend your knowledge than if you have learnt by rote, limitations on it. It's thinking outside the box more, lad, which is a favourite phrase used today.

*Was there any particular branch of mathematics that appealed to you?*

Building. I was into drawing architect's drawings when I was a kid and everything about building was a pleasure to think about.

*What did you draw architect's drawings of?*

Houses, shops, anything which I could read about.

*What's the difference between an architect's drawing and just a sketch that I may make?*

Does the sketch work? I mean, you know, is it a place you'd care to live in? Can you tell that from the drawing? I think you can. [14:40] Anyway, I was so into building that later on in life when I came back from West Africa, we built two houses brick by brick, my brother-in-law and myself, and so it all came to fruition. I found I could lay bricks at a great rate.

*What actually appealed to you about doing architect's drawings and building, as a child?*

Leaving something behind. You feel that you've done something which has helped other people. Building a house to live in is like building a nest, a bird feels as if it should do it and I felt the urge to look after, to be responsible for structures of one kind or another. I suppose that's it. And when you think about it, you see, drainage is a subject which people don't understand and when it rains you've got to get rid of it and so on. To be able to work out how much rain, what size sewers to put in and so on, takes an imagination and you can do one scheme and it'll cost a bomb, but another chap coming along could do the scheme at half the cost and use different devices to improve the work. In Cwmbran, for example, we've got impounding lakes. In other words, the water doesn't run off, you hold it up so that what's called the time of concentration is lengthened and you store the water so that when the rain is over the water flows away, so it takes a longer time to go away. Whereas in a flash flood the water's getting from all points to the same point very quickly. So the idea of building on land which is flood prone, it seems to me a bit ridiculous. Otherwise you've got a... what you could do though is dig holes so that the water table is lowered. In fact in Western Australia that's what they do for the crops, because it's saline water, so they lower the water table so the crops don't get salt burnt. So knowing how nature works is really quite important in a way.

*Did you understand much of this when you were a child, growing up?*

Yes, I think so. I used to watch buildings being built and ponds being dug. My cousin and myself would dig a pond and the ducks would be on it. I always felt that it was doing something which we were leaving behind.

*Did you have any other hobbies when you were growing up?*

[18:15]

Oh, we had a mountain in front of us, called Lasgarn Wood, and on the mountaintop we had examining ponies and the fun was catching the pony and riding it bareback. And my cousin and I used to – and the guys from next door – used to go up there and catch a pony and ride a pony. Whether the ponies liked it or not I'm not sure, but it was better than being down the pit. And I think that's something about my life as well; it's better than being down the pit, whatever you say. I mean we've been brought up with disasters haven't we? There was the Senghenydd, 240

people blown up all in one go. And so the Welsh are emotional about things and they've got a lot to be bloody emotional about.

[19:16]

*Was there much mining in the area where you grew up?*

Oh yes. My grandfather was always a blacksmith, so he didn't have to go down the... well, he'd go down the pit, but not for long. And shoeing the horses. And he was strong and I remember him making me a steel bowly. Do you know what a steel bowly...? It was a quarter inch thick ring of steel with a stick on it which was around the bowly and you bowled it along like that. Well, I had a bike later on when I was about eleven, I had a bike and then I had a bigger bike. And I cycled all the way to Porthcawl, believe it or not. And we always used to cycle as far as that so we could go swimming in the river.

*What was the area that you grew up in actually like? The neighbourhood around you?*

Well, it wasn't as depressed as people now would see in retrospect. You got used to whatever it was you were born into and you made do with things. Going swimming cost money, to go to the local pool, but they would have a stilling pond in the colliery, a big pond, and we'd go swimming in the big pond instead. But boy, was it bloody cold. Oh! And diving, I enjoyed diving. And getting out quickly. [laughs]

*Were there any sports you were interested in?*

Yes, I was interested in soccer, I played soccer for Abersychan, under elevens or elevens, elementary schools. And I went to West Mon and got turned on to rugby, because I was growing by this time, I was a big boy. And the sports master thought that I would make a good rugby player. So, we played against all the main grammar schools in the area: Newport High, Cardiff High, Abertillery, Newbridge and Monmouth and what's the other place? Christchurch, Brecon. And we always used to win because we were about 600 strong, you see, as a school, whereas they had less people.

[22:07]

*What was West Mon School actually like? What sort of school was it?*

It had very good laboratories and classroom and... but they were, a lot of the boys were bullies and you had to fight your way up to precedence, up the list, until nobody bothered you any more. But they always would steal, open your case and steal and what they would do would be, you were given lines as a punishment, they'd steal your lines so that they used it as their own. So cheating was part of the... And to learn not to cheat is something, I suppose. But they were a rough lot, but clever enough, because I was in the A form, and so they were clever enough to cheat. You found that perhaps someone who's not quite so intelligent wouldn't cheat, because they didn't know how to.

*Show sort of initiative?*

Show initiative, yeah.

*You mentioned that you enjoyed physics classes, I was wondering what about physics actually appealed to you at school?*

What physics appealed to me?

*Why did it appeal to you?*

Because it was showing me something of the world that I didn't know. And light, speed of light, protons and the very idea of going faster than the speed of light and going backwards in time. You had to have an open mind to accept all that and Bicknell was a very good master who taught it very well.

*Are there any physics classes that stick in your mind in particular from being taught by Bicknell?*

Well, it was just the explanation of something I didn't otherwise understand, and that explanation stuck with me then. In fact, I mean the Newton equations – it's  $v = ut + \frac{1}{2}at^2$  and all that – I had my daughter home over last Christmas and with the chap next door I built a slide which you could push up and down with a little car over it, a little pulley and a weight. And we went through establishing the Newton equations of motion so that she could understand it. She

got ninety-five per cent, but someone got ninety-eight, so granddaddy wasn't so... [laughs]  
treasured any more.

[25:20]

*Had you had much thought about what you wanted to do when you grew up, when you were a child?*

I think I always wanted to do something like building, architecture or... civil engineering was something, it was a course used in university, which I thought would suit me. I wasn't too academic while I was in the RAF doing my National Service. In fact I could tell you the tale about my first day. The drill corporal came on the square and said now, two paces forward all those with a university education. One pace forward all those with a High School Certificate. Now all you go around the square and pick up all the little bits of paper and you dumb buggers watch the way the intellectuals do it. So I didn't feel very great about that.

*How well did you actually do in school?*

I did a county major scholarship. I missed the state scholarship because I was spending an extra year playing rugby for the Welsh secondary schools and didn't pay as much attention as I should have done. That's always been my problem in life, even when I was in the RAF. I enjoyed all the sport and I did art courses with education department and didn't think too much about doing well at school, but when I got to university I could manage to pass a degree without any trouble, like working hard.

*What did your parents think about your ambition to be a builder of some description?*

Anything, so long as it paid better. They were very keen on making sure that it paid well, which is understandable. Understandable. Oh, they were quite pleased with what I was doing. And my mother used to come and see every rugby game I played in. My father came occasionally to international matches.

*Do you think your parents wanted anything particular for you?*

No. As long as I was happy, that was fair enough.

[28:00]

*When did you leave school and start... did you go straight from being in school to National Service or...*

Absolutely.

*When?*

1948. 1948. And I went to Padgate and then West Kirby where I did my square bashing. And I went to Stafford, 16 MU Stafford, as a clerk provisioning, which meant nothing but filling in bloody forms. So I was playing rugby for the camp team and the skipper was Wing Commander... Wing Commander White and I said I'm fed up with being in the stock control office. He said, 'Well what do you do?' I said, 'Well I paint a bit, I do painting', I was a member of the camp unit's club. He said, 'Well we need the dining rooms doing up, how would you like to paint murals?' So all the time I was there I painted murals because the place was scattered with canteens everywhere. And a chap I also had painting them with me was a chap called Grant who later on in life joined the Ballet Schools School of Scenic Design. And I haven't ever seen him since, but I'm sure he did well.

*What did you paint murals of?*

He was a Druids man. [by which interviewee meant he painted Druidic rituals] I was a... east and west wind. The east wind was a woman and west wind was a man and when they go over the door like that... [indicated with hands to show how they would blow over the doorway] and sunken treasure and... imaginative.

*I meant to ask as well, did you go to church at all when you were growing up?*

I skipped church, I skipped Sunday school and took the money that I was supposed to be paying as the... and we bought sweets with it and went up the mountains and played away from home while the parents were on their own on a Sunday. And so I and others skipped Sunday school. In fact those religious ideas never... the belief in God and the belief in... were running counter to what you were learning in physics. I mean I couldn't believe that anybody arose from the dead.

Dead is dead. And so it was always made difficult to believe when you argued with the vicar and the vicar said well, it's all... you don't have to argue with a vicar. I mean I've been around longer than you have and I'm telling you that religion is the thing. Well no, but explain to me how you could get all those numbers of animals on a bloody ark that's only 290 cubits long.

[laughs]

[31:25]

*From some of the things you've told me so far I get the impression you like explanations for things and knowing how things happen, would that be...*

Absolutely. If I don't understand it, I don't like it. In fact you'll find the place here scattered with *New Scientists* and it's got now that I don't understand it. I mean particles which go through, one particle which goes through two holes at the same time. What are they learning from the CERN centrifuge? It's a little beyond me, the dark matter and... So I'm very much more a sort of hands-on engineer than an abstract scientist.

*Why do you like to know how things work though? I don't particularly share this, I'm quite content that stuff just happens when I press a button.*

Oh, I don't know. I think it's just desires. When you know something you feel better for it. And it's helpful talking to others as well. I suppose that conferences have been my lot for some time. When I think about it I've given an enormous number of bloody papers to one society and another.

[33:20]

*To return to National Service for a moment – sorry to take you away from the thread there – but I was wondering how you felt about it and being...*

I think it was a solution to many problems. I mean we have sink estates today with kids running riot and out of hand. We've been through this before and the scout movement was a movement which took people from their own environments and put them in a different environment with other children and still learning things. Woodcraftsmanship, get a badge for everything. And because they were away and with other people they didn't actually have to adopt the habits of their home town and the scout movement has been very good for that for some time. Well,

National Service was, we had public schoolboys and down and outs in the same barracks and if you didn't clean your bed space the others really sort of set about you.

*Do you think that National Service was good for you in any way?*

It was good for me, yeah. I sort of got to know some good friends, I played a lot of rugby. Whether I – can I tell you a... You can scrub this story.

*We can lock it away for thirty years, but once it's on tape it's there forever, but...*

No, well we... The officers' mess was out of bounds to us when we were playing rugby, we'd use the NAAFI or... but we had a similar toilet and we were playing this guards team and one of the guards said to the other, guards officer said, 'Do you see that chap from the RAF? He's gone to the toilet and hasn't washed his hands.' And the RAF folk says, 'No, in the RAF they teach us not to pee on our fingers', which I thought was Coa downer which took a lot of beating.

[35:42]

*Did you take to army life? Or air force life?*

Oh yes, yes, yes, you know. You're on your own initiatives and I enjoyed painting murals in dining halls and we had, I had one friend who's still a friend, Glyn Phillips who got a first in physics at Aberystwyth and when we were at training camp he put in for a, the MT driver, but on the course he stalled the vehicle and ran down the hill and backed into a lamppost. So he got sent to 16 MU Stafford as an ACHGD – AC General Duties – and found himself painting coal white, marking the side of a track up to the... in other words, that was a waste of abilities. So I saw the Wing Commander White, said, 'We've got the best outside half this station's ever had, why isn't he playing for us?' 'I don't know, well he ought to be.' So he played outside half from then on. And he held the paint tins and painted lines and everything around the murals. And the WAAF sergeant rather took to him, but he didn't take to her and he ended up scrubbing the bloody greasy tins in the kitchen. [laughs] But he is a great outside half, he played for Ebbw Vale when we got home after and he really was quite a good guy. But everything he could touch could go wrong, nothing ever went right. Just one of those personalities.

[37:50]

*When did you stop doing National Service?*

1950, went to university 1950.

*Which university did you go to?*

Bristol.

*Why that one?*

Oh, it's got all sorts of associations. It's probably one of the best degrees you can get in civil engineering. Brunel's the... you know, Brunel is feted in Bristol and Brunel is a particular hero. Never got put off by something that hadn't been done before. There is a story about Brunel's sovereign if you... Brunel's sovereign. He was entertaining his children at Christmas by making a sovereign disappear through his ear and come through his mouth, but in making this happen he swallowed the sovereign which was on the top of his bronchus. Now, he thought about this and he built himself a centrifuge, a board that went round and round like that and he got himself strapped to the board and a little beater and expected the sovereign to come out of his body, but it didn't. So he had the first tracheotomy operation has been recorded, but not until he designed the forceps to get at the sovereign. And the forceps is used today in the theatre, it's called the Brodie forceps. Well, this time he got himself put back... the Brodie forceps wasn't quite good enough and he got himself put back on the centrifuge and this time the sovereign came out... his throat. And the chap at Brunel's house ran around to White's Club, into the door and shouted, 'It's out!' and they all know that he was talking about Brunel's... He was quite a man.

*Is Brunel something you've become interested in now or was he someone you knew about when you were...*

Oh, I knew about. I mean he did everything like bridges, railway lines. His railway lines were novel, only Stephenson was rather better at the railway line because Stephenson used tyres, Brunel used piles into the side to hold the rail together and he was broad gauge. There is the joke that the Irishmen in north Northern Ireland, faced with the broad gauge and the narrow gauge took the average. You wouldn't get a train to run on the average.

*Is Brunel someone you knew about when you were a child or...*

No, no it was reading about him later on when I was at university and he'd done all sorts of... because actually I got a hook into Brunel's story because he did the suspension bridge at Clifton and my great grandfather – great-great grandfather or great grandfather – was a chap called Coppel who was master mason on the Clifton Suspension Bridge, which is my connection with Brunel. But even, I mean he did everything like railway stations, Paddington, and he had two ships, which one was a paddle steamer and one was screw-driven and he wanted to know which was best so he got them in a tug of war. And of course it showed that the paddle was the least efficient. But he was quite a man, you want to read some of his letters which set out to take down, man, my man you are a... idle good-for-nothing. He must have been a hard taskmaster to work for. And when they were building the sub-aqueous tunnel below the Thames the frame between the machine broke and the tunnel was flooded and Brunel only survived by getting blown up an airshaft and he sat down and wrote a report on why the shield had broken. [laughs] Now, how did that happen? [laughs]

*And you said you first learnt about Brunel at university?*

Yeah.

[43:05]

*What did you actually study?*

At university, civil engineering. It was structures, strength of materials, surveying, all that comprised a civil engineering qualification.

*Could you tell me a little bit more about what each of those activities you've just described involves? What's structures?*

Well, structures of building things like bridges and houses and car parks and so it's columns, slabs, decks.

*What sort of things do you have to learn to actually do structures?*

Well, you've got to know about bending moments, sheer forces and so on and make sure that this thing is not overstressed when it's in use. So you've got a load which crosses the bridge and if the bridge deflects you can work out the deflection, you can work out the stresses and the stresses never exceed that which is permitted. But sometimes you get the wrong information, it goes wrong.

*What's involved in strength of materials?*

The strength of materials is the strength of materials. You put it in a... you pull on it and find out when it goes crack.

*And surveying?*

Surveying. Well, it's to be able to draw a plan as a small scale of what's on the ground. So you start off with a traverse, that is a series of straight lines around the area that you want to survey, and you close the traverse. Closing the traverse means distributing any error that is there at the end amongst all the points that you've put in your traverse. And now once you've got your traverse you've got a set of points which are under the - ordnance survey will have left you with benchmarks as well for levels – so that you can start plotting the surface area, the digital terrain model, to use a technical word for it. And then you can put lines across it and draw cross-sections. Now, it's when you're building a road of course, what you've got is an alignment and along that alignment you've got cross-sections and you want to work out how much material is being moved as we move from one spot to another and that's called a mass haul diagram and in the mass haul diagram you're trying to minimise the earthworks. And that's where the computer comes in later on, but doing it longhand is... And there was a place called Blaise Castle in Bristol, it's been surveyed by every bloody engineer that ever went to the university.

*Did you take to any of those subjects you've mentioned...*

Yeah, I...

*...more than others.*

Structures was fine. One of the final things we had to do was do a design of our own. They gave you a layout with contoured plan and you had to decide where the road goes and where the bridges went and how you would skirt, scale a side, the cliffs of a mountain. So you could tunnel through the cliff and then you were left with troughs the other side which you would build a bridge across, and you had to do this for your finals. So I designed the bridges and it went very well, except it was rather good. I also did, geology was another, economics were other subjects which we took.

*Where do they fit into civil engineering degrees?*

Well, it's deciding whether the thing that you're building is worth building and if it's worth building whether it's the least cost that it could be. So least cost is, well not least cost, most effective cost benefit. And you're really starting working with the ideas of cost benefit from graduation. It's what can make the most profit for the least cost. So economy is one thing in building that you want to look for.

*Where does geology fit into this, some of this?*

Well, you're digging the ground up so you want to know what sort of materials you're going to get. [48:35] And there's a lovely little story with Sir James Drake, was county surveyor of Lancashire, and in most county surveyors' offices you had a soils laboratory. Now, what's important is whether the material is sound or not and what is the optimum moisture content of the layers you're putting down because you've got to compact them to get them dense. And one of the tests for clay, sort of thing, is that you roll it on your hand and if it's all wet it's above the optimum moisture content, if it's dry and crumbles it's below the moisture content. And they had some cow belly – cow belly is a local term for muck – and James Drake turned to his soils mechanic and said, 'Now Mr Jones, what do you think of this material?' and Mr Jones said, 'Well, on the one hand, but on the other...' [laughs]

*How important is knowing about the soil to civil engineering?*

Well, it's compacting it. So you don't want too much air and you don't want water to get in it later and you don't want the side slopes to slip away and this is why I told a story of slag tips in Monmouthshire. In one bit when I was at Monmouthshire County Council I had to look into

why the River Ebbw was flooding near Cwm, and it's got a large embankment like that and the river is at the bottom of it.

*Could you describe what 'like that' is for the...*

Sorry?

*Could you describe what the...*

Yeah, you've got a long slope down to the river and at the top of this long slope are heavy shale tips and slag tips and I became convinced that the slag tips were pushing the slope down and pushing the river up and that was happening because the cohesion and friction which held the soil together were being overcome by water and the water percolating through the slip would mobilise it and it would push the river up. And all the county council would do is come back and re-grade the river because it was pushing up the toilets in the local school. Well, you couldn't keep doing that every bloody spring. Every autumn it's pushed back up again. And so I had a solution for this, which was to remove the slag tips. But everybody pooh-poohed the idea. Quarter of a mile away it's slag tips and you moved the slag tips and you changed the course of the river. Don't be silly. Well, we had a great bloody disaster which proves the opposite, it was called Aberfan. And after Aberfan, which was a different kind of slip by the way, because it was like an avalanche, it got saturated completely and all slipped en masse, like an avalanche, whereas this was a slip on a plain. Anyway, they didn't do anything about it and I think it must have been three or four years, I've forgotten how much, after I got back from West Africa, I was in Cwmbran New Town and when the Aberfan disaster happened and we all volunteered to dig but the chap next door was on the site and he was digging and after that slag tips got moved just because they were slag tips. And it was removed, the one, and prevented it flooding at Cwm, Ebbw Vale. So I was proved right at the end.

*Did you actually go to Aberfan?*

No, I didn't. But the chap next door did and I offered to go with him but he had a carful. Must have been terrible. Terrible, terrible tragedy. Men get killed down the pit and it's not as bad as children getting smothered to death being in school. No, it was a sad time.

*Having looked at the mechanics of slag heaps before, did you feel any sort of personal interest in...*

[53:40]

Oh yes, I mean because not only that, later on there were inventions called reinforced earth. I mean I used reinforced earth at Cwmbran by putting together the soil and lime in and pug mill and then compacting it and the lime goes off, of course, and it leaves you with a stable material. Reinforced earth is something that the French invented and what it is is you've got just panels up the front and you lay the soil and then you put a reinforcement in it which is flat and long and the weight of the earth on the reinforcement provides the tension which holds the plate in place. Now, the – I'm going on a bit here because this is a different time of life – that was designed by a chap called Vidal, whom I know, and I was, felt that if he was going to take every British system to court, we were going to be in dreadful trouble. So I looked at the patent that he had to find an area, which we call the Vidal area, and an area which I call the free area so that we could use round bars with a hook on the end and they would be outside the Vidal patent. Well, Vidal didn't like this very much at all because there were other things coming along as well like polymer grids, which you just wrapped the grid around the earth and the grid holds it in position and we didn't want any of that interference. We paid Vidal £30,000 simply to go away and we, I had the problem of the French Minister of Transport sort of felt he could order me to go to France and explain myself. I said, well it's a matter for British law and if he wanted to see me he'd have to come to London. They dropped it after that. And Vidal and I were good friends. He let... I had a bottle of whisky when we finished the deal and at a conference in Manchester he sent a caseload of his wine, because he was then retired on an island growing wine. So he sent us all a bottle of wine.

*When abouts in your career was this?*

Sorry?

*When abouts in your career was this?*

When I was in the... Chief Highway Engineer.

*Right, okay.*

And I mean British firms were getting a bit of trouble, challenging Vidal's patent.

[57:10]

*I've got a few more questions I'd like to ask you about university, but I suggest we take a short break. It's getting quite warm in here.*

Right.

*Were there any hot topics, big issues in engineering that you were interested in while you were at university? Thinking more widely?*

No, I used to go to meetings and take an interest in all the meetings that I learned from it.

*Meetings of what?*

Of the local institution. I used... well, everywhere I went I... I mean I did a lot with the institution.

*Of Civil Engineers?*

I was an examiner and that was an interesting period of life. I was on the examination board and we had a chap come up from South Wales and they were all very nervous and you shake their hand and tell them who you are and then you promptly forget it, forget who you are altogether. And we had this chap coming in front of us with a design in an area of mining subsidence in South Wales. I said this is a very interesting matter, how did you set about it? He said, well as a matter of fact, we used an esoteric paper by Sims and Bridle – are you aware of the work? And to my everlasting pride I never told him who I was. And he understood it and he was pretty good, and so he got through it. One of the other incidents in examining was, I wasn't the examiner, but Ken Jenkins who was a nervous young lad from Wales was behind an interview and he was sat behind a desk and during the course of the interview he worked his finger into a knothole and when the exam was over they had to come round and help him get his finger out of the knothole. He passed.

*Were you an examiner for the ICE while you were actually at university or...*

No, no, no, no, later on. And I was always interested in institutional affairs and I used to make sure that juniors working for me had an opportunity to have a go at the Miller Prize, which was for the best paper given by a graduate during the year and if you were the best of the Miller Prizes you got a gold medal. Well, based on the bridge at Llanfrecfa Way, I had three juniors, two got Miller Prizes and the third got a gold medal. And it was putting them in after work and making them portray what they were going to say, asking them questions and training them in presentation. And I'm very pleased with that, and specially the guy who had a gold medal, never went into civil engineering afterwards.

*Why did you think it was important to be involved with the Institution?*

Well, involved with the Institution? Well, because that's how you learnt more, how you got to know more people and you got to know more about the subject because you're asked more to write about subjects. And human error was a big part of what I used to write about.

[1:01:05]

*Other than going to ICE meetings when you were at university, did you have any other social activities that interested you?*

No, not really. I went to the lecture and that was fun. Used to have a pint afterwards in the... what's the one, we used to go to the... featured in *Treasure Island*. Not the Llandoger Trow, which is somewhere else. Anyway, the Admiral Benbow or whatever the hell it was...

*Yes, actually. I think that's it.*

That must have been it. And so you get to know people in other offices and so on.

[1:01:50]

*Had you had much thought about what sort of civil engineer you wanted to be while you were at university?*

I wanted to do buildings, structures more than anything. Roads were just a means of getting into the structures business. I mean the thing is that I can, I built a career on failures, because I was

there when failures happened. And so it was analysing the failure and finding out why and making sure that the standards which we were putting out from the department, which ultimately became British standards, made sure that that sort of thing didn't happen. See, concrete cancers was one thing we did a lot about. Concrete cancer – I don't know whether you know – but the gravel that you put in the concrete is subject to expansion with water and then you put the cement and the gravel expands, cracks the cement. Well, we haven't had a bridge doing that because we've pointed where the gravel was, what sort of gravel to avoid, and so on. But locally, at county council headquarters, they've got concrete cancer and they're having to knock the headquarters of the police down and find other places for them to work. So now it would have been much better had the architect been noticing what they were doing with the concrete works.

*Were you taught much about safety, for instance, at university?*

No, not really. Safety came a little later after the failures and one of the set of failures is the buckling of Acrow props and scaffolding tubes. The other thing is, we used to go to, try to influence European standards.

*This is later on?*

That's later on, yeah. The Germans would send, we'd send civil servants and the Germans would send marketing people. And we lost out on the scaffolding tubes and we allowed it to go metric and the Germans picked up most of the market compared with us. And I thought we shouldn't try and let that happen again, so we used to, we used to go to meetings with this in mind, of what the British manufacturers wanted. So it's something which you ought to see, you know, you'd like to see British manufacturers doing better than the rest of the world. And we had this very fine project in Buenos Aires. A thousand junctions online to a computer, run with a TRRL program called Scoot, and we were the interface, we used to referee the differences between the English contractors and the Argentinian civil service. There's always something, I used to travel to South America, which I enjoyed.

*Shall we take a short break?*

Take a short break, because we're trampling up the fields everywhere and anywhere, time-wise.

[end of track 1]

[Track 2]

*So that's running again. I was wondering, how did you actually do at university?*

I got an ordinary degree. But it was good enough to get a job, that's the main thing.

*How did you go about looking for work?*

I didn't. I was playing for Newport. Last year at university I was playing for Newport. I had ambitions of getting a Welsh cap. But then I decided, having been at Monmouthshire County Council that a Welsh cap was nothing compared with a degree in civil engineering. If they'd only allow me space and time and effort, I could make a difference. And indeed, the time at Monmouthshire County Council was well filled because Walter Coles, who was the principle assistant, thought I was bright and made sure that I had some jobs to do that tested my intelligence. And so I got some work on the Llanvair Discoed Arches Tabernacle Chapel, Penhow Post Office, A38 improvement.

*Sorry, say that again more slowly.*

The Llanvair Discoed Arches Tabernacle Chapel, Penhow Post Office, A38 improvement.

*What was that?*

Long drawings, and that was only for the title. Only it had some aspects: drainage earthworks, so on, that generally helped you to get into the drawing board and doing the work.

*Sorry, who are you actually working for?*

Monmouthshire County Council.

*How did you get the job there?*

By influence. Newport Rugby Club decided that I could work at Monmouthshire County Council and I'm quite sure that the interview panel had it in mind that I played for Newport.

*Do you remember the interview?*

Yeah, it was no trouble at all. 'I suppose you could do the job as well as anybody.' Because councillors are not exactly the brightest of people. In fact, some of the stories, well there is a story about Abertillery council at the end of the depression; slashing estimates left, right and centre and they get to any other business and one of the blokes stands up and says, 'Mr Chairman, I propose we have a new chandelier in the town hall'. With that, another blazing face comes up and says, 'Mr Chairman, we've been all evening slashing estimates left, right and centre and some bloody fool has to stand up and say, let's have a chandelier in the... and if we have it, we'll only have to pay some bugger to play it'. [laughs] And that's about the standard of councillors, as a matter of fact. You can cut that.

*We can put that away for thirty years, if you feel like afterwards. [laughs] Don't think there's anything too...*

No. So I got the Llanvair Discoed... that helped me to start off. And then there was the question of Llanelen Bridge and the slip at Cwm Ebbw Vale.

*Okay. To start off I'd like to put this in a little bit more, more context if you like. Monmouth County Council – I don't think of county councils as doing engineering.*

Oh, they're responsible for all trunk roads by, as agent for the Ministry of Transport. It was... because the Severn Bridge came out of pressure from Gloucestershire, Monmouthshire and Glamorgan pressing the government for monies to have the Severn Bridge so as to boost trade in south Wales and Gloucestershire, and the south west. So it's, county councils have always been highway authorities.

*So whereabouts in the county council were you actually working?*

Newport. There was a place called Stelvio, which was the drawing office for the Highways Unit. And they were generally staffed by people who had been surveyors in mines who were looking for an easy number. And there were some graduates and Walter Coles was inclined to look after his graduates.

*Sorry, Walter?*

Coles. He was the principle assistant and so he was giving work to do that wasn't likely to be built, just in order for you to get the experience of putting it on a drawing board and working it up.

*What sort of chap was he?*

Older. Dead. Died while I was still there. And he was a nice man. And the Llanelen Bridge gave me an interest in stone arches for the rest of my life. And it took a lot of pressure to get some money for a diver to go below the river and find out how much it's eroded, and that frightened everybody to death.

[06:23]

*What was the Llanelen Bridge?*

We nearly, we didn't go over it because we didn't come that way, but it's between here and Abergavenny. A4049. And it could only let one vehicle, heavy vehicle, pass at a time. And so the idea was to widen it, but it's been overtaken by the Raglan to Abergavenny trunk road, the new motorway, head of the valleys. So nothing's been done, but the foundations have been underpinned.

*What was the actual issue with the bridge when you were working for Monmouthshire County Council?*

Well, to extend the bridge, we'd do it in reinforced concrete arches, so I had to calculate the loads and the stresses and find out how much steel to put in it. So it was a little set of drawings which I could have actually put in for membership of the Civils. And of course the slip would have been a good back-up as well.

*The slip?*

The slip, Cwm Ebbw Vale pushing the river up. But I got fed up with doing something for nothing really and never going to be built, and so I decided that I had to go somewhere where they had the money, and that was West Africa.

[08:00]

*Right. Could we talk a little bit more about Monmouth before we...*

Oh certainly.

*... because you've mentioned a few other bits in passing and I was just, you know, I was wondering as well, you mentioned you working in Cardiff, I was wondering what your working environment around you was actually like? Are you working in an office, a laboratory, a...*

Yes. You had drawing boards. Drawing board and tracers and draughtswomen and, but no computers until I got to Cardiff. But Cwm Bran had tracers.

*What's a tracer?*

You'd present your pencil drawn diagrams and then they'd make a tracing of it so you can take prints off it. Right, so we had... in fact in Monmouthshire County Council we had no tracers or draughtswomen. We had to do it all ourselves, now I come to think of it. So it taught you how to draw anyway. And colour all the cross-sections for earthworks, coloured them. Red for cut, green for fill, and so you had to be putting on washes every day on to the cross-sections.

*I was going to ask, how were you actually doing these drawings? Because, you know, to me a drawing, I sit down...*

Pencil and T-square. And protractor.

*What are you actually drawing on?*

Paper.

*What sort of size paper?*

Drawing paper. Well, as big as a drawing board. And you have a series of drawings; one with alignments, alignments and then cross-sections and so on, and drainage and course in Cwm Bran you can't compare it with the County Council, there was a lot more drainage because you were estate building, you're draining out of the estate. And feeding the estate with spine roads and so on. So you're there on a drawing board, drawing a long section of the road, the plan of the road and cross-sections along the road to decide how much earthworks you're going to do.

*How long did doing these drawings actually take?*

Ages. [laughs] I mean it was tedious work. Working on the alignment itself wasn't so bad, it was... and, you know, working up your surveys, you've got to reduce all your levels and so on. So I wasn't so keen on all the arithmetic palaver but you had to get it done. But it would have been much better had you got through all that and went out on to site and saw it built. And you weren't in Monmouthshire County Council getting out on site and seeing it built.

*Where does the data for actually doing these drawings come from?*

Oh, logbooks. You go out with a theodolite and a level and you've got a chainman. In fact, seeing as you can cut things out I can tell you a little story about a chainman and myself in Cwmbran New Town. There's a low bridge and my chainman was out in front and I was coming up with his colleague behind him and he saw a lorry and he... and the lorry got stuck under the bridge. So I'm coming up behind and I say to the driver, 'What you want to do is let your tyres down, get from underneath the bridge'. And he said, 'Bugger off, I've had enough advice from the corporation already'. [laughs]

*What were you actually doing out with a theodolite, bearing in mind I don't know what a theodolite is.*

A theodolite is an instrument which you set up over a point which you know and you level it and you can take angles like this and elevations. So there are two ways of doing the survey, is you set out a chain or a line and take levels along it by a level and you have a little notebook and you reduces all the levels to the ordnance benchmark. Or you can do tachymetric surveying where you have the staff and you elevate the theodolite to read off a staff and by trigonometry you can tell what the level is. So then you have a digital terrain model and there's a lot of digital terrain

models, but there was only one when I started, and that is a square. You have a series of squares with the levels at their... or you have cross-sections with levels along the cross-section and the new road imposed upon it. When it got more sophisticated when we had computers and so on, it started to become a rather different business because the digital terrain model was replaced by the string model and different ways of showing the levels and interpolating levels to develop all the cross-sections and alignments as you want. So, it was drawing board stuff and we were reducing all the arithmetic and reducing levels. And for closing the traverse you've got algor... logarithms to help you do the arithmetic.

*Just let me get, make sure I'm reading this right. So you're sort of going out and doing the surveying work with the theodolite.*

That's right. And taking it all back in little booklets to the office where you reduce your arithmetic in the booklet to get the levels that you know and you know where you're taking the levels and then you plot the plot which plots all the levels and plots the roads on top of them. And so you start then playing around with the road, whether you have sharper or less sharp curves, depending on what the earthworks look like. And then as time went on and computers became – this is as time goes on – you got computers, you go to poly... oh hell... I'll think about it in a minute. And they're just different ways of plotting the line of the road. [15:55] And so for the TRRL in '77 they started the optimisation with all these Roman names and we sold it to Eastern Europe. We used it on the Trans-European Motorway from Danzig to the Bosphorus.

*This is computer software though?*

It's computer software. So the development of the line goes from logarithms and field books all the way through to the computer generating more and more data.

*Back at the Monmouth County Council offices in the 1950s, so you've done your surveying work, how do you decide on where the road actually goes?*

You use your common sense. It's hard to explain now, but what you do is you say where you're going to and from and you try and find the cheapest way through the to and from, which means testing a couple of lines and so the lines are straight line, transition curve, transition straight line, and you keep moving this about until you think you've got the best line. And that's really

optimising the earthworks as well. But you're not optimising anything, you're making your own judgement of which is the best line. Optimisation came later with all the arithmetic that could be done by computer.

*Right. What were sort of earthworks in this context as well?*

Well, you have, the ground doesn't run according to... the road runs through the ground, it goes into cut, it goes into fill, goes into cut, goes into fill, and what you've got to do is so organise it that this amount of fill goes into that amount of cut goes into that amount of fill, this bit goes into that bit, and so on until you have a mass haul diagram, a diagram and then you start changing the vertical dimensions of the road until you minimise the earthworks.

*Why do you want to minimise the earthworks?*

Because it's cheaper.

*Did you have any things to help you do the calculations?*

No, you did your own calculations.

*Not even a slide rule with a mechanical calculator?*

Oh, a slide rule, yes, but you had to be accurate in many ways so the logarithms were... with the traverse you needed to be that accurate, so the logarithms for the traverse, slide rule for doing quick calculations, levels.

*Who else did you actually work with at Monmouth?*

I was in an office with Ron Bailey and Phil Paines. Phil Paines's father was chairman of the Roads and Bridges Committee. [laughs] They were good guys. And Colin Easterbrook was another bloke who came into the office, was the graduate. Phil Paines wasn't a graduate, he was doing it through his work externally, the civils examinations. But the fact is I can remember those, I can't remember anybody from KRI. Bloody amazing.

*What sort of chaps were they?*

Ron Bailey had previously been a stress manager at British Aircraft and he was older than I was and he was married. Phil Paines was older and married. Colin Easterbrook was much the same age, played wing forward for Glamorgan Wanderers. And then you had the chainman who drove you out to the site, carried the staff for you and you used the levels and theodolite. Levelling one day, theodolite work the next.

*What sort of chaps were the chainmen?*

Ordinary blokes off the street. They got used to finding out where to put the staff and... but they were decent chaps. But one had had polio as a boy, I remember.

*You mentioned there were drawing office girls around as well?*

Not in Monmouthshire County Council.

*Right.*

You had to do the work yourself. But in Cardiff, when I went there, and Cwmbran, when I went there, they had tracers and draughtswomen. Not as many as there were engineers so you had to fight to get your thing drawn up for you.

[21:30]

*Could we talk a little bit more about what a typical, typical day's work is like for you while you're at Monmouth?*

Oh, at Monmouth.

*Yeah. I'm just sort of interested in how long was...*

All day on the drawing board and all day out surveying. And surveying and transmitting it to the... keeping up building lines, surveying the middle of Chepstow, for example, just make sure

that the roundabout, it wouldn't get clogged with traffic. That was the sort of day. You can see why I suddenly got fed up.

*Why did you get fed up with it?*

Because I wasn't building anything. I wasn't being satisfied. I could do a neat drawing, that was it. And, you know, structures, I could draw Llanelen Bridge and put out the reinforcement, make all the bar bending schedules, and it's never going to be done.

*Did the A38 extension not get built either?*

The which?

*The A38 extension.*

Oh, that was ten years later, Phil Paines was resident engineer. Ten years after I'd done some of the drawings. Phil Paines had done some more drawings and somebody else had done some more drawings. All on the same scheme.

*So...*

It was frustrating, it was frustrating beyond bloody belief.

*What did all your colleagues make of it? Were they as frustrated as you?*

No. I don't think so. They would have moved. Phil Paines' father kept him in the job, I suppose, you know, he felt dad'll do something for me sometime, I'll go in for promotion. Ron Bailey was just idle.

*What do you decide to do about it?*

What did I decide to do? I decided to go to West Africa.

*Why West Africa?*

Because it had lots of money. They were building roads and investing in improving the country. And it struck me that that was something I would like to do. And if you've read the little bit about West Africa it was really marvellous.

*I was interested in how did you get the job out there in the first place?*

I just applied for one with the Crown Agents and I went up for interview and they gave me the job. And so I was soon on a plane, going. And there were other engineers of my age and other RCUs or MRCUs.

[24:59]

*Had you actually met your wife before you went out there?*

Yes.

*Whenabouts?*

Well, we met in school; she was head girl and I was head boy. And she went to university and when she came back she worked in the children's department in Newport, and that's when we decided to get married. And we had an awful flat at the top of Caerau Road where they had drawings of Dickens' characters all the way up the stairs. Mr Pickwick at the bottom and Bill Sikes at the top, I remember, which was a comment on the salubriousness of the bloody flats we lived in. But it was much better in West Africa, we had a bungalow all to ourselves, a boy to do the cooking and Beryl used to amuse herself by going to the library and getting a tubful of books.

[26:06]

*Whereabouts in West Africa were you sent?*

Accra. At mile twenty-five out of Accra. We had a camp at mile twenty-five and that's where the drawing office was and I looked out of the drawing office and they were all African local boys in the drawing office and did drawings for the other two executive engineers who were, Tony Dunlop was mile fifty-five to the Volta and Karasek was doing a survey from the Volta to the French overland.

*What were you actually out there building?*

A two-lane road, but a high speed, all-weather, which was, the base was laterite and that comes from the Latin – *later* meaning brick – and it had a sort of self-cementing property. So you put down a layer of laterite, having done all the cut and fill and you sprayed the top of it with cut back bitumen, which soaked into it for about three-quarters of an inch or an inch, you know, which made a sort of bastard macadam and then later on you chipped it with three-quarter chips with full macadam, with a full tarmac base. So a bitumen, you sprayed the bitumen and you put all the chips on the top of it and then the traffic belted in the chips. But you had to keep a lot of things all going at the same time. People digging trenches for drainage and building culverts and... because flooding was, oh, I was there during the Accra floods and at the crossroads at Christiansborg, opened the door on the one side and water goes *ssshhh*, through the car. It was a bit hair-raising.

*Why was the road being built?*

You build roads in Africa to get goods to the ports and the wealth of Ghana, or Gold Coast as it was then, cocoa. So the roads could support the cocoa crop to the railways and to the ports. And also, it meant that the African farmer could do something about selling his surplus, because it was accessible all year round to the market. And so you encouraged Africans to be entrepreneurs and to hire men on our behalf as well and look after them, and so that you were changing the economy of the country very considerably. And I mean we were only the coastal road. There was a road up to Takoradi and so on elsewhere, because we were Mechanical Road Construction Four, so there were other Mechanical Road Construction units building other roads.

*How did you feel about actually taking part in that mission?*

I felt very good about it. I enjoyed the people, I got on well with them. I got on well with British inspectors of works. Some of them were racist, that's understandable, but we had two inspectors of works who were African and foremen who were African. And they were alright, they were okay.

*What did you think about the end use of the road that you described a moment ago?*

The end use is getting the stuff to the ports and so on and it was working. It was actually achieving its end and it taught me a lot about the machinery, I learnt to drive all the machinery and a scraper is an art form because you've got to put the super elevation in the base, so you're pushing the laterite along and compacting it to the levels that you decided upon in the office.

*I'm sure there's something in the name, but what's a scraper and what is it for?*

A scraper's got a blade underneath, it's a four-wheeled machine with a blade that you can change the angle of. In fact we had a very, very bad accident. I was travelling the grader up, you've got to travel the grader, you put the grader blade up alongside the cabin and then you travel it along the road, and a mammy wagon coming down the hill went straight into the blade, killed the driver, had his arm off, and this is where I admit we had tomatoes for breakfast. Bit off-putting. But it happens and life was cheaper. [32:10] And there were differences between the tribes. The Hausa and the Fulani made the best drivers. But they were northern boys and not the southern boys and that made for... in fact, what's the book called? Oh... Never mind. Never mind. So you had a mixture of languages as well, so it got impossible to understand what was happening sometimes. But if you got on alright with the chiefs and the police you were doing okay.

*What do you actually use a scraper for as well, sorry?*

Well, when you put the laterite down you've got to get the levels, got pegs in the side of the road showing where the level to come to and so on. Be like this on super elevation and like this where you're going straight.

*So at different angles of...*

Yeah, the pegs would be at different levels. In a straight road the pegs would be on both sides of the road at the same level and you're sweeping at about one in forty and one in forty so you've got a camber in the road. But when you've got super elevation the pegs are different and you've got to grade the laterite to give you the super elevation of the road that you want. And then you spray it and chip it and so on. And you've got the bridges to widen at the same time.

*I was going to ask as well, was there any other bridges involved in this road as well?*

Oh yes. Some bridges we had to knock down because they were useless. And culverts were, there were easily undermined because the water would come through the culvert and dig a hole this side of the bridge or... well, all we did was build a concrete wall down and let it happen. Sometimes though you had bush crocodiles and the boys would get a bit worried, so I actually have shot a bush crocodile.

[34:46]

*I was going to say as well, what sort of landscape are you driving this road through?*

Open landscape, prairie stuff with little hills protruding here and there.

*What sort of colours am I picturing?*

Colours? Green-yellow.

*Are there any particular features that make this difficult or easy?*

Well, what you could do is get a series of basins, the land would be... and in these basins you get drainage run-off and that can be a river and perhaps you want to make the culvert or bridge bigger to let the... And I wondered why I'd had flooding in the one valley but not in the other and then suddenly I had flooding in the other valley. Well, there was a consultant working up north of us who had changed the drift of the river. Could have told me first. But precast beams were something which I could lift with dozers and so on and I made a series of precast beams which I could widen the bridge with.

*What's a precast beam?*

Precast, the shuttering already there, you cast the beam, take the shuttering off and you've got the beam in its own right and you lift the beam and you put it in place. You use the road, the existing bridge and you put the beams over the side until you make the widening.

*How difficult is all this work?*

It was lovely. [laughs]

*What did you like about it?*

It... nobody interfered with me, I could design bridges, I could design precast beams and decide how it should be built, when it should be built and I had all the inspectors of works going along with me.

*How do you actually design the bridges on this from scratch?*

Well, you want a span, you've got the abutment to put down first of all, extend the abutment. So you've got earth pressure at the back of the abutment, the abutment has to be heavy enough to withstand the earth pressure at the back...

*The abutment being the bit of the bridge that's next to a slope of the...*

That's right.

*...of the ravine of whatever height.*

It's the end of the bridge. The end of the bridge. Then you've got piers. Let's say it's a three-span bridge. So you've got piers in between. Now you can leave the piers because they probably, well you had to check them first of all to see that they could carry the load, then you put the precast beams in like that. And the precast beams are designed to carry the loads, British standard loading. So that all the mammy wagons and so on could pass in safety. [laughs]

*What's a mammy wagon, sorry?*

Oh, a mammy wagon is, instead of buses you have mammy wagons, which is a truck where they all cling on the back and they're not at all careful about going into drainage drums, keeping them off your tarmac bit. But I had 'em, I put stones in the bins. That slowed them up a bit.

[38:40]

*Could we talk through the... I'm interested in how you build a bridge in this context. I was really interested in the way you sort of described the whole process of how you went out, you surveyed a site, when we were talking about all those things that never got built in Monmouth...*

Yes.

*...and is it the same sort of process in Africa?*

Absolutely. What you do is get your loading and you've got your limiting stresses for steel, concrete and so on, and you put the load on the bridge and you calculate what the compression is and you calculate what the tension is and you provide enough steel to carry the tension and provide enough concrete to carry the bloody compression. So that there you've got it. You've got to design the bridge. Now, I can modify the bridge myself by making the piers wider or narrower and the abutment is a mass abutment and it's just got to be heavy enough to prevent the earth pressure pushing it over. And then you have the bearings of course, the bearings are a sliding plate on the one end and a fixed joint on the other so that it all expands one way.

*So expanding in the heat, for instance?*

For instance, expanding in the heat, yeah.

*Right. Are you still doing all the drawing, surveying, calculating yourself?*

No, I've got staff who can do it for me. I'd do the calculations myself, by the way, in the bridges, but then I would teach the Africans how to set about it. What I had in mind, let them check what I'd done and let them get taught, because the time was coming when they would have self-government and I thought it was a duty to teach the Africans... We made a mistake, you see, we taught a lot of technology to Africans but we didn't teach them administration and our administrators left the country and then it got into corruption and people who didn't really know how to run things.

[41:20]

*Was independence a subject of conversation when you were out there?*

Oh, bridge. No, I don't mean bridge, building bridges, I mean bridge. We had enough for a bridge club and we had a, Jim Alladyce was a mechanical engineer whose wife was there with the two children, and so we used to go down to Prampram swimming. And I suppose the topic of conversation, well for me it was, oh we had some strange, we had Harry Cumberledge who was a plant supervisor and he was living with the Asantehene's daughter. The Asantehene is the Ashanti tribe head man – not his daughter, his niece. So Harry had this ring which worked miracles. When he'd show it he could go anywhere and do anything. But he invited us around to lunch, to dinner when he first came there, with the African lady, and he came to the door. [laughs] He had a mammy jacket on, a string vest and all his grey hair poking out of his shirt, and a mammy cloth. And we had a palm chop oil... palm oil chop and it was an African evening. But you get, you don't get any surprises. The main topic of conversation was what Kwame Nkrumah do next.

*Who?*

Kwame Nkrumah. He was the strong man, like Assad is in Syria, and he was reported to be able to walk on the water down at Labadi. It was all rubbish. And he was in court, he abandoned the court, brought it to an end. He was going to be charged. So he had total power. But come his time, his time came and off he went.

[43:54]

*Was there much talk about upcoming independence?*

Yes. Only when we'd gone. They'll manage. Because the bloke I took over from was a chap called Ted Francois, whose mother was a West Indian, her father was West African, and he made it to director general of the Gold Coast, but we had to, from the Institution, we had to write to the... the government were going to sack him for one reason or another and the Institution tried to intervene, not very successfully but enough to keep him his job, which is something.

*What were people's opinions of what would happen after independence, back in the time?*

Oh, he would run back to the bush. You know, typical English, without us they're lost.

*What did you think?*

I didn't think they were lost. I was in university with one of their engineers. Ted Francois was a cultured man. I didn't think they would be at a loss. I thought there would be difficulties with politics, but they had enough people there to keep the country going and Ghana's been one of the most successful economies. Not Sierra Leone. Sierra Leone is the prediction made for them after independence and bloodletting and hard times.

*Did you have much contact with Africans when you were out there?*

Oh yes. First of all you have a little riot where people feel they're not paid on time or whatever and it's surprising how you could pick one out and make fun of him and all the troubles would go away. They were a bit like children, to be honest with you, but nevertheless they would do their due.

*What was life like there, where did you actually live?*

Well, we lived in this bungalow, and mosquito netting framing the windows. And one morning, I was always a man of regular habits, I was walking down to the drawing office when the [incomp – 46:43] boy started shouting from the back of the bungalow. A little hole had appeared in the mosquito netting and I had a green mamba sleeping around the bucket. Boy. [laughs] I went seven shades of white.

*What did you do?*

Nothing, we'd get one of the boys who was used to doing it to catch it by its tail and go like that and its head would come off.

*Were there any...*

You get used to living in conditions, you know, where you had to take actions.

*Was the bungalow far from the drawing office?*

No, it was only just about fifty yards and there were four bungalows and then African accommodation at the back of them. Four - five bungalows. One, two, three, four, five, that's right. And they were occupied by Europeans and the little tin huts were occupied by Africans. There's no doubt about the class system working.

[48:05]

*How long was your stretch of road?*

Twenty-five to fifty-five, thirty miles. Plenty of bridges. And plenty to look after. You get a tad frightened when you're there with 3,000 quid in the tin box and two soldiers trying to sort of quell a riot.

*Is that a typical payday or...*

Well, not typical, but... because normally the pay went very well, because I made sure they were all paid in one day, because they had their mummies to, you know, they all lived in huts which were... because the entrepreneurs were the big fat African women. Mammy Nartey was our local village entrepreneur and she wanted her money and if you hadn't been paid you couldn't pay her her money. So I made sure that everything was paid on the day and that helped them no end. So when Wibberley came along, who was the cost and works accountant, wanted to package it all into little envelopes, that caused a riot because we were a day late. And it's understandable, very understandable. You mustn't think of, in those conditions you mustn't think of yourself, you must think about what they're up to. Up to and deserve.

*Were there any other problems?*

No, no, it was alright. Had problems sometimes in things being mistranslated and you dug this trench level, with the level they'd dig it however deep it was bloody getting. If you see what I mean.

*Not quite.*

Well, they would carry out your instructions to the letter and you want to make sure that the letter was what you wanted.

*So if you didn't tell them to stop digging they'd just...*

Keep digging.

*Right. [laughs] Were there many other Europeans out there working on this?*

Oh yes. There was, first of all, because I got seconded into Accra for the... to survey and extend the airport and Accra was full of big bungalows all on the second floor and they were called battleships I think, and so we stayed in a battleship for about two weeks while I surveyed the aerodrome and made the plans for its extension. And then they had all the PWD officers – Public Works Department – who were responsible for all works regionally and so on and there was an assistant director and a director general and the director general was Welsh, Ivor Wynn Pugh, and Wadzalla was a Pole who was assistant director and Price was the other assistant director, who was Welsh. And the chief engineer was from Abergavenny. Surprising how you can fall on your feet.

*How did you all get on?*

Alright. Wynn Pugh was a very nice, cultured man. And the Welsh generally are, I mean they're not... they're not aggressive in the way that some people are. They try to see both sides of the case.

[52:45]

*How did your wife take to living in Africa?*

She'd have gone mad if she'd stayed there long enough. Well, she just read books and we had a day out every month, shopping. I used to drive into the pictures in Accra, which was in the open air, and that was it and she just looked after the cooking and would go swimming at Prampram and she got on well with the other women on the camp, but she was glad to get home and go back to work.

*When was the road actually finished?*

About six months after I left.

*When did you leave?*

That's a good question, I wish I could remember. It says...

*I think you mention about 1957 before...*

That's right. That's right enough, because Cwmbran came on line then.

[54:03]

*Why did you decide to actually leave?*

Well, we had children. We had two children by the time two years had gone by and we wanted them to be brought up in a civilised country and also Beryl could be with the family and find ways of satisfying her intellectual demands and we were building a building, two houses. So it wasn't, no sense in going back, because we had a mother to look after as well. John looked after the mother while – but he'd been to Africa.

*Who's John, sorry?*

My brother-in-law. He went to South Africa with his firm. So we're a sort of well travelled lot.

*Did you already have a job lined up before you left?*

No. Take a chance. But Cwmbran was a certainty I think after the experiences I'd had and so I got some of the best jobs in Cwmbran. Do you want a funny little story? I had a guy working for me called Prem Pal Kalia who was an Indian who'd come from Uganda.

*Was this in the Gold Coast?*

No, this is in Cwmbran New Town.

*Right, okay.*

And from the drawing office we always used to pop down one building and go to the barber's, local barber's, and Prem is in the chair and the barber is getting talkative, he said, 'Where do you think you'll go for your summer holidays?' 'Well, as a matter of fact I thought I'd go to Rome, see the Olympics from beginning to end.' And the barber said, 'You don't want to do that. You don't want to do that. See all the little figures and you'll be at the back of the stand. Not worth doing. What else do you think you'll do while you're there?' He said, 'Well I thought I'd go around and see the Pope'. He's heard it before. 'Thought I'd go round and see the Pope.' He said, 'You don't want to do that, he's up on a balcony and he's a little tiny figure, see him better on television at home'. Time goes on, Prem back in the chair. He said, 'How did your summer holiday go?' 'Went very well. I was in the front seat in the Olympic Games from beginning to end and the day I went around to see the Pope he came down and talked to the crowd.' And the barber said, 'My God, what did he say to you?' He said, 'Where did you get that bloody haircut?'

*I think we should probably finish today in a moment, but I was just wondering, as my closing question really, if you could describe yourself as you were when you got back from Africa. What sort of chap were you?*

Well, better if you did it. What sort of a chap was I? Moustache.

[female voice] It's no time for us to get divorced now love.

[laughs] No, outgoing...

[female voice] Got on with, could mix with anybody.

Outgoing.

[female voice] Outgoing.

Plenty of good friends in Cwmbran. Played for the... I played rugby again because I'd put on a lot of weight by this time as well, so I couldn't get back in the Newport team, so I played with the Old Boys and that was socially good and we had friends here. I had a friend who was headmaster of that little school we came past, Mac Harris, he's dead now, but we still have his wife to dinner on Sundays. And a lot of people I was in school with.

[female voice] They didn't notice we'd gone for twenty years did they?

[laughs] And come back.

[female voice] No, you had the kids by the time we came back, so it was a different ball game.

Yes.

[female voice] But you were, you were travelling back and forward to Cardiff at one stage from Penperlleni.

Yeah.

[female voice] And leaving about eight, coming back about six, so didn't leave much time. And we were building John's house weren't we?

We were.

[female voice] Yeah. My mother ran a shop in Pontypool and came to retiring age and of course no pension and she'd had accommodation over the shop for years, so we set to and started John off building opposite us. That's the reason we went to Wakefield, didn't want your mum-in-law opposite. [laughs]

[laughs]

[female voice] It wasn't for any engineering.

No, her mother reckoned I was a dustbin full of irrelevant general knowledge.

[female voice] She wasn't too wrong.

*It actually was a wonderful place to stop for the day, so thank you.*

[end of track 2]

[Track 3]

*How did you feel when you'd got back from Africa, Ron?*

A little bit marooned. I had to apply for jobs, so I was trying to find a place that had a lot of work to do. And surely enough, Cwmbran turned up and I got the job and from there on we had a house which we were renting on the estate, but I was anxious to invest some of my money that I'd earned in Africa in a self-build, which cured me of self-building actually. But my brother-in-law and I built two houses brick by brick and we settled down to life in Cwmbran New Town.

*Why did you self-build?*

Because it's cheaper. [laughs] There wasn't any way in which I could pay a construction company to build it for me and I knew about bricking and I learnt all the arts and crafts one way and another. So the only job I didn't do was plastering. We had some of John's friends in to do the plastering, one of which was called Pantry Jones. I said, 'Why's he called Pantry Jones?' 'Because they'll only let him plaster pantries.' Anyway, it was interesting to start work in Cwmbran New Town, because I had a number of jobs to start off with, which was estate development, building small roads, minor roads, and drainage. And drainage is a difficult job really, one way and another.

*What was actually your job title?*

Senior engineer. So then I got put on Cwmbran New Town shopping area, central area, and also in charge of Llanfrecfa Way design and construction. Llanfrecfa Way was a spine road from the town centre to the estate at Llanfrecfa, which crossed a railway line and the river. So not only I had to build the roads, you had to build two bridges: one over the railway, and it was easier to lift the beams and put beams in place so you didn't interrupt the trains by trying to put scaffolding and everything up, whereas in the river you could put shuttering without any problem at all. And so that one was a continuous beam, reinforced continuous beam and the other were post-tensioned, pre-stressed concrete beams.

*Where does a senior engineer fit into the scheme of things?*

Well, you get two juniors working with you and you set the job, something to do in arithmetic and drawing and designing bits and pieces, the sliding joints and so on and you direct their efforts.

*Who's above you in this scheme of things?*

Principal Assistant. Captain Malcolm Evans, whom I knew very well, and he was at Dunkirk. In fact, Cwmbran New Town, during my first stay there, my first stay there, was like allied command headquarters during the war, because there was Borlase, Captain Evans, Flight Lieutenant Button and they still hung on to their titles, which was quite amusing. But Malcolm was a good guy and let me have a go at better jobs. So the bridges were something which I had a yen for anyway because that had been my experience in West Africa and it gave me a bit more experience than other people in the office.

*Was the office run along military lines?*

Oh yes.

*How so?*

Well, you addressed people who were your senior as 'Sir' and paid due obeisance. Anyway, the Cwmbran New Town, the central area was quite a feat because it was all starting from scratch. So you had all the car parks arranged to make easy access and there was also easy access to the services like electricity, drainage. And there's a tunnel under the main thoroughfare in the New Town which gives access to all the services. Anyway, we had to take twenty feet off the top of the hole in New Town to get decent, not, so that it wouldn't be steep roads or anything like that, and it was convenient to use that twenty feet of material in the embankments at Llanfrecfa Way, the embankment up to the bridge, the bridge over the railway and the embankment back down again. And because the stuff was mixed clay gravel, needed strengthening, we would put it through a pug mill first with lime and then the lime set and so on, we had solid embankments.

*What's a pug mill, sorry?*

Well, you put the clay in and you put the lime in and then you pug it all up together. [laughs]  
And then deliver it by lorry to the site and dump it and compact it.

[06:36]

*Talking about Cwmbran New Town, could you give me some idea of what the end result was supposed to look like?*

Oh well, the central area with all the shopping and spine roads out to the estates, so that it was easy access from the estates to the shopping centres. And on each estate was a little shopping centre of its own.

*Where do you start with something like that?*

Well, you start with a plan and you have to survey the area and get it all down on... and it's all on china tablets we kept, we had two surveyors doing nothing but surveying. And so you could take your drawings off the plates and so that it's a very simple matter of just laying out the road, because it's straights and curves, and as I say, the kit for an engineer was a drawing board and a T-square, a setsquare, a protractor and drawing instruments, including the fine pens and so on. And outside on site was a level and a theodolite and that was where you took the levels and found out the position of a house, newly built or whatever it may be, so as you could draw on your drawing board a one five-hundredth plan of the site that you're going to put the road through. And now you start putting the road through it, which is by straights and a box of curves. Oh, this one'll fit in there, and between the curve and the straight you had to have a parabolic transition curve because as you go round the bend you're subject to centrifugal force, so that around the bend is super elevation. You make the roads slope in the direction of the centre of the curve so that the outer balance counterbalances the centrifugal force and you don't bring it on all of a sudden, you put it through a transition.

*Why do you need to balance the centrifugal force?*

So you don't slip off the bloody curve. In fact, when you're going at a speed around a curve you want to remember that the factor of safety increases or reduces as the square of the velocity. So this is the reason why roads ought to be kept chipped, to keep the friction up, and that's another thing and when we get to TRRL all with motorways and maintenance. But sticking with

Cwmbran, we had two bridges to build and in order to build the one across the railway it was quicker to put precast beams in a two-span because the railway thought it may need another railway line alongside the existing one. So the two spans and there's the pier with simply supported beams between the pier and the abutments. Now you have a load of various materials you can use in designing bridges: block work, stone blocks, concrete blocks, brickwork. You've got reinforced concrete in which the tension in the beam is carried by the reinforcement which is in it. Pre-stressed concrete whereby you stretch cables to high tensile bars and you cast the concrete around it and then you let the tension go, which means that the beam has been compressed and you don't have to worry about tension because it's just lessening the compression. Post-tensioned means that you're building the beam with ducts inside it through which you thread the cables and then you pull the cables up and anchor them off, jack it up to its limit and then anchor it off. There's loads and loads of calculations to do with this. You've got to allow for creep, shrinkage, all sorts of other effects. So the size of that book there tells you what it's like trying to do the analysis.

*A thousand page book on concrete, that's...*

On concrete. And only on reinforced concrete.

[12:15]

*Were there any bridges in this part of your career you remember in particular?*

Well, the two that we built in Cwmbran was something because there was a chap called... hm, name forgotten, who were also building other bridges on the other spine roads. And they were all pre-stressed beams because it was always the railway line was the main bridge stock. So what, where have I got to?

*I was asking you about bridges and you mentioned there were two in particular. So one of them was the railway bridge – what was the other one?*

The railway bridge, there was a river bridge and there's no difficulty in putting up shuttering on the river bridge, so the river bridge was a reinforced concrete, continuous span, three-span bridge.

*Could we talk through the process of how you actually design, you know, a bridge from scratch?*

Yeah. Well, you've got the materials to start off with, that's block work and there's reinforced concrete, pre-stressed concrete and post-tensioned pre-stressed concrete and steel, and indeed in this day and age, plastics.

*What guides your choice over which material to use?*

Economy. Whichever you think is coming in at whatever price. Mind you, it's judgement as well sometimes and particularly the interests is often... skew the judgement.

*How do you decide what type of bridge to build as well?*

Well, for reasons that is it convenient, is it the least priced, because people will come in and give an alternative tender, say I don't like building in reinforced concrete, I want to build in pre-stressed concrete, and they put another price in lower than the one you thought you were going to get. And in fact there's, when we get to West Riding, there was a cause célèbre called Tinsley Viaduct and we had a bid in which was one million pounds lower than the official design. But it was because the steel companies wanted to get work.

*I'm going to pause you for just one second.*

[pause in recording]

[15:10]

I was very interested in graduates getting experience and presenting papers. And the two young, three young men who ultimately worked for me all did the Miller Prize for the Civils. Two of them got the Miller Prize and they won, got a gold medal, for which I was very pleased, and it was all on the Llanfrecfa Way bridges. Studies of cubes and the frequency with which cubes failed and so on and all quite intricate, you know, does delivering the cement in bags make a difference compared with sticking them in a big tower, as the cement pumped into a big tower. And it did and a little bit of research for them. So I was very pleased with that, that's what I was very pleased with.

*Could we talk through sort of the process of designing and building a bridge from start to finish?  
So I imagine... where does it start?*

Let's start with the abutments and the wing walls. Now they can be built, faced in block concrete, block stone, brickwork, and you fill in with mass concrete behind it so that the weight of the mass concrete balances the pressure coming from the soil behind the wall so that the wall doesn't tip over. But it's not the only – that's called a mass wall – it's not the only kind of wall you can build. You can build a reinforced concrete cantilever wall in which you've got a slab at the bottom and a cantilever standing up from it and then earth behind that. And what happens is, the weight of the earth on the slab at the bottom turns the wall this way, whereas the earth pressure turns the wall that way.

*So you're sort of counterbalancing.*

And you counterbalance the two. So having got the abutments in, let's start... because the pier's the same you see, they only have to hold things up and perhaps bend as well. It all depends whether you hinge them or not. And then you've got the deck to put in. Well on Llanfrecfa Way they're post-tensioned. It was the first post-tensioned in Wales and all the beams were cast in the field alongside the bridge and the ducts were threaded and the beams compressed and then they were lifted by crane on to the deck so that they formed a deck. And the slab went over the top to carry the traffic.

*What do you mean by post-tension?*

That means tensioning it after you've cast it. Pre-stressed concrete is stretching the cables, casting the concrete round and letting the cables go. So the one is, if you like, pre-tensioning and the other one's post-tensioning.

*Why do you need it to be tense at all?*

Because concrete can't carry any tension. The permissible stress of concrete is zero, so what you're doing is compressing the beam so that you don't get any tension, just get a lessening in the compression. The compression is say, like that, and then the moment keeps turning so this is getting more and more and it mustn't go past...

*Could you explain what that means without using your hand?*

This is compression in the beam...

*But for someone who's listening to this later...*

Yes.

*...they're not going to be able to see your hands. Could you just explain what it looks like, it's...*

The stress at the top of the beam is compression. The stress at the bottom of the beam would be tension, but because you've pre-compressed the beam, it's only lowering the compression, it isn't putting any tension in. I think that does it, doesn't it?

*I think so, yes. Do you...*

Whereas steel, steel has the same in compression, same tensile strength and compression as it has in tension so you get, instead of precast beams as I've been describing, you get I-beams, universal beams pumped out by the steel companies, and they can be simply supported as well or made continuous or made as a portal, whichever you like. [20:30] And finally, there is the box girder, which is just simply boxes bolted together, put together, and what you've got to be careful of is plate of the box buckling. Have you got the book again?

*The motorway archive book with the bridge designs?*

That's it, that's it. And they had a lot of trouble with, why I went into London is because we had collapses. [pause] Ah. [pause] Well, box girder collapses are well known, I don't have to look it up. But nothing, although the Merrison Committee was concerned about buckling, and it is a concern, and all the calculations weren't done properly, but nothing ever fell down because they got the calculations a little bit dizzy. They fell down for human error. The one that fell down first was the bridge in Pembroke, the... bridge in Pembroke which went across the straits there, and they had designed the diaphragm at the top of the pier to be three-quarters of an inch thick. Somehow or other during the process of all the coming and goings, they got put in as three-

eighth and of course when you're cantilevering out, it finally buckled and down the bridge went into the drink. Took some men with it as well. Now the one at Koblenz, which is in Germany, they were cantilevering out by – there's a stiffener on the bottom of the box and they wanted to make this weld done automatically, so they cut the stiffeners back six inches either side, made the weld, and they put the stiffener back but they didn't weld it to the bottom plate, they welded it to the existing stiffener and as the weight came on, it buckled and down it went. I'll find it in a minute. And so down it went. In Yarra, which was in Australia, they had two half boxes coming up side by side and they were putting the bolts in at the top. Well, unfortunately the top deck of it had buckled, not buckled, it was deflected and they couldn't get the bolts in. So the resident engineer without a bloody thought of safety, brought in some kentledge and tried to press the deformations out. Well of course it just made it buckle and down the Yarra bridge went as well. So the question is, is human error or calculation.

[24:31]

*How much is safety actually on your mind when you're designing a bridge?*

Very safe. On my mind especially because I've been rung up as I get into work in the morning and say, 'The Loddon Bridge has collapsed, there are six dead, are you going to tell the Secretary of State?' And that's a position which you don't care to have very much.

*How about earlier on in your career when you were actually building them? Was safety one of your major concerns?*

Oh absolutely. Absolutely. And certainly checking the arithmetic and checking everything and you always had the check, I always made sure that the check box was initialled and filled in.

*What does that mean?*

Well, I've done some calculations, I give it to my junior to check and he then checks in the check box, he puts his signature to say he's checked it.

*Thinking back...*

So... but that's not just as it sounds, it goes with some conversation. Why have you done this, how do you do that?

[25:50]

*Do you have to do much surveying work before you can start building a bridge?*

Well, you have to set it out. So you have to, you've got a level and a theodolite to set it out with. And you've got to set the shuttering in place and in fact one of my friends – Cyril Lawrence was the other bridge designer, who'd been on M50 – and he had some precast beams coming in and he wanted to measure the span between the two abutments. And one of my friends held a tape bunched up in his one hand so that all that was in Cyril's mind was when the beam was coming in, it dropped short. Said, 'Try it again Cyril'. Tried it again, this time it was alright. But that's why Merrison was so keen on having Merrison checks and you had to give a certificate that the bridge had been checked for buckling, etc, according to the Merrison rules and I adapted that to be for all bridges.

*This is later on in your career, I'm guessing?*

That's right. But it all stems from Cwmbran and making sure the juniors had done their bit and there wasn't any... a flaw in the setting out or the...

*What sort of, what do you get out of surveying the ground around where you're going to put a bridge?*

Well, it's not surveying so much as taking samples, taking boreholes. You want to find out where to found the abutment, it's got to be on a good layer, not on mud. And it's more inspection of the site. But you have to draw it, of course you have to draw the bridge and you've got to, where there are surrounding... you may have to divert a sewer or suchlike. In fact sewage was quite a problem with Cwmbran because rain fell in Abertillery and came through the coal seams out in Cwmbran New Town.

*Do you have to do many calculations in actually designing a bridge?*

Yes, you have to do a lot of calculation and one of the aids coming to the fore when I left Cwmbran was the calculator. First of all it was a turn handle job, which enabled you to do logarithms very much quicker, and then it was the electronic calculator. So it cut down on... because it was a boring, terrible exercise. When you want to find out how much earthwork is being moved from one place to another you've got to have cross-sections all the way down the road and where the road will be and then green is fill, red is cut, and what you've got to do is work out those areas, because the amount of material in cut between this cross-section and that cross-section are the two areas divided by two, times the length between. Now that means you've got to get the area from the cross-section, which was a planimeter, and you had to take the planimeter around the perimeter and it told you what area it was. Well when you'd done that several times you're getting a bit fed up.

[30:09]

*Do you need to do any calculations for stresses on the bridge itself?*

Well yes, that's what I was explaining with finding the redundant forces so that you could work out what the stress was, the stress distribution was in the bridge.

*We talked about that a little bit before, we didn't actually talk about it at all on tape. What sort of things are involved?*

In...?

*In balancing, why do you need to balance the forces at all?*

You need to make sure there's no stress which is greater than the permissible, that's what you need to do. Because if it's greater than the permissible you're going to get in trouble and it'll crack and in fact they've got a problem in the County Hall in Monmouthshire here at present called concrete cancer and if they'd only used the technical memoranda which we were putting out from the department they'd never have built it, because it's got aggregate, which when it gets wet, expands and it's cracked all the concrete. That wasn't foreseen.

*How do you actually go about solving the forces and doing the stresses on a bridge design?*

You get hold of a book like that over there...

*That big thick tome on concrete?*

Big thick thing on concrete, and there are compatibility methods, finite element methods, three moment equation. There are several ways of doing it – energy - and you just have to flog through all the... have a look at... you have to flog through all the arithmetic.

*How much arithmetic? Just give me an idea of how many sums.*

An SO book full. Thank God for computers.

*I guess computers is something we need to talk about in relation to your next job, but there was one other thing I was going to ask you about...*

Yes.

*...about road design actually.*

Go on.

[32:40]

*I was wondering as well, do you have to be... what sort of things do you have to be careful of when you're building a road?*

Well, when you're building a motorway – let's take that because that's the top end of the scale – people don't mind little improvements in their side roads, but when you get to a motorway and you're knocking down people's houses it's a slightly different thing. And there's a consultation process. We go through all the calculations to find out which is the best road and we try optimisation until we finally are satisfied that it's the best we can do. Now we go out to public consultation and then you get the reaction and you can't escape these days a public enquiry in which one of my chaps from the headquarters would serve as an expert witness. And you have some very fine problems. Like there was one place where we were knocking down an old people's home, compensation being paid of course, set up, but the council for the old people

said, Mr Inspector, you can't transplant these old people and if you try they'll die and when the next one dies I'll write and tell you. Changed the line. [laughs] I'm a coward.

*Did you ever feel like you were the bad guy as a road builder?*

Oh, absolutely. We had all sorts of – well I can't remember the chap's name now. Anyway, he was found climbing the drainpipes outside my offices to look at the maps on the wall. [laughs] But no, there were lots of scenes where people didn't want the road, didn't want to have it. So finally though, you press enough until the Secretary of State finally gave the order.

*You mentioned as well, you had to be careful about optical illusions.*

Oh that's, that's only, that's to get a flowing alignment. You coincide the vertical curves and the horizontal curves. If you have one traversing after the other you have a vertical curve and then a horizontal curve, you get what you may call a malalignment, it doesn't look right. That's it. Public enquiries are... you have a lot of able blokes working for me who at a public enquiry were under cross-examination and...

*Just thinking again about the optical illusion part of this, what sort of effect does that cause if you're driving towards it if you get it wrong?*

Well, an unpleasant effect. And the road won't let you escape, it's all... but no good engineer worth his salt is going to do other than coincide vertical and horizontal curves.

*I still don't quite see why.*

Well, it gives a pleasant ride.

*In what sense pleasant?*

Well, if you're looking at the road and you feel that doesn't look right, that's not a good thing is it? So get a flowing alignment you try to coincide and it also helps in the optimisation as well.

[37:00]

*When... did you enjoy your work at Cwmbran?*

I enjoyed it and I didn't mind the arithmetic too much either, and it was specially good when they had calculators. But it was the end result, the end result is worth... I mean we've got a book full of end results here.

*I was wondering as well, after you've designed say, let's say a bridge, who actually builds it?*

Well...

*In this case?*

Right. So you get a bill of quantities. You take all the – that's another bloody arithmetic dredge – you take all the quantities off; how much reinforced concrete, how much... and you put it in a bill of quantities and then you go out to several contractors, say six, and they put in a bid. They price the bill of quantities and they make submissions, some of which may be, we've put the price in for this assuming that we've been able to... if we can't assume that, we want to put in another price. So it's a matter of negotiation and, you know, that's how it's done and finally the tender's resolved and you've got a contract with the contractor and the contractor gets on and does the work, under our supervision, we do the setting out – he does the setting out – we do the setting out checking and we make sure that everything is... there's a site laboratory in which you take concrete cubes, soil characteristics and so on, to make sure it's all kept in accordance with the design.

*What's setting out, sorry?*

Oh, putting pegs in to tell the contractor where to, you know, if you've got a grader, that's the blade on the bottom like this and you're sweeping the road, so that it goes to the pegs you've put in.

*What were your relationships like with the contractors once something is under way?*

Can be bloody-minded. They can be... I'll tell you one little joke though, was in West Riding where the Lofthouse Interchange is the intersection between M62 and the M1 and the bridge has got all sorts of [laughs] joints in it and it's a bridge like that. Anyway, to explain to the contractor how to build it, which joints to keep stiff and then release afterwards etc, I had a model and I built the model in this progress meeting and said, there you are, that's how it's done and I hit the table and the model fell down. And the contractor looked across the table and said, 'Ron, that fills me with utter bloody confidence'. But it all went very well, that one did. But I was pleased to move to Cardiff in the end because it was opening up again.

*What sort of issues can actually occur between a contractor and you, the council?*

Well, claims. They put in claims for unforeseen circumstances, for something they think we've got wrong, can't do this, got to do something else, and it all costs money. So negotiating the claims with the con... at one time we had something like 900 million I think, outstanding in claims and the chap from contracts division and I went around the country settling quickly.

*This is later on when you were Chief... yeah.*

Yeah. So your relationships with the contractors ought to be good, you ought to be sensitive to his needs as you are to your own. And I've always got on very well with contractors. Some have been my best friends. [laughs]

[41:40]

*When did you decide to move to Cardiff and why?*

Well, the bridges were finished, it was only just tidying up the scene and I didn't see what I was going on to next. And I knew the Cardiff Eastern Avenue was in prospect and they were going to spend money and you were close to the university and you could try your best to be innovative.

*What was... how did you actually get the job at Cardiff?*

Interviewed by the City Engineer. I thought I would do fine. [laughs] Actually, he was quite a guy, Roberts was the City Engineer. He came in on a Saturday once, forgot he'd left his wife in the car and went home on the bus. [laughs] But he was a nice man.

*What sort of chap was he?*

Fussy. A little chap. Yeah. No, it was fine. I made some very good friends in Cardiff.

*What was your job title in Cardiff?*

Senior Engineer.

*And again, where do you fit into whatever hierarchy there was?*

Well, there was a Principal Engineer and that was it. And we didn't get on so well, actually. Keep that to yourself.

*We can restrict it for x number of years, but what was the source of the disagreement?*

The fact that I wanted my own way. [laughs] We'd argue about things.

*Where were you actually working?*

Under the Cardiff City Hall. We had a drawing office down the bottom.

*You actually worked...*

One of the troubles was that I'd taken a fancy to trying to find out how to use computers and Neville Kilborn hadn't. And so we didn't quite see eye to eye and when Gauntlet and Roberts found out we were pursuing the computer, they endorsed it and Neville wanted to take the credit for it all the same.

*Who was Gauntlet, sorry?*

Was the Deputy City Engineer.

*Just going to adjust your mic slightly again. [45:00] When you said you were keen on, or taken a fancy to using computers, what did you mean?*

Well, I discovered there was an old Stantec Zebra, which is a standard telephones machine, at the College of Advanced Technology in Cardiff and I got to know Ed Stuart who was the head of the laboratory, computing laboratory, and I started teaching myself how to program a computer, which was a bit more difficult in those days because you had to look after the store yourself. But not only did I fancy doing it myself, I fancied everybody else doing it.

*Why did you think it was a good idea in the first place?*

Oh, it resolved all that arithmetic.

*How did you actually get access to the computer at all?*

I went along and asked for it and John Bevan was, who shared the little office with me as the other Senior Engineer and we got on very well together, and not only did he learn but we got all the others to jump in on the bandwagon, we got Ed Stuart to set up courses, because the feeling at that time was, well my feeling was, that engineers ought to learn how to program it, not in fact just set out and let someone else program it, or use somebody else's program because you wouldn't know what you were doing.

*In what sense not knowing what you were doing?*

Well, if someone else had put sub-routines or whatever in and you hadn't quite cottoned on to what they were doing, it's easy enough to make a mistake, to have an output which is not valid. So it was, I thought it was better for the engineer to understand what he was doing than having a third party try and tell him what he should be doing. So not only did I involve the Cardiff City Hall people, but I involved Glamorgan County Council, Cwmbran New Town... [laughs] and so Stuart, Ed Stuart had a real good bit of business going really.

*Did you actually have to pay for the privilege of using it or...*

No.

*Who was Ed Stuart?*

He was Head of the Laboratory, the computing laboratory.

*How did he react when you turned up and say I'd like to use your computer for some civil engineering?*

Enthusiastically. Had all sorts of ideas.

*How did you actually use the computer?*

Analytical techniques I was doing at the time, a continuous bridge across the... Roath Park, which got cancelled because they used an embankment instead. But it's very difficult because you've got to get, with a continuous pre-stressed, post-tensioned deck you've got to have a cable which is a cable profile which doesn't transmit any extra forces [incomp – 48:48] to the abutments and piers. You have to have a concordant cable, and you can have a transformed concordant cable in which the... you can moderate the load on the piers and so all that took a lot of computing.

*What did the computer actually look like?*

Just a piece of, a paper tape with holes in it. And we had to punch all the holes ourselves and punch the paper tape ourselves, put the paper tape in it, it would then go *phhtt...* [laughs] [49:40] But there was one bridge on the Eastern Avenue bypass, which is multi-level bridge and it was I-beams and what was juggled was the transverse distributional loads across the bridge. If I put an Hp load – that's the MoT standard loading – on the one side of the bridge, it goes down more than on the other side, and it's finding that transition... that deflection which was the point. And John Bevan and I spent a hell of a long time learning how to use English BASIC functions, finding out what it was all about, and so on, and we finally did it. And we did work together very well and we published a paper together, called *Edge Stiffening of Bridge Beams*, and he came to the Midlands later on as a senior engineer again.

*Did you use the computer in that example?*

Yes.

*What difference does actually having the computer available make for you at the time?*

Well, it got things done faster and calculations. And in fact there was a... you had to write up, if you did a program which you were going to use, you had to write it up, have a paper tape in there of what it's all about, so that other people could use it. So everybody was doing inertia beams and flexible stiffness and all sorts of odds and ends. In fact we got the roads people using it as well.

*Are there any things having the computer available, are there any things you can do with a computer that you couldn't do before?*

Yes, I think that you couldn't do the amount of volume of arithmetic and you couldn't use some of the methods that were being used, because of the volume of arithmetic and... iteration, the one thing the computer can do that other systems can't do is iterate and iterate and iterate and iterate. And that's a powerful, powerful methods then. So you can use methods you couldn't possibly use longhand.

*What difference does actually being able to use the iteration mean? Is there any sort of particular engineering significance of iteration?*

Well yes, you can get a better result, a better optimum result. In fact, you know, for example, in Cheshire we've got the Cheshire standard beam which comes from iterating lots and lots of beams to find the optimum cross-section. And so the Cheshire standard beam was adopted as the national beam. It was modified a little bit by the Cement and Concrete Association, called the M-beam, but it was essentially the Cheshire standard beam. And so the iteration was the great thing that the computer could do. So you could do finite element analysis and so on, which... and this is why you could do it with a road scheme. You could move the alignment, like this, keep iterating, moving the alignment until you could get minimisation of travel costs and going up and down, minimisation of excavation costs. So that's optimisation system which later came

into being and programmed by the TRRL. So that was the main breakthrough. For example, with drainage, and we didn't use the Ministry of Health rainfall formula in Cwmbran, we used the Newport formula, which Colonel Borlase had measured all the rain and it never rained so much since. But...

[interruption]

[end of track 3]

[Track 4]

*I had one other question about computing in this. I was wondering how the other civil engineers you were working with actually took to using computers?*

Well, they never offended me by saying they wouldn't. I think that I put a lot of pressure on, but they all got fascinated by the time they'd finished. By the time they'd accomplished the goal of understanding how to do it there was no looking back. Jack Evans was a friend of mine, wrote a program for drainage. It's a much more difficult complex system of calculation than you suppose. There's two methods: one just the one that was used before, the TRRL produced this hydrograph method and the real critical variable is the time of concentration, which is the time that it takes a spot of rain to get from the catchment area to where you're going to measure it. And if you can slow it up you get less flooding. So storing water either in a flood plain or just absolutely setting out to have a storage basin for water. And in Cwmbran there are several basins which holds the water up during the rain and allow it to flood off afterwards.

*In that case in particular, what value was having the computer?*

The volume, the number of catchment areas. [pause] Oh, people can't hear that. There's a number of iterations go around and you can keep changing the slope of the drain to optimise the, reduce the cost and optimise the flow.

*Did you get interested in computers?*

Sorry?

*Did you get interested in computers? And what was driving that interest?*

Only what they could do. I wasn't interested in being able to design a computer or anything like that, but they're useful and this was really tremendous. Even things like concrete cubes. You can plot the results for concrete cubes and you can project forward and say if this goes on you're going to have some failures in two weeks' time, and then that props it back up again, more care.

*What's a concrete cube?*

Six inch by six inches by six inches, and what you do is you crush it and the stress, the stress result, you know, it crushes at 6,000 pounds a square inch, whatever, that's your... if it gets down to 5,000 pounds a square inch, you're in trouble.

[04:00]

*You mentioned that the main sort of road project that you were working on, was it Western Avenue?*

Western Avenue.

*Could you describe to me...*

Eastern Avenue, it's East... Eastern Avenue.

*I was thinking, my knowledge of Cardiff is a little bit hazy these days, I couldn't remember which it was.*

No, there is a Western Avenue, but that wasn't to be improved. Eastern Avenue is...

*What was Eastern Avenue, or is Eastern Avenue?*

It was a minor road that was getting overloaded and so the idea was to have a distributor to Cardiff so you could get into the central area of Cardiff several ways. And the – what's the name of the interchange? Anyway, there's an interchange, got a three-level interchange and that's where the English BASIC functions came in. Trucks travelling over the top of it, we had to calculate what the transverse deflections were. And so we made up the method.

*Could you give me an idea of the scale of what was involved in the case of Eastern Avenue?*

I can't remember... got priced, but the scale was significant. It redistributes the traffic to give access to the central areas and to parts of Cardiff and I think it's about 20,000 PCUs per lane, per fourteen hour day.

*What's a PCU?*

Passenger Car Unit. Which was a big improvement on the quantity of the traffic that could get through.

*Is a PCU a measure of capacity then or...*

Well, it's just the trucks get two cars, or whatever it is, you see, so that the number of PCUs really allow for the number of heavy goods vehicles. But now it's all in vehicles per.

*How do you actually know how many PCUs there are going to be?*

You go out and measure it. You measure the existing flow. [pause] There's a paper here saying how to... ah, never mind. What you do is you observe the existing traffic and you have a different network after the road is built, so you have to reassign the traffic, and reassigning the traffic by cost, or cost and the perceived cost and the perceived cost is partly time and partly cost. Alpha TIJ plus Beta CIJ, and what you do is you infer the values of Alpha and Beta from the existing survey. Now you've got a model which you can either put into the past or into the future. So if I go into the future, instead of having origin and destinations, I've got generations and attractions, like Telford New Town wasn't there before, it's there now and it's generating its own traffic. Where's the traffic going to and coming from? So you have to get how much space is devoted to shopping, schools, so on, and each one of them, those trips generated by demand. And now you have to assign that to the network and hopefully the fact that you've got it right in the present means that you're going to get it right in the future. But of course as the planners make a different set of judgements than the ones you've worked on, you're going to get it wrong.

*How accurate a process is it?*

It was very good... there's the paper over there. Oh now, I was going to show you the graph. Is that it?

*I don't think so, that looks like a letter.*

Well, I'll find it for our next occasion.

*Just a general idea of what... of the sort of graph that would result.*

Very close. And take it, you don't finish the survey now, you do the survey for now and then you make a projection and later on you do the survey again. See whether you were right or wrong. And of course you'll be a bit wrong. And a bit right.

[10:04]

*Are there ever any times when it goes horribly wrong?*

Yes, it did... I was very keen, because engineers were coming to my office as Under-Secretary and I'd question them on the traffic flows, they didn't do so well. So I thought that everybody ought to have a mathematical model like the Midlands and by this time the economics directorate were putting their foot in and I handed it over to the Chief Highway Engineer and Maurice Maggs was in charge of engineering intelligence and my idea was a regional model for every RCU. In other words I expected the behaviour in Leicestershire to be very different from that in South Wales. But the economic directorate wanted to have a universal model and they couldn't get the screen lines to match up with each other. In other words, it failed to calibrate. But they collected so much information, the information was valuable in its own right.

[11:30]

*Back when you were planning Eastern Avenue, was it a job you used the computer for or...*

Yes, reassigned the traffic, but it was all pretty crude, crudely done as though there were no other desires... you see, the new road makes changes. You put a new road in and oh, I used to go to Birmingham along the M50 but I now go to Birmingham along the M1, or whatever it may be – M40 rather. And so people's habits change because you've changed the network. So this is why you need a model to be able to describe how the changes are being made and we agreed with all the county planning officers what the background would be to calculate the attractions and generations. So there's a predicted population for Telford and that's going to generate so many trips to school, so many non-home based trips, so many shopping trips and so on, leisure trips. And so you've got all these categories and you shove people into the categories and then find the extent to which they are being distributed around the country. And we used two consultants:

Freeman Fox and Partners and Wilbur Smith, who were American. And so we were only doing what America had already done.

*These two consulting engineering companies, are we still talking about the Eastern Avenue example or a different one?*

No, no, no, no. [inaudible] In other words, absolutely crude in Cardiff, only simple little changes you make, whereas when you get to a whole region like the Midlands, you've got a rather different problem on your hands. So it's simple stuff in Eastern Avenue, in other words, all the traffic running along this road will transfer to the Eastern Avenue. And unless there are destinations for them to take before you get... so Eastern Avenue doesn't make a difference to them. It's got to make a benefit for people to transfer.

*In the case of Eastern Avenue, is it you doing that sort of calculation work?*

No, no, the roads people were. Oh, that was the lowest, we were the structural people.

*What sort of hierarchy is there?*

I don't know. I guess that bridge engineers always thought of themselves as best and the road engineers always thought of themselves as best.

*As a bridge engineer, why did you consider yourself to be the best?*

No, I didn't consider myself to be anything, I was interested in doing the job. In other words, I was interested in traffic engineering and Ed Stuart became interested in it as well. And we gee'd up the road section to use them.

*Did you think that Eastern Avenue was important?*

Oh yes. Yes, a distributor to Cardiff. Cardiff would be in a bit of a mess now if all that traffic that's on Eastern Avenue would be filtering through roads in the town.

*Thinking about it, the road is still there, how do you think that your predictions back in the late fifties have matched up to what's happening on it today?*

Hardly at all. Hardly at all. But updating, updating surveys make a difference. You can keep updating. But we had a really, quite a good model in the Midlands, it did its job well. And supported the new town of Telford.

*What did you actually enjoy about working in Cardiff?*

Oh, it was South Wales. Go and see the rugby matches. We played tennis against Cwmbran and County Council and it was a good social life.

*Was there much social life attached to the job?*

Yes.

*What sort of things?*

Well, a night out together with the boys. Sing rugby songs and generally yatter about how to do things.

*Was there anything particular you enjoyed about your work?*

I hadn't thought about it as enjoying the work. Being interested in the work. Enjoy is a different sort of concept. Interest is the thing that drives you. How is this going to work out, how is that going to work out? I mean I've always come up against a problem and not wished to let it lie. Nibble at it like a dog nibbles at a bone until you find a solution of some kind or another. It puts people's nose out of joint sometimes. I took all the work that the Cement and Concrete Association had done on concrete hinges and I put a new theory on it, which didn't please the bloody Cement and Concrete Association one little bit. [laughing] And Best – not Best – Base [interviewee was referring to Geoff Base] was the researcher who was doing it and we both spoke at the same conference. My presenting why it worked and him presenting results.

*And how did you both get on at those conferences?*

[18:35]

I got on well with the people from the Cement and Concrete Association. When I was at Cardiff I went there on a teach-in on distribution in the deck, depending on how torsionally stiff it was, if it wasn't torsionally stiff at all it deflected a lot, that's why we had to use English BASIC functions. But the TRRL – not the TRRL – the Cement and Concrete Association had worked it all out and all you had to do was calculate a certain parameter and then it gave you all the coefficients of the transverse deflection.

*What actually...*

Am I sounding a bit technical there?

*I was actually just wondering what the Cement and Concrete Association actually was?*

Oh, it's... well, it's the same as the BCS [sic] which is the British Steel Corporation. Its interest is in pushing steel and the Cement and Concrete Association are interested in pushing concrete. And therefore they've set up their own research departments. But the Cement and Concrete Association has been much more upfront and more competitive than British Steel.

*What's...*

This is why Tinsley... well, we'll come to Tinsley Viaduct next time. But this is why they were keen not for concrete to win again.

*What sort of relationship did you actually have with the Cement and Concrete Association in your job in Cardiff?*

Oh, I just went there on teach-ins, courses. I went there for courses on road foundations and structural analysis. And I got on with the people there, I know Best pretty well and Ray Sharp and so when you're on a course you do nothing but tiddle in the evening and you get to know people quite well.

[21:08]

*Why did you actually decide to leave Cardiff and go somewhere else?*

Well, it's obvious that Cardiff was going to turn down, it actually didn't, they got a few good bridges, but it looked as though it was coming to an end and I was keen to get on to motorways. So M1 was **the** motorway and West Riding was West Riding. West Riding had a good reputation. And some of the best friends I've made have been from the West Riding. Joe Sims, Norman Buchi. They'd already built some big bridges. They built the Doncaster bypass and Joe Sims had done a lot of pre-stress work. So we got on well together.

*What took you to West Riding in particular?*

Because of the quality of the work they were doing and Colonel SM Lovell was one of the great tyros of... he and Sir James Drake were the two motorway kings. In fact they apparently, Stuart Lovell and James Drake meet on the top of the Pennines and James Drake says, 'Do you know, all with me, only half the buggers do any work'. And Colonel Lovell says, 'It's the exact opposite in West Riding'.

[23:08]

*Did you get to know Lovell and Drake?*

Oh yes, I knew Drake very well, he was a great man.

*Can you describe what the chap was like to me?*

Well, he became Director of the North-Western RCU and I was going to the Midlands, so he called me up, demanded that I came up to his office in Preston and we had an afternoon together where we walked around his office and he pointed out all the things he'd done in Preston and was a kindly man, very kindly. Stuart Lovell was very much more the harder type altogether, but James Drake was a lovely man. In fact he tells his own jokes. If you wanted to find out... you pick up the earth, the earth you going to put down's got to be at optimum moisture content and what you do is you take a little sample of it and hold it in your hands like that. Now if it's very, very wet you'll soon know. If it's very, very dry it'll crumble. If it's got the optimum moisture content it'll stay solid. And they had some cow belly down on the Preston bypass and

Jim Drake went with his lab technician and said, 'Well Mr Morris, what do we do about this?'  
And Morris said, 'Well, on the one hand, but on the other...'

*What was he like professionally?*

He was good. He was good. And he had a staff that really adored him. There's Dai Evans who was later Director of the Eastern Road Construction Unit, in due time. And they all loved him, they all loved him.

*When you describe Lovell and Drake as the motorway kings, what did you mean?*

Well, they'd done the work, see. You know, they'd pushed and pushed the government to put money aside. They were all part of the County Surveyors' Society trip abroad to see Hitler's motorways and American motorways and they kept being motorway addicts until the government was ready to finance it. [25:57] Because after the war you see, it was Churchill who first agreed the motorway system, because after the war was concern to Churchill and one of my predecessors as Chief Highway Engineer drew the first sketch map of the motorway system in the country. Because you know how the A system works do you? Well, if you take London, A1 is due north and then you go clockwise around – A2 into Kent, A5 down back to Wales, and so on. And now the first road off the A1 is the A11 and the second road is the A12, and you can get to three numbers. Now, trunk roads, those are all trunk roads and they're looked after by the county councils. Only when you get a big job there's a fight between the county council and the consultant. Consultant wants to keep his workload up as well. Now, I'm running ahead of myself again. But when the RCUs came along, this was Bill Harris's, Sir William Harris, his idea, because he was concerned that resources were being abused. In other words, you'd build up a bloody great team and then the road would appear in another county and the next county wants to build up a big team. And they'd snatch all of them from the one... And so what he wanted to do was run the whole system so that the resources were uniformly used. And this is why I fell foul of the Shropshire County Council surveyor because I gave the scheme to the, New Town, to Sir Owen Williams and Partners. That wasn't appreciated. But it was appreciated by Owen Williams. And what I tried... oh, I won't go on to the Midland RCU now, keep it for again.

[28:40]

*On the subject of West Riding, you mentioned that motorways interested you – why?*

Well, because the work was interesting. It was proceeding in new directions all the time. The BIPS thing – British Integrated Program Suite – was all, it was all a ferment of computers and that's why I got the job, is because I'd been using computers.

*I...*

And this is how I got the job in Cheshire as well. I gave a lecture to the Local Government Association in Harrogate and the... Chief Executive of Cheshire County Council was present and decided... and he approached Lovell and said could he come and work for us, and Lovell said, it'll do your career a lot of good, go and work for Cheshire.

[30:04]

*I was interested though in the way that you said when you were talking about Cardiff and deciding where to go next, the M1 was the thing. As someone was building roads in the 1950s, how did you feel about the coming of the motorways?*

Well, they were necessary. I mean you wouldn't remember because you're too young, but the road to Brighton, for example, was stuffed full of miles and miles of stopped traffic on a weekend and the roads were running... the traffic was – where are we? I wrote down somewhere the volume of the vehicle stock and I modelled the vehicle stock and put a curve on it to find out where we'd be in 2050 and if you start in 1900 and say there's virtually no traffic on the roads, other than horses, and then you plot through 1900 up to 2000, it's like every other good on earth, every other good that is sold starts off slowly, climbs in demand and then turns over and becomes saturated and then goes down again as another vehicle takes... I mean what's going to take the place of a motorcar is a self-drive motorcar and then all the old motorcars will be... So saturation is when the vehicles falling out of the stock are equal to the vehicles coming into the stock. And so you can use an S curve to fit it to the... and I fitted it somewhere and it's around here somewhere.

*It's alright, I can picture an S curve, we're okay.*

Right, you're okay. Right.

*Back in the 1950s though, I'm just trying to sort of think what sort of emotion motorways might inspire in someone who's building roads.*

Well, building anything is something. Absolutely just building anything. Making a change for the better. Putting your mind to work on solving problems.

*Was there any particular attraction to motorway?*

Well, it was the best of its kind wasn't it? I mean you don't want to be, waste away doing maintenance on the county council highways. You want something new and invigorating.

*Did you think about yourself as being ambitious early on in your career?*

I didn't think of myself as being ambitious. I wasn't doing it to have the job. I was doing it to do something with the job once you'd got it. I think that motivated most people who were in the highway business.

*What was your actual job in West Riding?*

Bridge engineer. But also did a lot of work on levels on the road and picking up the mathematics for laying out the road. And because we were using computers I got asked questions by the roads people, so the roads people were on courses in Bradford University, because I got on with Dr Ord-Smith who was the computer specialist at Bradford University and he was only too anxious to have a lot of people coming to his courses. So that's... and Stuart Lovell, you know, he and I got on very well because I was satisfying his urges.

*What were his urges?*

Well, he wanted to build more and better roads than Jim Drake.

*Was that actually his stated ambition or was that just...*

Oh no, it was his behaviour. [laughs] Absolutely clear.

*Can you give me an example of that in practice?*

No, it's hard to say, but somehow or other he was pleased that I was, we were doing more computing than Lancashire County Council. So he was pleased with that and we were doing some unique designs because of the mining subsidence.

[36:05]

*What was the problem with mining subsidence?*

Well if... in West Riding the seams are shallow and as you take the core out and let the roof down you get a wave going through the ground, just as though the tide were coming in, and if your bridge is on the... sinking, it's on that curve, then your bridge has to take torsional stresses that are really quite significant. Now, it's calculating how much movement it can stand, what you ought to resist and making a bridge which is three-dimensionally statically determinate. Three-dimensionally statically determinate.

*What does statically determinate mean?*

Can I explain that if I'm putting a theodolite up it's on three legs and so to get the table level I can put the screws and get the table level. Now because of the problems of mining subsidence, you want a bridge that'll move and go back again afterwards. So it means making it three-dimensionally statically determinate. And they decided, or the department decided this was such a problem, because I mean I was trotting up and down to London saying, look, we've got problems, mining substance. You can't buy, it's bloody expensive to buy a pillar of coal, you can't buy a pillar of coal to keep a bridge in place. So what you want to do is have a bridge which can move a bit. Right. So that's what bridge design in areas of mining subsidence is all about. And now the three-dimensionally statically determinate solution is one for the West Riding, which is a railway bridge, but one from a national competition and the national competition was they set up a committee, the usual civil service thing, to look for, to set out a prize for who could come up with the best bridge for this area of mining subsidence spanning the River Calder. Well, obviously we'd been talking beforehand to consultants about the same problem and Gifford was one of the people that I got on well with and he's – EWH Gifford and

Partners were a well-known consultant – so he was the one who came up with the three-dimensional statically determinate bridge by being on three points. If you're on three points the bridge moves but it doesn't distort. And so Gifford won the competition. Actually there was another group who were second and they were all put away for corruption. Who was it in the North-East... Maunsell's? No, Maunsell's were the engineers. It was an architect. Anyway, they had been caught in corruption so he was glad they were second and not first.

*What does a three-point statically determinate bridge actually look like if I were to see one?*

I can show you.

*Could you also describe what one looks like, you know, for the tape, please?*

Let me show you first. [pause] If I got a plate like that and I want to do this sort of thing, I got a thing on three points, it doesn't move. It moves in accordance with the way the ground is moving. In fact, if I... I should get out a piece of paper now and have it on three points and move the book about. And it means you can find all the forces in it for the amount of movement that it makes under mining subsidence. [pause] There's the Calder bridge. Now that's just one pier on one joint and on this end it's got a pier on two joints. So it's three pins, which makes... and one end is called an anticlastic hinge because it can move like that, it can move like that and it can move like that, and it can move like that.

*Could you describe what all three of those movements actually are for the...*

Yeah. If I drew a mining wave it's got a limit this way, because it's only the piece of core that's been taken out, right, and so what you've got is a distortion here like this and back again on the other side and up ahead you've got a wave form like that, and that's how the earth is moving, right? Now what you can do is you can draw a bridge to the same scale and with tracing paper put it over the deflected shape and find the worst movement, that is either strain which moves back and forth in the ground like that, moves like that, or moves like this. And you can account for all those without inducing an extra force in the bridge.

*It's alright for me because I can see what your hands are doing, but I was just wondering if there's any way you can explain that for someone who doesn't have that benefit?*

Erm... the shape of the deformation in the ground is known. You can put the bridge on the deformation to find the worst movement in slope, in extension and in circle of movement. And with those worst effects you can design the bridge to respond and the easiest way for the bridge to respond is if it's three-dimensionally statically determinate. You do not induce any loads from the ground movement. [laughs]

*I think I follow that. But if I were to sort of just be, you know, a complete layman knowing nothing about bridges and I were to be standing looking at a three-dimensional statically determinate bridge, what would I actually see, what would it look like to me?*

Like any other bridge, except it's on three points.

*By points you mean the sort of stilts the bridge is on?*

If the pier is coming down here, it's got one pier on to one joint and at the other end it's got two piers on to two joints. So it's like a theodolite which you can move the thing up and down until you get the plate level.

*What's a pier?*

Oh, that's the column that holds the bridge up. That's right.

*Okay, I can see this now. So it's a sort of bridge going over the top on three...*

Now you can see why...

*...on three pillars.*

...we were so keen on the Wichert Truss.

[45:09]

*What's a Wichert Truss? Again, could you explain what that movement is for the...*

Well, the Wichert Truss has got main span and it's formed a delta shape over the pier and at this delta shape it's got a hinge at every intersection. So it's four hinges and those four hinges can put a reverse moment on the centre span, which has got all the economy then of a continuous span girder without the stiffening effect. So it's statically determinate and yet it can put a bending moment on the centre span. Now, the clever bit is that the pre-stressing cable goes through the top hinge, but sagging, that's right. Goes through the top hinge, so the compression in the top hinge is full on, the pre-stressing cable puts the hinge under three-dimensional compression. The tri-hinge at the bottom is bound to be in three-dimensional compression because it's got three hinges and the two hinges at the side are also a concrete hinge. So if you know how the concrete hinge works you can do structures like this. So we went to Leeds University [laughs] and we tested it and it fitted in extremely well with my bit of theorising.

*So the Wichert Truss comes along as another way of...*

Yes, it's, to be honest it's a bit of a gimmick, but it works.

*Where does the idea come from?*

A chap called Wichert, who did it in steel, had hinges that were in steel and he found it was more economical than a continuous span bridge in steel.

*Was he someone who was working at West Riding or somewhere else?*

No, no, no, Wichert's German.

*How do you find out about it in West Riding then?*

Reading.

*What sort of things?*

Structural analysis, about girders, all on girders and this one came up. Said well, Christ, they can do that in concrete. And the other thing is, aesthetically you see, because I've got this delta I can make this leg of the delta parallel to the slope of the ground, significantly aesthetic.

*How did you actually go about testing this at Leeds?*

Put it in a three-way compressor and then moved the leg and the hinge was so good that the jack punched through the leg and didn't disturb the hinge a bit.

[49:25]

*Could you explain to me the idea of a hinge in concrete on a bridge?*

Yeah.

*Obviously I'm familiar with how a door hinge works, for instance. Is it the same or is it different?*

No. It's the shape of the hinge. The way the concrete hinge... the concrete column's coming down like that and then you nick it in like that. So it's got shoulders, right? The shape is sort of... no, no. The shape of a single hinge, it's like that. And the point about this is, this is uniform compression up here, and these lines go through like that. I'm not drawing this very well, so forgive me. And so this concrete that's in the hinge there is kept in three-dimensional compression, therefore it doesn't ever have any tension to break it, except if I turn this pier into a position like that, I will break the hinge, but I will have increased the load on the bit that remains. So it works even better.

*Thank you.*

Now, all you've got to do is draw that three ways. Put three columns coming in to...

*Okay. I think I can just about see this, but I think we're going to need a picture of it.*

Let me draw it for you.

*I think it's okay, I think we can probably get a photograph which will do the same job and...*

Well, the one in the book.

[51:40]

*You mentioned that there was something aesthetic about the Wichert design, the Wichert Truss. How important are aesthetics when you were designing a bridge at this time?*

I think it could be quite important. I think to have it looking nice is rather better than having it not nice. Aesthetics are important in the whole business of motorway... the impact of the motorway on people, noise. For example, the property that... you've got a property and the noise goes up from your window frame to above sixty-five dBA, you can now have double glazing and the compensation is paid to you by the district valuer. Now, the - it's like a market, the district valuer settles the prices which means that there's not too much reference to the Land Commission, you know. In other words, he's doing a deal. Now what we were able to do at the Chief Highway Engineer's department was calibrate what the district valuer would give in compensation for a change in noise level. We got all the information of the past and fitted an equation to it so we were in a position to say something about the aesthetics, because trees don't do anything about noise, but gases and carbons and so on spray down the bank and in fact it's disrupted kids' education in the Midlands. The noxious fumes that were put out by vehicles going past schools. So a part of the appraisal at the consult the public time is putting up a table of environmental impacts and ACTRA and SACTRA – that's the Advisory Committee on Trunk Road Appraisal put before them how it impacts on people who are still living in the place, people in the town, and you've got all the impacts on the people and put it in the consulting, consultation papers. Now the best one was the M54 because it got down at the public enquiry not only being a choice between the three roads, but what was the worst damage aesthetically. And so we set up an architect with an office in the middle of the road and let everybody come to him and see him privately. And he made recommendations about trees and noise bunds and so on, and satisfied people that we were... that they wouldn't be disturbed by noise, they wouldn't be disturbed because the trees would fade off the motorway, the motorway was going into cutting where it had to. And so the architect and the architect's report came on my desk and put up to headquarters and all accepted after about three or four enquiries. And – is the microphone still on? Can I switch it off?

*Yeah.*

[end of track 4]

[Track 5]

*I was going to ask you one or two final questions about your time up in the West Riding and you mentioned that the Tinsley Viaduct became a cause célèbre in your time there.*

Yeah. I was made responsible for Tinsley Viaduct but it had already been largely designed as a pre-stressed concrete girders with these trusses to have two decks, it's the first multi-decked viaduct in the country. When we went out to tender we had tenders back from steel manufacturers as well as normal contractors, had got together to decide that they were going to make the bridge a steel bridge and they put in a bid which was one million pounds lower than the bids they were putting in for the pre-stressed concrete bridge. Much to the chagrin of the County Surveyor, Colonel Lovell. And so we set about trying to find everything we could that was wrong about a steel girder bridge and we came up with some of the buckling problems and so on which later were to emerge as a real problem. And also several other problems to do with mining subsidence which Freeman Fox and Partners who were the main consultants behind the new concept felt... what was I going to say? That Freeman Fox felt that mining subsidence would not take place, that's it. But it was shown on the soil survey, there was... but they convinced us that... Later on in life I was Chief Bridge Engineer in the Chief Highway Engineer's department and we had to strengthen the Tinsley Viaduct because many of the problems we were speaking of when we were opposing the steel solution had come home to roost. And so we put in bracing columns like this to strengthen the bridge and when you had discounted the cost of the maintenance, added it to the cost of the original structure, it was more than had been bid for the pre-stressed concrete structure in the first place.

*Why was Lovell against steel bridges?*

He wasn't against steel bridges, he was against the bridge going out of his care, be supervised by consulting engineers and not by the West Riding staff. In fact he felt it personally. Although he'd had nothing to do with the design himself of course, but nevertheless he felt ownership.

[03:45]

*What's a consulting engineer?*

Well, a consulting engineer is a group of firms who do design of civil engineering works and we employ them to be the equivalent of a sub-unit. And the idea was just formulating when I went to Cheshire. Well, first of all I put together a computer team with Norman Lee, I appointed Norman Lee who's made a major contribution and in fact is in Brian Hawker's account of the history of computers, and he's been a significant presence in the field. And at the time there had been a change in Director-Generals. Sir William Harris had been made Director-General Highways and he was concerned to reorganise the way roads were built away from county councils taking the major share and as this moved from one county to another staff would get laid off and would move to the next county. It wasn't the best use of resources. So he decided to have a regional structure in which using the resources widely was the main concern, so that when Owen Williams came to the end - for example, in the Midlands - came to the end of the Midland Links, they got to the M54, much to the displeasure of the County Surveyor of Stafford and the County Surveyor of Shropshire. [laughs] But there was enough work for the Staffordshire sub-unit, but not enough work for Owen Williams to keep his expert staff. So it was the balance of resources which made the decision.

*Right. So you sort of have, you move around the consultants really...*

Yes.

*...but you keep the regional sub-units in place then?*

That's right. So Freeman Fox were well known and Sir Owen Williams was as well. Howard Humphreys. In fact, there were a number of consultants were drawn upon. [06:37] But when I was in Cheshire we were visited by a team trying to establish the framework of RCUs and sub-units and they were inspecting the county councils for efficiency and whether they had good people or not. Anyway, in the north-east, north-west we had Cheshire and Lancashire as the two sub-units in the north-west RCU and James Drake who had been County Surveyor of Lancashire was appointed the Director of the north-eastern RCU. So my role was to negotiate the sub-unit agreement with the department, because the investigating team that was coming around had made a recommendation that Cheshire should be a sub-unit and now you need an agreement, so negotiating that agreement fell to me. And I was impressed with the intellectual quality of the team that was coming around from the Department of Transport. So we managed to point out all the things we were doing; computer team, critical path analysis for the programming of the

highways, and so on and so on, and especially our relationship with London. I'd gone out of my way to make CUA welcome in Cheshire. CUA is the Construction Units Administration. George Cockerham was the assistant secretary and so I linked arms with George Cockerham in making submissions for the preliminary report, firm programme report, compulsory purchase orders and so on. Got the full help of the Department of Transport and instead of opposing the Department of Transport got all their help and resources to make it stick.

*What did the Department of Transport take of your helpful attitude?*

I think that they were quite happy with the negotiations with the sub-units and when the appointment of directors of the RCUs, nearly all of the directors' jobs went to established county surveyors and assistant, deputy director, deputy chief highway engineers from the district regional DRE set-up. And there was one job left, which was Director of the Midland road construction unit, which I applied for. Got interviewed and I was asked at the interview whether I would take the deputy's job. I said, no, I could make a better contribution as superintending engineer of the Cheshire sub-unit, because everybody was going for the deputies' jobs, you see. And I thought well, strike out, and I got appointed to it and I got on well with the Director-General, Sir William Harris. And so Midland RCU was an RCU which was somewhat different from the rest. For example, if you were the south-western RCU you had the M5 down in the peninsular and assigning the traffic was an easy job, in the corridor they prefer to use the motorway. But the Midlands was a rather different kettle of fish. [10:56] Anyway, to finish off with Cheshire sub-unit to start off with. In order to get productivity in bridges I felt they should be all standard bridges with only a few exceptions where an exception was necessary. And so we designed the Cheshire standard beam, which was the cheapest form of pre-construction that you could make. And we published a paper on the Cheshire standard beam and the Cement and Concrete Association took it up, modifying the dimensions just a little bit, and issued it as a national M-beam.

*Why...*

Sorry?

*Why did you decide to come up with the idea of a standard beam?*

Well, it made the productivity on the drawing board very great. They'd just keep putting standard beams in. And there were other things to be done. Actually, the whole of the M56 and the Sale Eastern bypass arose out of a study that had been done in the south-east Lancashire and north-east Cheshire, the SELNEC Report, and so the M56 and Sale Eastern bypass were the bits that came out of it as reasonable jobs for motorways.

*Could you remind me, what do the M56 and the Sale Eastern bypass actually link?*

Manchester with the southern bits of Cheshire and with the M6 motorway and... And it just picks up the south-east Lancashire/north-east Cheshire traffic into Manchester, and then M62 across the Pennines.

*When you're building a road scheme like this, a motorway scheme...*

Well, there's a lot of ... the White Paper on roads set out a lot of sections of that paper, so you get the preliminary, the preparation pool – get a scheme in the preparation pool – you get the preliminary report, whether that's accepted and you finally get the firm programme report, which is announced by the Minister. And then that's in the programme and in the preparation pool you can expect to get that built within five years or so. And then there's all the procedures like the public enquiry, which got very common. On the M62 there was only one public enquiry and most of the people accepted there was going to be a motorway. As time went on, people objected more and more and more and more to motorways until it was virtually prescribed to have an inspector's enquiry, a public enquiry with every scheme.

*Why did so many more people object?*

Because of the feeling of environmental intrusion. If you've got a house and the noise goes up, you're not too pleased, even if you get compensation from the district valuer. In fact, I remember going into Manchester and proposing a noise bund and it had some posh houses downstream of the noise bund and one of the – and a lot of immigrants from pre-war in Manchester – and one of the women at the public meeting that I held on this said that why don't they have them for council houses and compensate us, they're not good for anything else. And I could feel the hairs on the back of my neck stand up. [laughs] My own prejudices began to show. But you keep it to yourself.

*What's a noise bund, sorry?*

Oh, people seem to think that trees depress the noise levels. They don't. They had no influence very much on the noise level at all, but noise bunds, that's a solid embankment with the traffic here, deflects the noise away, so your two armaments in environmental amelioration was a noise bund, false cuttings and trees to change the view.

*In the case of the Manchester example, where did the noise bund end up?*

Oh, it got built. Got built, it's part of the earthworks. And you could work out the value of a noise bund because we had a model for what the district valuer would appraise it, is based entirely on the noise. You can calibrate the noise level and what the district valuer was likely to compensate. You see, it's like a market. The district valuer makes settlements which goes straight to the Lands Tribunal as an objection, then he's not doing very well. So the market is keeping the reference to the Lands Tribunal to a minimum. So the market sort of works it out. Sale Eastern bypass was, before Cheshire picked it up we had about two consultants and Manchester doing the work there and all three sections were a different solution. [17:40] One was a viaduct, one was an embankment and so we came along and said, well no, it's one bloody solution for the lot. And we took it over and we dredged topsoil and made playing fields out of them and dug the underlying clays and gravels to form the embankments for the Sale Eastern bypass, which ended up with ninety acres of marina within five minutes of Manchester. And we finally got it through the Sale local authority without a public enquiry and so it was quite a coup really.

*I've really been interested in the way that you've sort of described when you're building things like earthworks of sort of taking earth from somewhere and then knowing where to put it and you've got some other structure in mind.*

Yes.

*I'm just interested in the sort of way it balances out. But you mentioned things like...*

Well, you get a soil survey to start off with, you see. So you know the quality of materials you're dealing with from the soil survey. And then you can optimise the vertical alignment to minimise the total amount of earthworks. So you're looking for the cheapest scheme.

*How do you get things like marinas out of that? Are they a happy side effect or are they sort of planned as part of the process?*

Well, at the meeting with the Sale Eastern... I had one councillor say, it's alright for Mr Bridle to talk about a marina, but it's the Sale council who have to do something about paying to keep it up and keep it going. And I said, well I hadn't thought of it that way, I thought of a private company making it go, but if you want to do it yourself you'll have to tell me what you have in mind before we can cost it all. And he said, well we'll have to have a man to look after it. And I said, well you won't have to cut the grass. [laughs] And there was the laughter and I'm sure it's what got us through the meeting with Sale urban authority.

*I mean I just sort of think, things like marinas, I assume they're the sort of things that people actually want to have though aren't they?*

Yeah, I'm not sure at all now, it's such a long time ago, I'm not sure what's going on there, I'll have to ask my daughter.

*I can probably find out for you, it's...*

Yes, it's...

*But I just sort of wonder, you know, attractive features like that, I guess we don't normally associate with motorways, it's...*

Yes.

*Are they just, you know, a happy side effect or are they something that you're actively planning as part of the programme?*

No, it was a happy side effect. So when you got the opportunity to do it, do it.

[21:00]

*I guess one of the other big questions I'm really interested in talking to you about motorways is, you know, when you're designing and building massive stretches of roads, how much are you actually thinking about what difference they'll actually make to people's lives and how much are you actually just concentrating on building a great big whopping engineering structure?*

Well, you're trying to reinforce efficient system of transportation. You're trying to satisfy where the county planning officer wants to put new housing and so on, see. So the Midland was exceptional because there was a complex network and you could have all sorts of odd things happen. But – and the same in the south-east - but for Lancashire it was a straight M6, straight up the country to Scotland so all you do is you take the traffic that are in the corridor and put it on the motorway. Whereas in the Midlands RCU you can't do that, because all the planning is going to interact and you can have several ways through the network. So working the cost benefit analysis is a bit of a problem. But we'll come to that when we get to the Midland RCU. Now, getting on with London was important and I made sure that we got on with London. In fact we had no hesitation in, no problems in putting together the alignment for the public enquiry, the compulsory purchase orders, the reorganisation of the local road system had to have a section order with it as well, and so to get headquarters on side doing all this was a coup. See, many of the sub-units or the county surveyors were sub-units, felt that they wanted their independence, whereas if you're going to do the rationing of resources so to speak, you can't have any independence, you all have to work together. In fact, to use a modern phrase, we were all in it together.

*I was interested as well when you mentioned standard pre-stressed beams. I was just sort of thinking, you know, in terms of introducing a standard component like that, what did the other engineers you were working with make of the idea?*

They'd use it. You don't push it down anybody's throat. You say, this is available, this is what we're doing in Cheshire, you write a paper, put it in the *Highways Journal* and see if anybody else wants to use it. Well, the Cement and Concrete Association certainly did. But mostly all of it is personal relationships, you know. I mean when – oh, we'll come to that in the Midlands, personal relations. But this was important, I got on with Harry Yeadon who was the RCU man in Preston and Harry and I saw eye to eye and George Cockerham was the chap from

Construction Units London, Construction Units Administration. And so they came to all the meetings I had with local authorities and helped out whenever they could, make sure that everybody felt that London was on our side.

*Can I pause you for one second?*

[pause in recording]

[25:17]

*What sort of chap was Harry Yeadon to work with?*

Oh, first class. He'd been around a long time. We'd known each other quite a long time, when I was in West Riding, and he was a good chap and he was a favoured employee in Lancashire County Council because when James Drake left, Harry became County Surveyor. And he's a good all round chap.

*What sort of things makes a good civil engineering chap, in the case of Harry Yeadon?*

Ability to think about the problem and not about the people. So that you have to be persuasive, you know, you want to sort of get something done. And Cheshire became quite known for it because Norman Lee was, and Geoff Formstone were advocates of... Geoff Formstone went to West Riding as part of the BIPS team. I explained what BIPS – British Integrated Road Program – was before, and they had a team in West Riding putting together an integrated program suite and Geoff Formstone and Norman Lee provided the drainage part of it and alignment part of it. And in fact, one thing we did which was for Cheshire only was a thing called BEACH, which was Building, Estimating and Certification for Highways. Because when you start making an estimate of the cost, you produce a bill of quantities which measures how much earth you're removing, how much concrete you need, and a lot of... And you have to be a bit careful because what the contractor's going to do with your bill of quantities is so arrange prices that it will enhance his cash flow at the beginning of things. So one of the funny ones is that into the bill of quantities went 40,000 trees and three stumps, but when they got on site it was 40,000 stumps and three trees. Now you can imagine you've got a big price in for the stump and a low price in for the trees. So there's lots of negotiation by the time the tender got submitted, on issues of this sort. So Building, Estimating and Certification for Highways meant you kept all the unit rates

that you'd had in the past and you're going to update them by exponential smoothing. Now this didn't guarantee you a great deal more exact, but it helped you to put together a preliminary amount for the work. And so Building, Estimating and Certification for Highways was something which Norman Lee had done and it printed out the bill of quantities, it printed out the prices for the bill of quantities, it printed the specification. That's about it. I can't think of anything else at present.

[29:20]

*You mentioned that you'd got the job with Cheshire as a result of computing and I was thinking if you could give me some idea of how the sort of computer techniques you'd been using before actually developed over your time at Cheshire?*

Well, the languages changed. You wanted a universal language, which we had in Cheshire, but in West Riding we came along with the Stantec Zebra old code with the dots in the paper tape and pushing the paper tape through the machine. But we finally got on to the Treasurer's computer, which was a universal language thing, and the Aire Bridge on the A1 was a cantilever out bridge. Now you've got to be careful where you put the units, because you've got creep and shrinkage happening at the same time, so it's a fairly complex thing to know where you put the block and it finally comes together in a joint at the centre. Now, we ran a program for deciding all the stresses and strains that were going to occur and allow for all the creep and shrinkage, and we started to run the program and it ran so long that it held up the wages. We weren't exactly popular!

*Would you have had to do those calculations by hand before then?*

Well, you wouldn't have attempted to do it by hand, you would have tried to find some other solution.

*So you'd use a different sort of bridge?*

We'd use a different sort of bridge. But this means that because of the complexity you can use cheap... it's a cheap way to do it, cantilevering out, but you know, you've got to take care.

*You mentioned... I was interested, you told me before about how when you were in Cardiff you got all the other engineers on board with this idea of computing, apart from one or two higher ups, and I was just thinking, you know, a few years later in Cheshire, what were people's reactions to...*

Well, we'd appointed experts, computation experts. Norman Lee was... and what he did was find out what the engineers were doing and between them they could provide a solution in computer form. In fact the M56 was done that way - alignment, mass haul diagram - all that was done with a computer. And drainage. Drainage is quite a problem. The TRRL produced some means called a unit hydrograph and you split it up into catchment areas and you plot each catchment area flow and then you add them all together and iterate and the flooding depends on what's called climate concentration, which means the time at which it takes a drop at the edge of the catchment area to flow out the other end. That's the time of concentration and that's what we were determined to, how much rainfall it has to carry. Is that alright?

*And you can do all that on a computer?*

I can do all that on a computer.

*Could you give me an idea – I'm just sort of thinking, you know, obviously you were building roads before computers came along as well...*

Yes.

*...how quick, how much does it speed up the process?*

Oh, very considerably. Very considerably. The thing is that you haven't got half the staff that you would have had, had it all been done by longhand, I guess is a guide, just sort of say half the staff, I don't know off the top of my head but it's certainly something like that. [33:50] What else can I say about Cheshire?

*You mentioned...*

Part of it was across the bogs outside Chester and the idea was that you use a dredger. You dredge the material and dump it elsewhere and then you fill it up with sand and you build your embankment on that. It didn't happen because one of the contractors was clever enough to buy a local quarry and they just sort of removed the silt by digging and put the stone from the local quarry in, as it happens. It was cheaper, as it happened. But it was a shame too because I'd like to have seen the dredger working. [laughs]

*You mentioned, I think in something you said previously, that you looked at standard bridge designs as well for...*

Well, the standard bridge design was a mass abutment, a central pier and standard beams. And you can make this fit anywhere; all over bridges, under bridges, and you just make it that length. But we had some oddments where you had skew and so we tried a few... one of the things about boxes is that if you have a thin web the concrete is very expensive because you've got to get it in and compact it and so on, but with a thick flange the concrete is cheaper. So all you do is, you turn the box on its side so that the web has become slabs and the thick slabs become walls. So then you cast it up and you turn it around and you can go and cantilever out with the box.

*I'm not quite seeing this.*

Say you had to... the box has got a thin wall, a thick slab and a thick slab.

*These are the boxes you're using for casting the concrete?*

These are the boxes which you ultimately put up and stress back to what has already existed and cantilever out. Right? Well, if it's a thin wall and the concrete is very expensive, better to have a thick wall, but that adds dead weight, so you didn't want a dead weight added. So what you do is you turn the box around so that the slabs become walls and the walls become slabs. So you've got a cheap box and you turn the box around and you cantilever out with it.

*I think I can just about see that.*

Well, we did it later on in the department, the Coquet Bridge in Northumberland. And we just had slabs made for the webs and cantilevering out with the webs and then put in situ the slabs top and bottom, Coquet Bridge. But we'll come to that, I'm sure.

*Just a quick clarification as well, by webs...*

Oh, the web is the vertical wall of the box.

*Why's it called a web?*

I've no idea. It's always been called a web. It's one of those archaic terms, I suppose. Rather like the baker's dozen or...

[38:00]

*You mentioned as well, BIPS, is the...*

British Integrated Program Suite.

*You mentioned it before, is it something that appears in this period?*

Yes. It was put together by... we had some county councils who were very keen on computers, Durham, West Riding and Cheshire and the three of them got together to, on behalf of the County Surveyors' Society, provide a suite of programs to design roads and motorways. And so we seconded Geoff Formstone and the West Riding and Durham seconded people of theirs and we also had input from the rest of the country, Bill Gallagher did some work on cubic spines and so on, and so they were all brought together and made into the program suite. And the ground model was a grid. Later on you had different ground models on strings and so on and so it started to, once the BIPS were in place, people started to try and make it redundant by improving the ground modelling and so on. And ultimately at the TRRL, they had an optimisation program. I'll have to look up all the various – it was Minerva, Theseus, and what that did was take the alignment and move it slightly and see if it reduced the cost and then move it a little bit more until it wasn't reducing the cost. So iteration was the key to the optimisation and we, TRRL put together a suite of programs on optimisation for earthworks and alignment and the place it was – it wasn't used very much by the county councils because they had all their own little things

which they were going on with – but it was used in the Trans-European Motorway from Danzig to the Bosphorus. And we ran courses for Eastern Europeans at the lab, but that was later on, it was '79, '79, something like that.

*Thank you.*

But BIPS was the baby. BIPS was the start of everything. And to put it out of business, you had to improve things before you could put it out of business.

*How much of an improvement was BIPS over the methods that you'd actually started off with on the Stantec Zebra?*

Oh, it was a universal language. ALGOL? It wasn't AGOL, it was Fortran, which is, you will know of. And Fortan could be used on county council computers which the treasurers had only used up until then and now we had all these engineers galloping into the treasurer's department to run programs for building roads.

*How exactly did the treasurer's department take to that happening?*

Well, they weren't very happy when we held up the payment, but they were alright. You had to say how much good it was doing, how much less it was costing the county council. Said we'd need twice the staff if we didn't run it this way.

*Was that true or was that just something to tell the treasury?*

Something to tell the treasury. But I can't say what percentage we saved, but we were saving a very good percentage of people.

*Good. Is there anything else we need to talk about regarding Cheshire or would now be a good time to move on to the Midlands do you think?*

No, I'd move on to the Midlands.

*In that case I'm actually going to stop this.*

[end of track 5]

[Track 6]

Well, I was lucky going to Cheshire because I got on well with Sir James Drake, Harry Yeadon and all the other characters who were involved in Lancashire, because they were a big competitor with the West Riding, but I managed to get on with them in discussing various problems. And so when I came to Cheshire they were all glad to see me.

*What sort of people were they? You mentioned one or two in passing, but...*

Oh, when I got appointed to the Director of the Midlands James Drake had me in his office and we walked around his office talking about history and he was showing me all that he'd done. In fact he was quite... more a sort of numerate engineer than most of the county surveyors and in Blackpool he was the first to come up with a pre-flexed beam. And so you buckle it downwards, cast in the concrete and let it go and the concrete goes back into compression, see. And that was Jim Drake's idea. But he was quite a guy, he was... There's a little funny story actually. If you want to find the moisture content of the clay, whether it's optimum or not, you roll a cigar between your hands. If it's all wet it's too moisture... the moisture content is too great, if it crumbles it's too [incomp – interviewee meant "too dry"] and they were discussing whether they could use this cow belly on the Preston bypass or not and Jim Drake says to his soil mechanic, 'Well, Mr James, what have you got to say?' He said, 'Well on the one hand, but on the other...'

*What sort of chaps were the soil mechanics?*

Oh, they were dedicated to their job and we foisted computers upon them as well. One example, you could take cubes and you want to know when the standard of making the concrete is dropping, so you trace the cubes in time and you'll find that the compression at which it cracks, you want to say, now contractor, you'd better pick up your socks and do better or we'll be rejecting what you're doing. So there was a computer looking after the statistics of concrete cubes. It was a simple little program, but nevertheless had a great significance.

*Could you give me an idea, because you sort of talked about a lot of different sort of groups of people in passing, some individuals as well, I'm just wondering if, let's take Cheshire as an*

*example, if you could just tell me about each of the different sorts of groups of people that you were actually working with, in turn?*

Well, I was working only with the roads people and the bridges people and that was my... I had to take a Landscape Advisory Committee around the M56 and so on. So the RCU was the main conduit for submissions from the sub-unit, because that's what Jim Drake would insist upon and so all the things like preparation pool, the initial preparation reports, firm programme report, and all the orders for compulsory purchase for settling the alignment, the alignment for a motorway was Section 11 of the '51 Act? I can't remember. And the compulsory purchase order was a Section 9 and a Section 7 was a trunk road and so the side road orders were the other thing, to alter the pattern of existing roads to accommodate the motorway. Now all those had to be put together, these reports, and go forward and ultimately you were trying to make sure that you got the firm programme report which, from which the Minister announced that the road would go ahead. That's about it.

[05:00]

*You mentioned you worked with the roads people and the bridges people, what's the difference between the two?*

Oh, bridges were just bridges. The roads people came up with, we need a crossing, and then that went to the bridge people.

*I was just wondering about the people as well, you know, was there any difference between a road person and a bridge person?*

Nothing but experience. And so you had two teams: you had the people who were designing the road – earthworks, alignment, setting out, supervising the contract, the resident engineer.

*What sort of... just sort of thinking, if I were to meet them, what sort of people would...*

Outgoing mostly, outgoing. I mean they'd want to brag about what they were doing. And so do I. It was interesting, it was groundbreaking and it was a good time.

*What did you like about it? At this time in particular, at Cheshire?*

Oh, it was interesting because the standard beam, the road, the earthworks and we put a laboratory in the contract for the M6 so that we could use it on the M56. Whether the bloody department understood that I don't know, but they paid up for the soil mechanic laboratory and we had a chap in there running it.

*But he should have been working on the other...*

No, the M6 business was finished by this time and so didn't put the laboratory out, you know, make it redundant, kept it going. And not at Cheshire's expense. [laughs]

*Shall we take a break for lunch?*

Yes, please.

[end of track 6]

[Track 7]

*I'd like to ask you some questions about...*

The two bridge engineers who've made the most contribution in Cheshire were George Bushell and Tony... Tony... ah, dear God. Fryston. F-R-Y... Fryston.

*Why do you say they made the most contribution?*

Well, they contributed to BEACH, the standard beam and did a lot of work on the bridges.

*What sort of people were they?*

Bright. George Bushell's dead now. But Tony Fryston was a very bright chap. Took his time doing things, but he did them well.

*What sort of qualities do you look for in a bright bridge engineer?*

Not to get too excited about things. I suppose it's calm, rational and interested in what he's doing. Tony Fryston was in West Riding with me and one of the things he did was plot a non-dimensional set of contours for the mining wave going through the bridge. What he did was scale the bridge down to the scale of the deformations and orient the bridge on the deformations to get the worst effect. It was really quite clever.

*What does that modelling actually tell you?*

How much the base is going to rotate, how much it's going to expand, what slope it's going to be on and how big you want the expansion joint to be. You have a large expansion joint so that it can take up a lengthening.

*Lengthening from what sort of causes?*

Well, when the wave goes through the ground you get a strain in the ground which pulls the bridge apart, and you can have it on... the footing on the one side on the one bank, which is like

that, and on the other bank it's like that. And then you've got to know how to deal with the torsion along the beam. So with narrow bridges, like the Wichert Truss, you're relying on the torsional stiffness to deal with any movements which are like that.

*So, twisting movements then?*

Any twisting movements. But as for longitudinal expansion, there's no strain input.

*This is waves in the ground thanks to mining subsidence?*

Mining subsidence.

*Right.*

So Tony Fryston made quite a contribution to that and to the Tinsley Viaduct.

[03:50]

*I'd like to ask you some questions about your time at the Midland RCU. To start off with, what is an RCU?*

Road Construction Unit. It's the government made small to the region, in other words you're doing all the things that ultimately central Transport Ministry would be doing. So there are units at headquarters, which you've got to get on with. I had a... of the three sub-units which was in the Midlands: Stafford, Fred Jepson; Derby, Gordon Race; Warwick, David Morris, they all wanted their independence, they didn't want to be kowtowing to the RCU headquarters. I'd taken a rather different view of how to control this, that what you did was you set up specialist units at headquarters which would be drawn on. So you take the total mutual interdependence so that the sub-unit would look to the RCU headquarters as supplying traffic information, computers and all the administrative details. The Deputy Director was Gordon Lake, whom I got on with really quite well, but he was a funny chap and he said, he'd heard about this big Welshman coming to be Director and he really got on with the Welsh people but there was one difficulty that he couldn't surmount, and that was they continued to speak Welsh even though they knew he was English. And I said, funny you should say that, I get the same problem in France. But we, he and I did a tour of the Midland RCU, looked at all the principal opinion

shakers, that's chairmen of county councils, county surveyors and the planning officers. So they understood what we were about and that we were out to help them and what we were hoping was, they would help us in supplying information for the growth of how many houses should Telford have, how many shops, what factories, because we'll come to the fact that the Midlands was a dense network of interchangeable trips. And so we needed to find out how to forecast what traffic there would be. Now, what you get is the present time, so you can, for the present time take traffic surveys and find their origins and destinations and you can take their origins and destinations and see if you can put a behavioural formula which would be able to explain the existing situation. You also know from past work what Tesco's or Sainsbury's require in the way of lorry and transportation, how many trips they generate. You also know how many trips are generated by non-home trips and then there are trips to the... trips, shopping trips, trips to school. Now once you've got your iteration calibration function you can go into the future, but into the future, in the future you have different land use and different patterns of interchange, because if you've got a big place which is causing congestion you'll find the traffic'll go somewhere else, so you've got to be fairly good. Now, it doesn't say that your forecast is excellent and going to be what you'd... but it's good enough to do cost benefit analysis. A cost benefit analysis is working out the benefits of the road as to the number of trips and cost and you take it each year and you discount to get the net present value, which is the net present cost minus the net present benefit, or the net present benefit minus the net present cost. [09:20] Now, if you've got control of this at the central headquarters and you're supplying information to the sub-units, you already have your serfdom [laughs] because they can't do without you. So I set up a number of... we had first of all the Controller Administration who was Geoff Hanson and they were responsible for financial accounts, preparation of documents for public consultation, etc, etc. Submissions to HQ were channelled from the sub-units to the Controller of Administration who also put in front of me the Ministerial and Parliamentary Questions that needed to be dealt with and all those would go up to the units at headquarters – and I'll go on about the units at headquarters later on when we get to being Under-Secretary. So it was, the submission to HQ was the preliminary line, firm programme line and all the section submissions would go to CUA, that's Construction Units Administration. There was also a Construction Units Engineering who backed up... who asked all the questions about the preliminary line, preliminary report and the firm programme report and put it up to Ministers.

*Okay. So it was a headquarters organisation? Right.*

Right. So that was the Controller Administration. We also had a Superintending Engineer who was David Spearing, who was head of the roads who had three senior engineers, that's one per sub-unit, and they had to agree with the sub-unit's submission or ask the submission to be changed, and he had three engineers working for him who were expert witness for the three public sub-units.

*When you say expert witnesses...*

Stand up at the enquiry and present the facts, the submission of the case the department was making. And they would be in contact with CUE, that's the engineering at headquarters, who would also pass what they were doing. So then you had the bridge engineer who had three assistants as well, one of whom was a soil mechanic, and his job was to make sure that the specification for the bridge was as it should be, to specify the design criteria, the design and make, check to see that they were implementing it properly. And they also had to look after contracts, bridge building – that's the temporary works as well – and we had one real problem with the temporary works on the Midland Links [13:20] because although the temporary works had been agreed, which was to hold up a group of shops back here when the motorway was in cut down here. Here's the motorway, here's the in cut, you've got a vertical surface, and then another road across the top fronting a body of shops. So I've got to build a wall.

*Between the motorway and the shops?*

Yes. So the way to build it is to take a borehole, put an H-section joist down in it and hammer the joist home next to the hole here with the joist in, and between the piles – that's the H-section piles – you put a board in and the board is to hold the earth up at the back of it. So you cut away and then you prop the earth off the boards. Well, what happened was, they didn't and what you had was as you dug the earth away there was a gap of six inches between the work supposedly holding it up and free-standing earth. Well the free-standing earth fell against the timbers and pulled the foundation of the shops down, which had a beam right through all the shops. It pulled the beam over and it pulled all the bloody shops over. Now, whose fault is it? Contractors? Or the design engineers? Well, the design engineers had made an oversight, but the contractors had got on with it. So finally the contractor had to pay. So you get these problems of negotiation with the contractors and so the bridges people had to be on the ball with temporary works.

*In a situation like that, what's your own personal role? When something like that happens?*

I think the contractor has a duty to look after the works, as the contract has, in his contract that he's looking after the temporary works. But that doesn't stop you trying to supervise, warning him if he's not doing it properly. And Sriskandan and his boys in bridges should do that. And they also had to see that the specification was all in accordance with departmental technical memorandum and they contributed too to the computer. [16:42] So we had a computer group with three people in it to make sure that all the best and modernest programs were used and they would write their own as well, for earth pressure, they did one for me because I was interested in earth pressure. And they developed a program to work out the pressures and what needed to hold them up. Now, we also had... oh, construction group of course, superintending engineer construction, and I also had a quantity surveyor in those four people who was also good as the critical path analysis. Critical path analysis – do you know what it is? Well, you have all the jobs which you have to do, let's say making a cup of tea, you've got to carry the cups from the larder, put the kettle on, and some of these are necessarily follow activities which are already being done and so some can be tolerated, you know, they don't... So the critical path, all those activities which cannot proceed each other and any addition in the time that is taken or the cost that is taken is added to the critical path. So you've got to have an analyst who's good at critical path analysis to set up a network of activities which you are doing and to choose the critical path to make sure that those were the activities we were concentrating on and making sure that the target dates were met. It was more important that target dates were met for activities on the critical path than it was for activities off the critical... although you could make them critical if you wished.

*Why might you wish to?*

Because something had gone wrong. But with most things going wrong you generally tried to saturate it with resources and put it right to get back on line. It's like a hydraulic, it's like a reservoir. If you've got the preparation pool and it feeds into the programme so that the programme is never, is never held up for want of anything.

*What sort of things can go wrong? Could you give me one or two examples from your time at Midland?*

Unforeseen circumstances is the basis for many claims. And claims are a bit of a burden, because when I was Under-Secretary claims had risen to 900 million, so it needed an effort to settle a good bit of that on account and then argue about the little bits that were left. So Leslie Henderson, some note going on about units at headquarters – Leslie Henderson was Head of Contracts Division – and he and I, when I was Under-Secretary, toured the RCUs settling claims on account and we brought it back to a nominal figure of about 25 million or something like that. But it was getting a bit of an embarrassment, having outstanding claims, no-one settling them. So that was what you needed to look for. But no-one had to settle claims in Midland RCU because John Sharp, who was Superintending Engineer Construction had kept his eye very much on the ball and was a good chap altogether. I also have a lot of time for people who are going to be expert witness. It's a frightening job to do. You can get under attack from objectors and you've got to keep your wits about you and calmness should prevail. So that people who were in the roads section, Eric Hinkley was a particularly good expert witness, and so was Mike Whelan. The other chap was in Derby and didn't have much to do, but Eric Hinkley and Mike Whelan were really up against it doing the M56, Mike Whelan was, and Eric Hinkley was doing everything through the Warwick sub-unit. But they were good people.

*Were there many women working there?*

Yes, in the computer branch and in the administration. Typists and so on. And...

*Can I just adjust your mic, one sec.*

[pause in recording]

[22:44]

But you had to make lots of submissions to headquarters as well, post the preliminary report. Preliminary alignment and then the firm programme report and we had to agree with headquarters the preparation of all compulsory purchase orders, side road orders and rearrangement of the local trunk road system. So all those were put forward and agreed by headquarters.

*Could you...*

And so that's how it worked on a day to day basis.

*Could you give me an idea of where you actually fit into this structure? I'm guessing you're basically the boss.*

I'm basically the boss. I sign all Parliamentary Questions, go through me, and then go through the Under-Secretary CUA. That's Parliamentary Questions, Ministerial correspondence, inspector's report with my comments on it, and orders. And headquarters would, headquarter units would receive the reports and contribute their little bit of specialism.

[24:10]

*Who are you actually reporting to at headquarters? Is there anyone in particular?*

The Director-General, who was now Deputy Secretary. And there was an Assistant Director-General so the Director-General that followed Sir William Harris was a Sir John Garlick and later on John Jukes. And I was supporting them. Now the first job I got as Under-Secretary I had to set up an arrangement of consultation with local authorities so that the Parliamentary Under-Secretary of State would come to the RCU region and once a year meet with all the local authorities in that region to interchange their thoughts and see what needs changing – nothing ever bloody needed changing. [laughs] But that was to keep everybody sweet and happy. And of course some good things came out of it. You got some things, some activities raced along because objections had been removed. And also we had to meet once a year with the Secretary of State and the Metropolitan and Local Authorities organisation, County Councils organisation, and they'd meet with the Secretary of State. And the same thing, was to make sure that everybody was at one. And I attended as well, briefing the Parliamentary Under-Secretary of State and briefing the Secretary of State. So I had to make up the agenda with the local authorities before we met.

*Is this still in your post in Midland or is this later on?*

Oh, in Midland the Under-Secretary, Dennis Hazelgrove would come out supporting the Permanent Parliamentary Under-Secretary of State and I'd be there to help. In fact, when Barbara Castle came to the Midlands to dig the first sod of Spaghetti Junction, I went down the list of people; this is the roads engineers, this is the bridge engineer, this is the construction

engineer, this is the Controller of Administration and we got to the end and she said in front of twenty-eight reporters, 'And what do you do?' I said, 'I worry, Minister'. [laughs] Which she laughed, and got on alright.

[27:10]

*Could you give me an idea of what... could you maybe talk me through what happens in a day while you're at the Midlands RCU? Step by step. Where do you wake up in the morning?*

Well, it's the preparation of reports. Parliamentary Questions and Ministerial correspondence was a big effort which you wanted to get right. Looking after the Landscape Advisory Committee when they came to visit your area was, obviously I had to prepare for that. And I would still be interested in all the schemes and I would have to be briefed by the roads people and the bridges people, so on and the whole idea was they had to keep me informed and I would visit local authorities that were having a problem or two and try and sort them out. The Tamworth bypass, for example. They wanted to replace the Tamworth bypass by the M65, M65 I think, yeah. And that would be benefit to Tamworth, but Tamworth didn't think so, they wanted the Tamworth bypass. So I went to Tamworth with Gordon Lake and Fred Jepson and presented them with how much better it would be if they had the M67. And got away with it. They said fine, you know, if we do it as quickly as we could and we do it quicker than the Tamworth bypass, and we walked out and Fred Jepson said, 'You made some friends today'. As an old friend, he said, 'There's only one thing now' and I said, 'What's that?' And he said, 'You're going to have to bloody keep them'. [laughs] So it was responding to the unusual and solving, problem solving.

*Where were you actually based?*

Leamington Spa.

*Can you describe what your office is like? Or was like?*

Big.

*What sort of building?*

A two-storey building with all the clerical force downstairs, superintending engineers on my level and that was it. I think I've explained that we kept the staff to a minimum, but they were all experts. They were chosen particularly for their insight and they were good, they were good, because we had the opportunity to appoint them. One thing, if I take it off record...

[pause in recording]

[30:34]

Sriskandan was the chief... was the bridge superintendent, head of bridges section and he was the bloke I worked with on choosing, advising the committee on the Calder crossing bridge, Sri and I wrote the report for the committee and they chose the three-point support bridge.

*What sort of chap was he?*

I only heard him once, only once complain about coloured prejudice. And I said, 'Not in your case Sri'. And he said, 'What do you mean?' I said, 'In your case, class distinction'. [laughs] Oh, he was alright, he really was a good... and clever. And he still counted in Tamil. I said, 'How do you count?' He said, 'In Tamil'. Which is amazing, isn't it?

*Where was he originally from?*

Sri Lanka. Oh, one of the things that he... one of the little stories that... he worked on the bridge on the River Kwai for Husband and Partners and Keith Best, whom I knew as well, was the engineer who designed the bridge in the film and always complained that when they blew it up he felt like the colonel in the film. So did Sri. Sri worked on the bridge on the River Kwai.

*As a prisoner of war?*

No, no, no, no. As a junior engineer. They had to build a bridge for the film.

*Oh, you mean the film, right okay.*

The film bridge.

*Right.*

Because the bridge on the River Kwai wasn't anything like the one that was in the film, *The Bridge on the River Kwai*. Bridge on the River Kwai was a balanced cantilever in greenheart timber, but the one the Japanese were building was a simply supported set of spans. So they were all regretful to see it being knocked down.

*Who was the other chap you mentioned there, who you said designed the bridge on the River Kwai?*

Oh, Keith Best.

*Now, was that the film one or the real one?*

No, Keith Best was the engineer who was the head of Husbands in Sri Lanka. I knew Keith quite well, we used to play a bit of golf together and he was always at home when he came to the West Riding or to the Midland RCU. He didn't do any work for us because we were really in hock to Sir Owen Williams and Partners.

[34:00]

*When you say in hock to Owen Williams...*

Well, had to find them work. And they did a good job of things, you know. So the thought of going on to Shropshire County Council and starting a new sub-unit there or allowing the sub-unit who had other schemes too, to go and do M56 was not sensible. It was sensible to give it to Owen Williams who was coming to an end on the Midland Links.

*Did you know Owen Williams or, or is it Owen Tudor Williams or...*

No, I knew Owen Williams, Sir Owen Williams, because he used to come to the Midlands and we'd discuss bridges on the Midland Links and I got on extremely well with his son who was OT Williams, Owen Tudor Williams. And he, I mean we got on well because we understood each other. Now, he wouldn't build in anything but reinforced concrete. He wouldn't look at pre-stressed concrete, Sir Owen Williams. In the office in the front room I have a painting of the

Spaghetti Junction under construction. That was presented to me by Owen Williams, Sir Owen Williams. Or it was presented to the Midland RCU really, but I pinched it when I came away.

*Could you describe each of them to me?*

Yes. Owen Williams was a determined bulldog of a man who would chase any pre-stressed concrete salesman off his site, never to return and blacken the day. Owen Williams was much more amenable and thoughtful. In fact, we had one meeting which he came to with Staffordshire County Council and they were all for the line along the A5. Now, the A5 had a house, the houses, they'd all have to be bloody knocked down. You couldn't do that, even if it was the most cost benefit scheme. So we met in the council chambers and there was a piece of paper going along the rows and it was meant for the Chairman of the county council and it was from the County Planning Officer, and it said, 'Mr Chairman, has Mr Bridle brought anybody with him with any recognisable planning qualifications at all?' So I stood up and I said, 'Mr Chairman, I'm afraid I have to apologise to you because I have read a note that was intended... and it says here, 'Has Mr Bridle brought anybody with him with any planning qualifications at all?' Well, any questions you want to ask on planning, we have consulted with the Planning Officer of Staffordshire County Council who has given us his okay on the information that's going into the Midlands strategic traffic model and we have backing us at headquarters advice from economists, landscape gardeners and anybody else you care to name. And if you'd like to ask me any question at all I will answer it from having consulted with them'. And it all faded away. And OT Williams came out afterwards, said, 'Well done Ron'. It evaporated. Somehow or other, I don't know what it was, but it just evaporated.

*What was... sorry, was it the younger Tudor Williams who had a...*

Yes, OT Williams.

*...who had a problem with reinforced concrete? Sorry, pre-stressed concrete.*

Pre-stressed concrete, yeah.

*Why was he against the stuff?*

I don't know, it's just prejudice. He could build in situ concrete, reinforced concrete bridges quite cheaply.

*It seems to be something you've brought up a few times, you know, some engineers liking some materials and hating others.*

Yeah, yeah, yeah.

*What sort of thing drives that?*

Personal choice. I mean it's still not a subject, civil engineering is not a subject which is numbers and crushing numbers. A lot of it is choosing it because you intuitively know it must be right. Intuition and then after the intuition comes of course the calculation, but intuition is there in the first place.

[39:45]

*I was wondering if you could, I guess just tell me how long your typical work day is in this time?*

Oh, I'd take work home with me. Yes. I... the thing was that during, as from a bridge engineer and computers going into being project manager on the Sheffield-Leeds motorway, the boundaries of my knowledge were getting larger and larger and I had to work to keep up with it. So I put a lot of effort in and a lot of hours to be up-to-date with it, so that at least I could hold my own with anybody who was going to be a planning officer, I could converse with him on planning details and county councillors. In fact I got a bit of a reputation for being a bit hard.

*Hard on who?*

Councillors mostly. If they... you can make gentle fun, like Fred Jepson, that's where he got the advantage of me, and even the Chairman of the Telford Development Corporation laughed.

*Don't think we've talked about that on tape.*

We haven't talked about that on tape?

*No. I don't know if you want to or not?*

Oh, I'm happy to put that one on, because Fred's dead. Well, we were having a meeting with the Chairman of the Telford Development Corporation and he was bowling, hard balls, saying, 'We've got to get on with this road, the new town depends upon it'. And I was playing a straight bat saying not until I got all the information, it had gone through the preliminary stage and the firm programme report, would I be able to say which was the best. At which point Fred Jepson interrupted and said, 'Ah Mr Chairman, in spite of Mr Bridle's remarks, any bloody fool can see that it ought to go along the A5'. And I said, 'Ah, Mr Chairman, that's where Mr Jepson has the advantage of me'. And it took Fred about ten seconds to realise that I'd called him a bloody fool! Still, he laughed.

*What are your relationships like with councils generally while you're at the RCU?*

I think they were quite good, because I was never afraid to come along and speak my piece. I had one very funny letter from a chairman of Derbyshire County Council. It said, 'I understand you have a mathematical model of the Midland Links, the Midland network. Can you tell me how big it is and can I exhibit it in...' [laughs] '...in the council chambers'. [laughs] So I had to go around and explain without doing it publicly that you couldn't show the bloody mathematical model, it wasn't a solid model.

[43:32]

*What were the big projects of your time with Midland RCU?*

Oh, M56 was certainly a troublesome scheme, but with the others it was mostly engineering detail. The kind of thing that dealing with contracts and finance with and whether the contractor pays or not on the temporary works. But basically temporary works were looked after quite well, it was definitely the contractor's fault because the drawings were quite clear that you had to strap the earth off the H-section. And it was firefighting. I like firefighting. Get a problem and... the money for the contractor was a lot of money for those shops and you had to be fairly much on the ball.

*How much does it actually...*

Well, the other thing was location of motorway service units, service stations.

*Yeah, I've always wondered how that gets decided.*

Well, it was an eleven, twelve mile interval or thereabouts and you start off with missing one out and then later on you come back and put it in when the traffic determines it. When I was Under-Secretary I would sit on the Motorway Service Areas Committee, which was a meeting between the Department of Transport and the motorway service areas directors and owners and the most major problem that we had with that was the time of petrol escalation. You see what we had was an agreement to take rent as a percentage of turnover. The more turnover you did, the more rent we got. Well, to have petrol escalating, which was making the turnover apparently large, that you had to pay, they were paying for it themselves. So John Peyton was Secretary of State at the time and he wanted to go out and meet all the directors separately and do a deal and I had to persuade him no, we'll do a deal with the Motorway Service Area Committee and I shall organise a deal, Minister, and you can come along and put your stamp on it. And he didn't like that, but I nevertheless did it and what I did was relate the price of oil at the beginning to increase only as the RPI and you took your rent as turnover of this notional sum for petrol. And it was all agreed to and we took our rent on an amount which you could expect it to have been over a time, but as it had been really rampeting [ph – 47:34] up and our rent was rampeting [ph] up, so I felt that was worth negotiation, that was a good settlement. But you get all sorts of odd problems. The higher up you get, the less straightforward is what you're dealing with and parliamentary questions and – shall we come to the Under-Secretary bit?

[48:08]

*I've got one or two other questions first actually.*

Go on then.

*I was thinking, you mentioned the M56 was problematic, I was just wondering why?*

Ah. This is the disclosure about Heseltine again. There was a need for Staffordshire County Council to go along the A5 because they felt this would be bringing back, bringing back growth to Stafford. The farther up you took the M56 the more it affected Stafford. But it affected everybody who was along the A5. The other route was the route south of the M5 and then the

one that was further south coming into Wolverhampton and connecting into Wolverhampton which was a very costly engineering operation. But the one in the middle, the one through Bradford's territory, he owned the land on which we were proposing this bloody motorway, and he wasn't very happy about it and neither was the Landowners' Association. I've forgotten what its title was now. And so we had all sorts of people coming in objecting to the centre route. We had about three public enquiries and finally I persuaded the Secretary of State that the main issue in all the inspectors' reports was landscape. And what we should do is get an architect, well, well known architect, plant him in an office in the middle of this middle route and to meet anybody and everybody who would care to come and visit him and talk about noise bunds, shielding from trees, realignment to stop lights going through bedroom windows, so on. And we had a number of proposals and an amount of money to do it with. And so what we would then do is take account of the architect's report and implement everything the architect was recommending, which is what we did and the Secretary of State agreed. And finally, that was the last episode of the inspections, inspectors' reports on the M56. But we had two or three. And so the Landscape Advisory Committee was also part of the job and they were only keen on opening up a cutting to – oh, what's the name of the mountain in the background in Shropshire? Shropshire mountain? So you could get a good view of the landscape, which I think we managed to do something about. And so the Landscape Advisory Committee was a bit of a body with very... Williams Clough Ellis [Clough Williams-Ellis], Bodfan-Gruffydd [laughs], Bodfan-Gruffydd used to turn up like Sherlock Holmes with a deerstalker cap and a cape with yellow and black. And the chairman of the Landscape Advisory Committee was Sir somebody or other, I've forgotten his name temporarily. And he was Governor-General of Australia and I remember going down this lane and a lady coming to the gate and saying, 'What are you doing here?' and him saying, 'We're putting a motorway through your property, madam'. [laughs] Oh, God almighty. So I had to stand on my head then, explaining that it wasn't yet determined and there'd be plenty of opportunity for her to complain if she wished and as it was only one of a myriad of lines. But the next stage of this, this is Under-Secretary, I was Secretary of the Landscape Advisory Committee as well, it was one of my jobs.

*What is the Landscape Advisory Committee, you've mentioned it a few times?*

Oh, they're a group of well-known landscape and well-known personalities who would give their advice on the landscaping of the motorway, choice of routes, choice of cuttings and embankments, type of planting. And at the time we planted more trees than anybody else other

than the Forestry Commission I think, Forestry Commission planted about as many trees as we planted. But they're all grown now and it's all faded into the... I mean you could be within fifty feet of M56 and not know that it's there.

[54:00]

*How seriously did you have to take the landscaping of motorways, making them aesthetically pleasing?*

Oh, you had to take it very seriously. We had our own – what was his name now? We had our own landscape architect who in effect would advise on schemes which we carried out. What was his name? No, I've forgotten it.

*What sort of things were important and why was it important to have a nicely landscaped motorway?*

So that, well I mean it made it pleasant driving, that's what, and people appreciated it. I guess that you had to do something with the embankments, sides of the cuttings, and tree planting was... in fact we got wildlife back, you see, motorways were good for wildlife. Would nest in the trees and so on and so on. And a lot of time was given to areas of scientific interest, you know, you can move the motorway because some bugs would be displeased. In fact I've moved a motorway, the only time I ever moved a motorway, changed the route, was where some old people's homes and the... and the advocate for the old people said, 'Mr Inspector, you can't transplant these old people, because if you try to transplant them they'll die and every time one dies I'm going to write and tell you'. And I thought twice about it. And you could do a lot by going through towns and on the edges of towns to reduce noise.

*I was wondering, sounds like a lot of what you're doing, the RCU is sort of administration and admin and writing reports and all that sort of activity, is there still any technical aspect to it?*

Well yes, we had to agree what the consulting engineer or sub-unit was doing and if we didn't like it we got it changed. So you had to be, the people I had had to be good engineers as well as good administrators. So it was a mixture of engineering affects the administration and the administration affects the engineering. In fact they weren't two separate issues, it was the same side of the coin.

*Are you still advising on technical things at all?*

Yes. In fact that's why I've ended up with twenty-eight bloody papers of one kind or another. When I was in Midland RCU I led the British delegation on motorway alignment to the PR Congress in Prague and laid out what we were doing in Britain and alignments and earth moving and strength of pavements and that sort of thing.

*What sort of reactions did you get when you explained what Britain's motorway scheme was?*

Oh, just interest. I mean I don't think there was anything earth shattering in anything I was going to say, that the Continentals weren't up with and doing something themselves. The French were, we got on quite well with the French and I had a liaison committee in the TRRL at the end in which we met with the French and shared alike on developments. In fact we did beat the bloody French to the Trans-European Motorway, got our programmes used and not the French. I used to keep a little joke to break the ice, which I could do in French. And at Colditz Castle they used to collect in the square in the morning and the Germans would say, 'Anybody who wanted to work for the German Reich, one pace forward'. And there were all catcalls and boos. One day a Frenchman stepped forward, said, 'I prefer to work for ten Germans than one Frenchman'. 'Oh, very good. What is your profession?' 'Entrepreneur de pompes funèbres', which is an undertaker. [laughs] He got put in solitary confinement from where he escaped.

*How did you find you got on with civil engineers from other countries at meetings, conferences, that sort of thing?*

Oh, I think very well. Saudi Arabia, I gave them a whole lecture on the Severn suspension bridge, Severn crossings, to the Arabs and explained the contractual obligations and so on, which the Arabs seemed to think was a bit much. Contractual obligations? What are they? Yes, I got used to talking to foreign people. The rest of the world speak English.

[1:00:54]

*Is there much social life attached to being a civil engineer in an RCU?*

Oh yes, you know, well, being at the RCU I first got on the councils of Civils and Highways. And I got to be President of Highways, but not Civils. I felt I'd done enough by the time I got to being the President of Civils. Sir William Harris was very keen to put me forward but I wasn't so keen myself.

*Why?*

You weren't... I don't think you were achieving much, you're just being President. But being President of Highways was an effort to change its title to Highways and Transportation and to get a royal charter. I felt as though I pushed the Institution along a long way along that road and it's now the Chartered Institution of Highways and Transportation.

*Why did you think that those two little points, the royal and the transportation, were important?*

Because it widened the scope, widened the scope of a highway engineer who was doing rather more than just building a road. He was affecting the way people behaved, where they were going to and where they were coming from and generally it had to be better aware of life than just engineering alone. Especially if you were going to try and be persuasive in argument.

*Whereabouts were you actually chair of the – was it President or Chairman of the Highway...?*

President.

*President of the Highways Association?*

Institution of Highways.

*Sorry, the Institution. Whenabouts?*

I wish I could remember.

*I'm sure we can look it up. [laughs]*

You can look that up, yeah. Because it's short enough, the bit in Who's Who, it gives dates.

*I was just wondering, when I mentioned sort of social life then, you... I was wondering what sort of social life was attached to actually being a member of those institutions earlier on in your career?*

Well, we'd meet as the Council of Highways and the Councils of Civils and I had lunch at the Civils, was a club which I used when I was in London, and so I got to know a lot of people and I did things, like I was a member of the Contracts Committee, I was an examiner and on the Board of Examiners. And so all these things started to add to the bloody amount of paper I was writing.

*Do you think those involvements had much effect on you?*

[1:04:22]

No, not really. You get used to argument, because the big thing actually which spans all the way through to becoming Director of the TRRL is a committee which was put together under Sir George Leitch, which was the, ACTRA – Advisory Committee on Trunk Road Appraisal. Now, I'd been successful with the Midlands transport model because it was the Midlands, but I'd crossed the path of the economics unit who had been trying to put a national model together, not successfully either. So I had been proposing that we have a model for each RCU unit. We appointed Alastair Dick who was Freeman Fox's, but now he was on his own, and that he would set about trying to make a model for each RCU. Well, economics directorate had their own way and said not a model for each RCU, but a model for the whole of the country, which I felt very doubtful about because traffic behaviour in Lancashire ain't the same as traffic behaviour in Kent. And they couldn't calibrate it, because your calibration was to compare traffic crossing gridlines, and they couldn't make it balance, they couldn't calibrate it. This got reported to the Leitch committee who was on the side of the economists, and said well it's just not possible to have a model. No-one had tried the model for... but it wasn't possible to have a model.

*A model for each region then?*

Model for each region. But by this time the RHTM – Regional Highway Traffic Model project – had supplied us with a whole set of zones which was postcode numbering, a whole amount of traffic observed, present day traffic, and all of which to be drawn upon in making the cost benefit analysis. Cost benefit analysis program had been put together by economics directorate.

Geoffrey Searle was head of the economics unit in the Department of Transport, and I got on well with Geoffrey, but they were determined to have this idea of a national model, and it didn't work. But the engineers carried the can for it.

*And this is in your time as Under-Secretary?*

Under-Secretary.

*Right, okay.*

No, as Under-Secretary I proposed it, but then it got transferred to Chief Highway Engineers, engineering intelligence and a chap called Maurice Maggs picked it up to run with it.

*Right, okay.*

And then I became Chief Highway Engineer and I had it back again.

[1:08:30]

*I'd like to take a break in a moment, but I was just going to ask you one other thing you've mentioned in passing, was Spaghetti Junction. Was that part of your remit as well at Midland RCU?*

Yes, they'd started building it when I first got appointed and we had Barbara Castle to dig the first sod and just before I left, it was finished, and I took my two girls on to the top and got them to scratch their initials into the parapet. And when they were doing it, I said, there's cameras watching you... yeah.

*I was just wondering, did Spaghetti Junction cause any particular issues in its building?*

No. It all went well enough.

*Were there any special challenges at that complicated a structure though?*

No, it wasn't a complicated structure. All bits and pieces, standard reinforced concrete beams and ordinary columns and abutments. But it was a bit of a tangle, but all obvious when you're on the road.

*I was just wondering how a structure like that related to the sorts of planning processes and modelling of traffic flow and things like that we've been talking about? I'm just sort of trying to see the link between those processes and a structure like Spaghetti Junction.*

Well, it would, you could get through Spaghetti Junction without delay, which would make a difference to the CIJ – that's the cost from any one origin to any one destination. So it just speeds the traffic up. Perhaps the answer to the future is a car which drives itself, no driver, driverless cars. Because what it can do is make an inroad in the amount of time it takes to brake from the car in front of you so you can get more traffic into the system. Because the growth of vehicles shows, well even if you just try to put an ordinary S sine curve function to the growth of vehicles, growth of vehicles is due to get up to fifty millions in... oh, I drew a bloody diagram somewhere. Fifty million by 2050 I think. Well, that's a lot of vehicles and you don't know that it won't be greater than that because of the increase in migration and so you're going to get roads clogged up. Now whether they build more roads, and with a Conservative government you can bet they'll be tolled. So it's going to be a problem in the future and people know that already. In fact there are a number of future problems. The cable'll have to be changed on the first Severn suspension bridge. It's failing now, you can hear it go 'click', under tension stress.

*Do you think the problems will be resolved?*

We'll get it back from the French who has its ownership at present. It's a French company which takes your money as you cross the Severn Bridge, and we can bet we'll have it back with none of the faults repaired and the government will have to pay for it. How it's to be done I don't know, I haven't been keeping up with it. But it is the main cable which is... because all the suspension rods have been changed, expansion joints changed, decks welded, everything has been done that can be done to improve the strength of the bridge.

[1:13:15]

*Back when you were actually planning motorways, how far into the future are you actually thinking of them being used?*

Thirty years. That's infinity as far as discounting is concerned. If you... the discounting figure for thirty years on is negligible.

*When you say discounting?*

Well, if I give you a pound now, it's worth more than a pound in a year's time. Because as the pound now I've had the opportunity to invest it, so it'll be one point one in a year's time. Well one over one point one is what the pound is worth in a year's time. So what you do is, is one over one plus R to the power N is the discounting factor. So every time, every year that goes by it gets less and less and less and less and less. That's discounting the benefits and discounting the cost, any costs that occur are discounted as well. Well, thirty years is when it sort of tails off to virtually nothing.

*So you sort of give the motorway thirty years to pay for itself then?*

Well, if I was looking at the strength of the Severn Bridge, I would say what is the chance of it falling down, what is the cost of it falling down, what is the cost of repair, and all that is times the risk that it could happen and the discounting factor of what, after the year you take. So by the time you've discounted it all back and added it up, you've got the net present value of the insurance. And this is what's going to guide you in how much repairs you do and...

*Not sure if that's reassuring or not. [laughs]*

Sri had a... we were advising the Secretary of State and Sri was giving a commentary and said, when this traffic occurs it could fall down. And the Secretary of State said, 'When's that likely to happen?' And Sri said, oh in 200 years' time. And the Secretary of State shrugged his shoulders and Sri said, 'Yes, but it could be tomorrow'. There is a risk that everything'll fall down tomorrow. It's not a very massive risk, but things go wrong and people are accident prone. In fact I think I've explained before the problem of box girder bridges.

*Shall we take a break?*

Absolutely.

[end of track 7]

[Track 8]

Well, having joined the civil service, I became aware of the department's undertaking of a parallel set of applications to administering the trunk road and motorway programme. And it fell to the technical staff to pursue. They related to international organisations created for the propagation of technical advance and sharing of ideas and innovation in highway engineering. The prime organisation within Europe was PIARC – Permanent International Association of Road Congresses – the founder member was France. But the chair of the governing board was given to prominent highway engineers of European nations: the department's Deputy Director-General, Maurice Milne, was at one time the chairman of PIARC. The department contributed generously. I was a member of the committee organising congresses, an auditor and a member of the Tunnels Committee with Sir Alan Muir Wood, later Chairman of the Tunnels Committee, several members of staff served with other British engineers from construction and consulting firms. The congresses occurred every four years. I attended five prior to retirement: '69 Prague, '71 Mexico City, '77 Sydney, '81 Vienna and '85 Brussels. I was the General Rapporteur for the Vienna Congress. The agenda for the congress required each country to supply its activity in each subject area on the agenda, the General Rapporteur sat in on as many meetings as possible and also used his colleagues in each session so that he could record the present state of the art, together with research findings of significance.

*Are there any of those conferences that stick in your mind in particular?*

Yeah, the Vienna one. Addressing 3,000 people as the conclusions of what we discovered. I can't remember any conclusions at all.

*Did you get much sense of overview then, from...*

Overview was what it was all about, yeah. I also chaired the British National Committee of PIARC for a period. My colleague, Sri Sriskandan, as Deputy Chief Engineer, Bridges played a similar role within IABSE, the International Association of Bridge and Structural Engineers. The extra work grew with time. I was elected a member of the Royal Academy of Engineers and served on the MacRobert Award Committee and a few groups called now and then to comment on relevant engineering, government engineering topics. The Duke of Edinburgh presented the MacRobert Award once a year at Buckingham Palace for that submission showing the greatest

innovation. A great deal of investigation was required including visits to the firms making the submissions. I also served on BSI committees and was a chairman of the BSI construction council and also a member of the EDC [European Development Committee] for civil engineering. Colleagues also filled expert roles for the BSI since the load design and construction requirements emerging from research and practice became requirements through the issue of technical memoranda, TM – TMs that is – policy was that TMs should ultimately find a place in British standards and European standards. Many other conferences were attended by British Steel, for example, the World Health Organisation held a conference in Mexico concerning traffic accidents, to which TRRL was the main contributor. A team was also sent to the annual meeting of the American Association of State Highway Officials, held in January in Washington DC. The department was also requested from time to time to give a seminar to developing and other countries, for example, Sri Lanka, China and others. We didn't get much out of the China visit, but Sri Lanka was followed up by a lot of British firms.

*What sort of things would you actually do on one of those visits?*

Well, you'd put down what was the most recent findings of research and what the practice had become, where the specification had changed, and all these related subjects. Clearly I was also, there was also an invitation to the Head of TRRL or the Chief Highway Engineer to give a lecture tour of South Africa and also of Australia. So I travelled a lot. [05:25] Clearly a great deal of organisation and effort was brought to bear in meeting these commitments. However, the object was to advertise British expertise at international events and improve on what was being learnt from others. The department avoided lobbying on behalf of construction firms, consulting engineers or manufacturers, but evidently personalities interacted and they were always helpful to British business. Personal relations cemented and we were asked in some cases to act as an intermediary between the British firm and the foreign client. For example, the Sao Paulo authority in Brazil had chosen a British firm to install SCOOT. SCOOT is a world leading program developed at TRRL for managing traffic in an urban area. This scheme had a thousand junctions of the city online to a computer and by optimising queues of traffic saved about fifty per cent of the energy otherwise used. Mediation was successful and the project concluded to the satisfaction of all sides. Another TRRL program suite, HOPS, optimised the vertical and horizontal alignments and was used on the Trans-European Motorway from Danzig to the Bosphorus with the assistance of British firms. It was used to the chagrin of our great competitor,

France. Such assistance proved successful over a number of issues including helping Saudi Arabia with setting up a standards organisation based on the British model.

*I guess there are...*

We could never go back to the trunk road and motorway programme.

*I've got...*

I thought we ought to get that on record.

*I think that's a few... there were a few things you brought up in passing I'd just like to follow up with questions.*

Yes, do, do.

*And I guess what you've just talked about is something that spans over your whole senior civil service...*

From the RCU to the... retirement. All the time I was in the civil service.

[07:43]

*How much of your time do all these extra duties actually take up?*

Well, it took up evenings and weekends like nobody's business. Because you had to keep your own job going at the same time. But it was important to be able to put down papers in the TRRL library, as you can see from the pile there, and it meant that you had to span, your brain had to span a great deal of subject material.

*Did you ever feel stretched by it?*

Stretched? Yeah, I guess so. Sometimes when you wanted to take the family out for a weekend it was too much trouble and you had to get something done by the Monday. So it was a stressful

business alright. Because as you can tell, I don't like making presentations generally. But I got used to it.

*I was wondering as well, you mentioned assorted trips abroad in different capacities, are there any that stick in your mind in particular?*

Oh, South Africa and Australia, because my daughter was living in Australia by the time we went there. And I gave a paper on human behaviour and accidents to the Australian Road Research Board. That sticks in my mind pretty well.

*What happened?*

Nothing, it was just they picked up doing much the same thing themselves. Generally human behaviour is important in avoiding accidents and extroverts are more accident prone than introverts, that was established at TRRL work, and you can tell the difference between an introvert and an extrovert by having a little test to tap an electronic tap because what happens to the introvert is it builds up and it releases it all in one go, so there's, the graph for an introvert would look like this.

*Just straight with a...*

Yeah, with a kick in it. Whereas an extrovert would be... all over the place. And really there are rules for extroverts and introverts. Introverts are best at checking, extroverts best at design. But what you would need to do is work up administrative techniques for trying to avoid error and in bridges, for example, we had a certification system. Now if it was a very big bridge I employ you as a consultant, but you have to employ someone else to do the checking and you get an independent... a certificate from you saying all is in accordance with the British specifications and one from your checker to say the same thing. And were there to be any differences, the Chief Highway Engineer had to sign which interpretation was going to be made. So by double checking in this way you avoided the worst excesses that had been shown by the box girder failures, because the box girder failures led to the Merrison Committee who published a lot of rules for the design of box girder bridges and they used a certification system so that we had to have people certifying that all was in accordance with the Merrison rules when it came to box girders. But I extended that to all bridges.

*When in your career?*

Oh, when I was Deputy Chief Highway Engineer Bridges.

[12:26]

*How did you actually become Chief Deputy Highway Engineer Bridges?*

Well, box girders started falling down and the existing Chief, Deputy Chief Highway Engineer Bridges had a heart attack. So I was approached by the Deputy Director-General, Maurice Milne, to come into London and undertake the job, which was pretty exciting.

*How did you feel about moving to London?*

Not very happily. I had to leave the family in Barford and I spent most of my time in the RAC Club or the Victory Services Club. So it gave me time to work on projects at evening and try and keep the weekends free.

*What sort of places were the RAC and Victory Clubs?*

There was also the Civil Service Club, the Liberal Club, which was like having breakfast with Gladstone every morning. They were all typical London clubs; the stained woodwork and echoing halls. So, two years, we then moved down to Barford. Not Barford, Laleham.

*How did your family take to moving to London?*

Well, not [incomp]. We'd waited until the girls were going to university, that was the reason for staying in Barford. By the way, Barford's been on the television, if you noticed. There's an accident, just below where we lived there's a weir and the family went over in the dinghy over the weir and the husband and two children were killed. That's nothing to do with this. Can be cut out.

*What's the chief duty of the MoT bridge engineering department?*

Is to put the research findings in technical memoranda, serve the BSI and make sure the certificates were received and problems investigated. And quite a lot of work comes your way when there is a failure. There was a failure of the Loddon Bridge, was on A, some A road and it was temporary works, so there was a whole national investigation under the Bragg Committee into dealing with temporary works. Temporary works ought to be the contractor's obligation, but we had to intervene to make sure that temporary works were... because the worst of the temporary works was the Yarra Bridge in Australia bringing two boxes up to... and they couldn't get the bolts in because the top flange was corrugated, was buckling, and he tried to get some kentledge and press the buckle out, which made it worse and he lost his... the resident engineer lost his life on the Yarra Bridge. So it was a bit dangerous.

[16:14]

*Could you give me an idea of, what's your typical day like working at the Ministry of Transport?*

In which particular office?

*Let's take the first one, as...*

Bridges.

*...Deputy Chief of Bridges, yeah.*

Well, you get particular problems. For example, one of the particular problems happened to be Tinsley Viaduct. You come in in the morning and someone presents you with the notion that Tinsley Viaduct isn't in accordance with the Merrison obligations. So we had to start redesigning, we started redesigning it within our own resources and actually it's a continuous girder over piers, but the middle is propped up now by girders propping the top deck up and relieving the bottom one. And of course it had been a cause célèbre and Colonel Lovell at West Riding had been very upset, but it helped him no end to find out that I had discounted the costs of the repair back to the time it would have been and that the box girders had proved more expensive than the original pre-stressed concrete. Not that it made any bloody difference to the department, it got lost in the innards. [laughs] But it was, there was some personal satisfaction in that.

*Was the bridge actually modified?*

The bridge was modified. In fact we've got a photograph of it somewhere.

*I guess we can find that in a bit, it's...*

[18:10]

*I was wondering, you mentioned the Merrison and Bragg Committees – were either of those actually happening while you were there?*

Yes. Well, it was because things had collapsed. Merrison, the box girders had collapsed and David Holland was the Chief Highway Engineer and he sat on the committee, but all the information was supplied by the bridges section and the same with the Loddon Bridge and the Bragg Committee. You provided the, set-up a TRRL experimental to prove what you thought was the cause and established the cause and then it went back into the committee who wrote rules and the BSI has now got a whole section on temporary works which have to be followed. And one of the troubles is scaffold buckling, because if you put too many scaffold tubes one on top of the other, they're likely to fail. So the resident engineer has to accept the proposals for temporary works, check them through and get a certificate from the contractor, or get him to change his proposals if there's any doubt about them at all. And fair enough, since we've had certification we've had no major accidents such as the box girders or the Loddon Bridge.

*Did you actually have to do anything for the Merrison Committee?*

[20:08]

Oh yes. You read everything, make questions and one of the difficulties was loading, the Severn Bridge loading. Because the Severn Bridge is a box girder but not, it's not, the strength doesn't depend entirely only on the box girder, but on the cable holding it up. But when I was in the Midlands we... the handed down wisdom was that the heavy goods vehicles would be fifteen per cent of the general flow, leading to a loading of four point five kilonewtons per metre. But when we ran the program, we found that motorways were more attractive to heavy goods vehicles than had been thought and it was thirty per cent of the flow was heavy good vehicles, translated into loading, this was nine kilonewtons per lane metre. And we thought well, we'd better check this out, so we put a weighbridge one side of the Severn Bridge and then we discovered a new

behaviour called convey behaviour, in which all the wagons came out of the steel company of Wales and all went across the bridge together, twelve kilonewtons per lane metre. Now, that's not as bad as it sounds because the dead weight has got to be carried as well and the dead weight outweighed the live load.

*What's the dead weight? The weight of the bridge?*

The weight of the bridge. And so that it led to all the things; dehumidifying the anchor chamber, replacing all the suspenders, welding the barrel deck which was cracking and keep it going until... and as it happened, the French are looking after it at the moment, and I don't think they're doing very much, but I mean I don't know now any more.

*This work on the Severn...*

But the danger that I would foresee was the main cable, because in monitoring the main cable, which has got stress cracking and you can hear the things going 'ping' on the electronic monitor. So it looks as though we'll get it back from the French when they've made all the money and we've got the maintenance to do. [laughs]

*And this work on the Severn Bridge was actually happening while you were...*

Yes.

*...in bridges engineering at the MoT?*

Yes. And it meant writing computer programs to have the cross-section of vehicles and choose vehicles randomly and then you put them across the bridge and then you monitor the queues and you find the worst queue, and that's your worst loading. Now, when you get a convoy behaviour you've got to give weighting to the heavy goods vehicles so they appear more often in the queue than the other vehicles.

*What do you actually do once you discover things like convoy behaviour? Is there anything you can actually do about the bridge or how it's used?*

Well yes, you reanalyse the bridge and find out what you need to do by way of repair.

[24:00]

*Could you give me an idea of, as someone who was working within the Ministry of Transport at the time when all this box girder failure is happening, how serious a problem was it actually seen from your point of view?*

I thought it was a very serious problem, in fact. You get those mornings when the day that the Loddon Bridge fell down I got a phone call as soon as I walked through the door, said, 'The Loddon Bridge has fallen down, there are six dead, are you going to tell the Secretary of State?'

*Did you tell the Secretary of State?*

I told the Secretary of State, who wasn't too pleased. [laughs]

*What did you do then?*

Oh, I told him what we were going to do by way of investigation, so I'd had to think very quickly about why it had failed and it seems as though I was right. First of all there'd been a temporary beam put up to cast the first span and then these beams were laid sideways to the second lane. Well, in sliding them sideways the support at the end got overloaded because they weren't holding the beam up, but at its neutral axis, and the strut buckled and it fell into the drink. And as I say, I think six men went with it. Now, clearly when you rebuilt it you were going to find out that the research work that had been done on the buckling was significant and you weren't going to let that happen again were you?

*Do you mean insignificant then? So the research work that had been done on the bridge was insignificant in the first place you mean?*

What was... it was a proposal of temporary works by the contractor and the resident engineer hadn't thought that he needed to check anything because it was standard components, been used elsewhere. But when they were sliding the bridge – I tried to explain this – a neutral axis is the axis in the beam along which there's no stress, there's compression on one side, tension on the other. Now, if you're sliding it at the neutral axis, that's one thing, but if you're sliding it and

the support is off the neutral axis, you get inbuilt stresses which you will not know of. And so it was a matter of recognising this, saying this is what we've got to look at, and then we'd carry out compression tests at the TRRL and discovered that it is, it's the beam buckling below the bridge which let it down into the drink.

*Once you know what the problem is, what can you actually do about it in this case with the box girder problem?*

Well, you had to rebuild the bridge again, but this time the bloody thing properly considered and properly designed.

*Are there any changes more generally to bridge building that come out of this?*

Oh yes. The whole BSI hierarchy came to bear on implementing the Bragg Report and you have a temporary works manager on the site now. In fact there haven't been any collapses for sometime now have there?

*What was the Bragg Report?*

The Bragg Report was on temporary works. Bragg was head of – which university? Can't remember. But that was the Bragg Report and we had to commit resources from bridges engineering to the team in writing the report and making sure that the best of the research was applied to discovering... So that's what you're doing and you're... just any oddment that comes up which is outside the general progress or general design was a problem for British engineering.

*While we're on the subject of committees, what was the key finding of the Merrison Committee as well you mentioned?*

Well it had... it produced a new set of rules for the design of box girder bridges, that's what it did. And then it was up to us to implement them and make sure that we've got certificates that... Now if it's a very big bridge you get an independent checker. If it's a medium bridge you get a checker who's in the same office but in a different part of it and it's only in the cheapest culverts and the like that you get checking within the team. But it's all set up and it's set up in law as well, so that we can demand certificates of people who are working for us. And that was part of

the discussion, the design specification was discussed with the consultant or the RCU ahead of the scheme getting on the drawing board.

*Were you actually on either of these committees yourself?*

No. The Chief Highway Engineer was, whom we supplied with all the information that he wanted.

[30:30]

*Were all your days at work as dramatic as bridge collapses first thing in the morning or...*

No. A lot of it was mundane and straightforward.

*What sort of mundane and straightforward activities?*

Well, responding to requests from the staff. What do you think of this, what do you think of that? What shall we do about this, what shall we do about that? And it was my job to see that something constructive was done.

*Was the nature of your work at this time more managerial or technical or...*

Oh, managerial, technical, both. There's very little else to say.

*Did you enjoy it?*

Oh yes, it was good friends. All the people I worked with were first class engineers and problem solvers.

*Could you give me an idea of what the atmosphere was like in your office?*

Pleasant. I went out of my way to make good relations with everybody in both the standards bit and the checking bit. I mean you've got millions of pounds' worth of bridges in hand so it was just odd problems that came up that you'd... And I was providing papers on the international

front and, you know, a lecture tour of South Africa and a lecture tour of Australia were no mean feats.

*What sort of reception did you get on those lecture tours?*

I got a really good response in South Africa because I had verbally learnt a few words of appreciation of your kindnesses since I've been here, and I did it all in Afrikaans. And everybody cheered. Playing, pandering to their prejudices.

*You mentioned as well that around this time you got involved with the MacRobert Award.*

Yes.

*What was it actually awarded for?*

For the best innovation amongst the submissions made during a year.

*What sort of things would these be?*

Well, the BAC engine, which was extended because didn't use as much petrol as anything else. Reinforced earth was another. The Dome in London, the O2 Dome – only it's not a dome, it's a tension structure. A dome is a compression structure. It's just like an arch in three dimensions. And so that was one of the ones. And what you do is you get a lot of information in which you had to sort through, weekend work and so on, and the committee would meet. And you also had to visit the works, listen to the presentations and then try and decide whether it was satellite in space or whether it was just plain reinforcing of the soil.

*What sort of things guide you in making that decision between the two?*

I think the amount of use and the cost benefit provided by it.

*In particular, the O2 Dome, why did you think that should win an award?*

Because it was cheap and you could span a city with it, theoretically, and it was well detailed in shedding water when the weather's bad and it was cheap and effective. And so it wasn't... there was a lot of criticism of the Dome, but that wasn't criticism of the Dome itself, it was criticism of what was put on inside it.

*Whereas you were viewing it more on its engineering merits?*

Yes, its engineering merit was very good.

*Right.*

In fact I met the designer and it was a young lad and we got him elected to the Royal Academy. So I wonder what he's doing now.

*Just going to adjust your mic a second.*

[end of track 8]

[Track 9]

The Secretary retired and I got moved into main administrative folds as an Under-Secretary.

*Now, could you explain to me where an Under-Secretary actually fits in to...*

I was just about to do that. [pause] Or at least I had something. There were a number of units in headquarters, supporting the Director-General and the Deputy Director-General, and there were Construction Units Administration, CUA, of which there was an Under-Secretary in charge, and that was me. There was Construction Engineering, CUE, who reported directly to the Deputy Director-General. There was a HECB department, which covered engineering intelligence, highway and traffic engineering, traffic communication and control, bridges engineering and the computer, highway computing branch. And a GPH, which was a General Planning Highways into the prep pool – I didn't see much of those. And Highway Economics, the economics branch was led by Geoffrey Searle and there was a certain resentment because I'd grabbed the Midlands mathematical model and got it working, whereas the economics unit felt that it should be for them, they've done all the work on cost benefit analysis and what the hell was engineers doing with it? Well, very simple. When I became an Under-Sec and started questioning people from the RCUs as they submitted the preliminary report and the firm programme report, I realised that there was a lot of problems in forecasting traffic. It's not so bad when you're going down a peninsula like Cornwall, Devon and Cornwall, because all you do is draw the traffic off the nearside roads, but when you've got a place like the Midlands, you've got such a dense network that all sorts of funny things can happen. Now, what I wanted to do when I became Under-Sec Construction Unit Administration was I felt that the – because both the CUA and CUE saw all the submissions from the RCUs and we had to put our own... and also PQs and Ministerial correspondence was a big thing. [03:21] Anyway, I had it in mind that we should have a mathematical model for every RCU to be used by the RCU itself. Well, it then went to the Chief Highway Engineer's department who were going to look after it and the committee set up headed by Alastair Dick who was the consultant for Freeman, Fox and Partners, Wilbur Smith and Associates for the Midland RCU model, and it involved the Economics Directorate and so on. Well, the Economics Directorate pressed for a national model calibrated nationally. I felt this was a misjudgement because I didn't see that the behaviour in north-east Lancashire was anything like the behaviour in Kent, and so it ought to be each... the largest unit you could get, which you would think the behaviour would be common, would be the sensible... As it

happens, it turned out to be impossible to calibrate it because you get your screen lines and you couldn't match the traffic across them and they had already set up a Parliamentary committee, an advisory committee to the Secretary of State called the Advisory Committee on Trunk Roads – SACTRA – Standing on Trunk Roads Administration... And we had to report to them that it hadn't worked. Now they didn't come back and say, well let's try it again with each region, they just abandoned it, but nevertheless, they underestimated all the material had been collected by way of traffic information, setting up the zone system and so on, and so to that extent the amount of information it had was a success, because that information fed into trying to decide what the flows were.

[05:52]

*Why, you know, at that strategic level in government you need to know about things like traffic flow and road modelling? What's its value?*

Well, because whether it's a three-lane or a dual, two-lane depends on how much traffic it's got to carry. So you want to forecast the amount of traffic, one for how many heavy loads for designing the base, and two, what are the capacity of the motorway for carrying traffic. So the forecasting the traffic was important, I mean even in things like noise, you know, if you had a, you were disturbed by noise, a new road is now making it in excess of sixty-five dBA at your window frame you could get all that double glazed and you get compensated by the district valuer. So all those calculations had to be done, so you had to know the traffic volume to work out what noise was occurring. And planting and environmental matters were also important. Tree screens to screen off views of the urban nature of motorways within countryside and so on and various noise bunds would be adopted.

*Other than the trying to push over your model of...*

Yeah.

*...road modelling compared to the Economics Directorate version, what were the big issues of your time as Under-Secretary of Highways, do you think?*

It was to make sure that the White Paper objectives had been met, and that was a thousand miles of motorway in the White Paper target, 1970, met by 1971. It was supposed to be met by 1970

but it got met by 1971, which is a good... and you get odd... in fact you feel that you're just an odd man. The first job I had as Under-Secretary was to set up a consultation structure to meet with the RCU Director and the local authority magnates of the area and they were met by the Parliamentary Under-Secretary of State, in my case at that time was Lord Carmichael, and also for the Director-General and Secretary of State for Transport to meet with the Metropolitan and other local authorities, associations. And so I had to find the agendas, agree the agenda, agree when the meetings would be held, making arrangements for the rooms, so on. So it was totally administrative. I was also Secretary of the Landscape Advisory Committee, again, wholly administrative. And then the odd schemes would... The headquarter units were Engineering Intelligence, which covered highway and traffic engineering, and Maurice Maggs who had been in CUE had got transferred to the Chief Highway Engineer's department and was supervising the modelling exercise. Little did I know that when I was going to become Chief Highway Engineer I was going to get it all back again, but it was too late to save. Traffic communications and control, lighting, traffic lights, observation, bridges engineering, computer, highway economics, finance. Donald Packett was head of that, contracts, Leslie Henderson was head of that. And none of these, when I arrived, none of these seemed to be talking to each other. [10:34] Well, I started them talking to each other at least and you get problems, for example, there was about 900 million outstanding in contractors' claims and climbing. So I saw Leslie Henderson and we did a tour of the RCUs and reduced the amount by paying on account and trying to settle issues as quickly as possible. Donald Packett, Head of Finance, was also very interested in that, as you can imagine. So we got everybody working together. Then you get oddments, peculiarities by watching the... and commenting on the Parliamentary Questions and Ministerial correspondence. And on one occasion I saw a PQ from the MP for Derby I think it was...

*What's a PQ, sorry?*

Parliamentary Question, from an MP at Derby, who was asking about a Cheltenham Gloucester contract, and I said to the Parliamentary Under-Secretary, I think this is a bit strange, I don't see why someone from Derby should be commenting on the... and there's something odd going on. Now, do you want me to come – it was a debate overnight – do you want me to come and support you? No, no, he's only just showing off. Anyway, the next morning I got into work and they said, God, the Parliamentary Under-Secretary wants to see you immediately. And the MP from Derby had disclosed that there was maladministration or corruption on the Cheltenham Gloucester contract. So immediately Leslie Henderson and I put our travelling boots on and

went down to the south-west and saying, 'What's all the problem? Why hadn't you told us about it?' Well, they said, they didn't think it was relevant. 'What do you mean, it wasn't relevant?' [laughs] To be raised in the House of Commons is relevant alright. And we then discovered by dint of questioning everybody in sight, including Freeman, Fox and Partners, that the quantity surveyor employed by Freeman, Fox and Partners had been spending his time trying to write a program to do his job and not actually keeping up with the measurements. And as he'd got into trouble he made complaints about Freeman Fox signing bills without support from quantities, and this was corrupt. And so he got his friend, the MP for Derby, to make this accusation in the House of Commons. Well, I had to write a report, a Parliamentary report and discover what the department was going to do about its being milked of funds. Well, what I did was I employed a firm of quantity surveyors... oh... whose name I've forgotten. No, it's not coming back. Corduroy's. Corduroy's. A firm called Corduroy's whom I knew from the Midland Links anyway, and I got them to plot what should have been paid against what was paid and have the differences discounted back to the beginning of the contract and then charge Freeman Fox for that amount, which was lower than it would have been had they... and it didn't do their reputation very much good either. But Kerensky said he recognised I was only trying to help.

*This is Kerensky of Freeman Fox?*

Kerensky of Freeman Fox, but then we were good mates anyway.

*How did you know Kerensky? This is Oleg Kerensky, I'm guessing?*

Yeah, because I followed him. He was Chairman of the BSI Construction Board and I followed him as Chairman of the BSI Construction Board, and we got on well together. We had both an interest in structures and he'd been impressed by doing, building bridges in areas of mining subsidence, and so we had plenty to talk about and I took him to see *Nicholas and Alexander*, the film. And he felt that that was very realistic.

*It might be helpful if you explain who Oleg Kerensky was in more detail as well.*

Oleg Kerensky was the son of the Kerensky who was Chairman of the Duma at the time of Lenin and they left Russia in a hurry. And Oleg Kerensky came here, a sixteen year old unable to

speak English, and became one of the best structural engineers we had. He was, really was quite a guy.

*What sort of chap was he? Could you describe his personality to me?*

Oh, sharp, firm. A typical Cossack. In fact, I remember when they were opening the Bosporus bridge, Bosporus suspension bridge, and a friend of mine, Kerensky wasn't to do with suspension bridges, [16:32] it was a chap called WC Brown with whom I was in school, and Tom Wilson who had visited the opening of the Bosporus bridge at our monthly meeting said to John Garlick that the worst loading was when, if all the population came on the bridge at once. And John Garlick, being a cynic, said, 'Well, Kerensky was there with his slide rule'. And I said, 'He'd be better off with his Cossack sabre to beat the crowds back'. [laughs] But he had a good sense of humour. He's dead now of course.

*WC Brown – is that William Brown?*

Yes.

*How did you...*

His father was a governor at a school we went to, West Mon. You can imagine him what the boys called him with the initials WC.

*What sort of chap was he?*

Wasn't communi...

[break in recording]

*What sort of chap was William Brown to meet?*

He was exclusively interested in structural engineering and he wasn't quite as... he wasn't quite as friendly to many people, but he happened to be friendly to me because we were in school together and at least I was always trying to help Freeman Fox, who were good consulting

engineers but had run into a lot of trouble with box girders and Kerensky was the fall guy as well. He appeared at the Yarra enquiry and was cross-examined by a Professor Bull, I think it was, from Sydney University and he was given a bad time. But box girders, well, they were all too much of a rush.

[19:00]

*I was wondering as well, what's it actually like working in that sort of ministerial environment? Where are you actually working as Under-Secretary Highways?*

Well, I was dealing with all the administration from the construction units, that's taking on board the initial location, going to the preparation pool, dealing with CUE on the submission of the preliminary report on the alignment and then on getting it into the firm programme report. And I was trying to get everybody to the same view, was what I felt was... rather than staying aloof from the fray, as it were.

*How do you manage to bring them round? When you've got different viewpoints?*

Through arbitration. [laughs] Well, you go a bit one way and then you go a bit another way and you try and find the solution that satisfies everybody.

*Does the solution ever satisfy everybody?*

Not entirely. But they are prepared to accept it. It's just like the government at present, same thing.

*Where are you actually working?*

On the floor, eight floors down from the Parliamentary Under-Secretary, because I used to have to go up in the lift at regular intervals. Because Ken Clarke followed... was when Margaret Thatcher came in, Ken Clarke was the Parliamentary Under-Secretary, and with whom I got on very well. And of course one of the jobs was locating motorway service areas as well and John Peyton was Secretary of State, Highways and it was a time of the huge escalation in petrol costs. Now we took rent from the motorway service units as a percentage of the turnover, so the petrol was thrusting the turnover upwards and thrusting our rent upwards and the motorway service

area people didn't think that was very fair. So I, now John Peyton was a bit keen to go out and do a deal. Said, 'Well, leave it to me Minister, I'll see the Motorway Service Area Committee...', on which I sat, 'and we'll see what we can do and then you can come... we can put it to you and you can announce it'. So I discounted the cost of petrol so that it was only increasing by RPI from the time that the shortfall started and that they paid a notional rent on a notional turnover, and John Peyton accepted that and so did the motorway service areas and that brought it to a conclusion.

*What's the building like you're actually working in?*

Oh, it overlooks Parliament, in Marsham Street.

*What sort of building is it? Any particular architectural style?*

Blockwork. Everything's rectangular and... nothing exciting about it.

*What was it like inside?*

Claustrophobic. I did actually have a shock one day when an IRA bomb went off and shook the windows. But that's the closest I came to the IRA.

*What was your office like?*

I had, because I was an Under-Secretary I had carpets up to the floor... up to the wall. If you're less than an Under-Secretary you don't get a carpet up to the wall. It's all very odd, little things like that. Get a hat stand as well.

*Do you get a better office when you become Chief Highway Engineer or...*

Yeah, I wasn't in the Marsham Street headquarters. All the engineers were at St Christopher House, down the river away. And you were in your own little compartment there, the Chief Highway Engineer ran everything.

*I guess to most people the idea of senior civil servants in 'Whitehall', in inverted commas, I guess most people's impression is basically Yes Minister. Could you give me an idea of what it's actually like working there?*

Yes, you explain to a Minister the problem, you offer him a solution and you see whether he'll take it or not. Otherwise you've got to start modifying fairly quickly. But Ministers were pretty good on average. They accepted what you had to say, so long as it held good sense and certainly the meetings, the framework of meetings with local government worked very well. So I had everything to be pleased with.

[25:05]

*Were there any Ministers you remember in particular?*

Well, John Peyton was... but who was one of the four? Bill Rodgers. He was an awkward chap at times but you could get on with him, but he gave me a bad time on one occasion. We were at a lunch for the Institution of Highways and Transportation and I'd written his speech. He stood up and said to the 3,000 guests, 'Ron Bridle wrote this speech'. [laughs] And then started to take the micky out of it from the first page to the last, which he said, 'Ron says here that engineers all ought to speak plain Anglo Saxon. I haven't heard anything but Celtic since I've been in the department'. Tony Gaffney who was President that year thought that was a good idea, so he took the micky as well, and who should be the guest of honour, Cliff Morgan, who played outside half for Cardiff and I played against many times. And he said, 'I also know Ron Bridle. Not only was he always offside, he was born offside'. So I was at the end of the bloody tablecloth by this time. Still, it doesn't matter what they do so long as they spell the name right.

[26:40]

*How do you think your colleagues actually viewed you at this time when you were Under-Secretary of Highways?*

I think we all got on very well. I was respected. I said my piece and I spoke up to Ministers and I think the staff rather liked my intervention on their behalf.

*How much sort of supporting staff do you have?*

I knew you were going to ask that question. [pause] The Under-Sec was... the Highways Act was made of course, Section 7, side road orders, they came through your desk. Section 11, the main location. Section 9, alteration to local roads. These are all coming through your desk, with attendant problems because the public enquiry was going to expose all the criticisms that the public had to make of you. Now, the Construction Units Highway Administration, I had an Assistant Secretary, Tony Pollington for a while, then Ron Denny, plus two Higher Executive Officers. In fact that gives me a little joke. There was an objector had a letter returned to him, he was writing to the Minister and it was returned to him by a Higher Executive Officer. When I signed it as Under-Secretary later on, he said, 'I've had one from a Higher Executive Officer and it's gone down bloody hill to a...'

*Sorry?*

'It's gone downhill to an Under-Secretary'.

*What's a Higher Executive Officer compared to your own position?*

Two down. Assistant Secretary, Higher Executive Officer, Senior Executive Officer, Executive Officer. But we only had two of those and that was the whole of the unit, that was what we were working on. So getting rephrasing of Parliamentary Questions, Ministerial correspondence, and so on. It wasn't much of a team to get through all that... Construction Engineering, CUE, Bill Farrow led that with three engineers and Maurice Milne was in it when I first arrived, but he went off to Chief Highway Engineer who looked after engineering intelligence, highways and traffic engineering, traffic communications and control, bridges engineering, computer HECB and highway economics, contracts, Leslie Henderson, finance, Donald Packett. And that was how many people altogether. Three, four, four, eight... well, not much more than forty or so altogether, supporting the whole of the road programme. So you can imagine how contributing to conferences and so on was really something.

[30:20]

*I do wonder as well, at this sort of level, who actually decides whether you build a motorway here or a motorway there? How do those decisions actually get made at Parliamentary level where you are?*

Well, by the recommendation of the inspector at the public enquiry. The public enquiry to the inspector's report will come to the RCU Director who would make his observations on the recommendations which the inspectors... then it would come to me and the Deputy Director-General and we would put to the Minister either a solution or an overruling. [laughs] You can't let this go, and sometimes the Secretary of State or Parliamentary Under-Secretary would agree, other times they wouldn't. So it's the best you can do. But at one time on the M62 there was only one public enquiry, but by the time we got down to this time when I was Under-Secretary every scheme had a public enquiry and the skill, I admired the skill of people who were expert witnesses at a public enquiry, from the time I was in the Midland RCU, and they were good. They had to get good because they had to get used to being questioned.

*Shall we take a break?*

[end of track 9]

[Track 10]

*One other thing that I've wondered about is how do you decide what number to put on a motorway?*

Well, we'll start with the A system. A1 is due north.

*Sorry?*

A1 is due north and then you go clockwise so that the A2 is down to Kent, coming round to the A5 up to the Midlands. So that a trunk road is A1 to A5 and then the first road off the A1 is the A11, second road is the A12, and so on. And the motorway numbers reflect the trunk road numbers that they're replacing. So the M5 was down the Cornish peninsula, the M1 goes due north and the M56 is the sixth road off the M5, and so on. M62 is the second road off the M6. But you can't rely entirely upon it. [laughs]

*Why do you say that?*

Well, things change, you know, roads change and as I say, you can't depend upon it entirely, but it's pretty well true.

[01:50]

*When did you move from being Under-Secretary Highways to being Chief Highway Engineer?*

When David Holland retired and they needed a Chief Highway Engineer and I happened to be the one. So that I'm going with a lot of baggage, from being bridges engineering, engineering intelligence, dealing with them from the RCUs. So I already have a good round... the one thing that I was uncertain about was road communications and traffic communications and control, but I had a chap called Derek Clark who was the head of motorway communications and control and he was very keen to push what we were doing internationally and he tried influencing Chile, Brazil, South America generally, and was being quite successful as my little story about the Sao Paolo interchanges.

[03:15]

*I was wondering actually, you mentioned the Sao Paolo interchanges, did you have to go on that trip yourself?*

Yes.

*What did you do when you were out there?*

Brought the two sides together and said, what are your problems? They were all to do with basic engineering, digging trenches and opening up traffic and that sort of thing. So you come up with a few simple examples and it all ended very amicably.

*What was SCOOT actually used for?*

What was...?

*SCOOT actually used for?*

What SCOOT does is observe the length in queues at traffic lights and it doesn't put the traffic lights on green, it puts it on green for a while until you get half a queue, and then you stop. And it's a means of optimising the queue lengths and it reduces congestion very considerably and it also saves, because it's not letting your engine rip in a queue, it reduces the amount of petrol you're using. And we had estimates of fifty per cent of petrol being saved by the use of SCOOT, which stands for Split Cycle Offset Optimisation Technique. [laughs] Which is an odd name but what it means is playing with the sequences of the inter-green period, the inter-red period and so on.

[05:10]

*I was wondering... talking about traffic managements systems like this seems quite different from just building roads...*

Oh yeah, well even the maintenance of roads, you know, we have a private firm which is exploiting TRRL inventions in monitoring the road strength and what you do is, you have a roller vehicle which is running over the surface, measuring the deflections and heights, in other

words, observing how the road is corrugating or whatever it may be so that you know when to intervene and repair. Because if you allow the road to get more bumpy you going to increase the petrol take and you're going to cause accidents as well as congestion. So you monitor the road monitoring machine, is quite important, and also keeping the friction up because the friction is what keeps the car on the road as you go round a bend, which we explained to each other before. And so there's, what the vehicle does is it's got a wheel which is running at an angle to the road like this and measuring the friction. So you have to chip again to get the friction up.

*How much work is actually carried out in maintaining the roads then from...*

I can't remember the account, how much it was now. But they obviously are well maintained.

*What does a Chief Highway Engineer actually do? What's the purpose of the post?*

I think it's to give authority to all the things we've been talking about, and in my view to contribute something, not just listen and make decisions, but to contribute to the process of improvement, contribute to the specification, the technical memoranda, etc, and question your staff on why such and such has been adopted, and make sure that all the groups which are liaising between the Chief Highway Engineer's department and the TRRL are coming up with valuable and viable projects. Because every year you have to justify what you've been spending and on what you've been spending and it's value for money which counts. Now, you've got to get people to agree to what you're doing as well and if your clients, your clients, which are the RCUs and other parts of the department, are dissatisfied, well you... But I never... we underspent one year because the Environment Department had been interfering with the Chief Highway Engineer's when, this was when it was Scanlon. Projects for research, wasn't value for money etc, and I failed to notice that the Chief Highway Engineer's bit, while I was looking at the TRRL, it's when I was Director of the TRRL, looking at the TRRL accounts and keeping those in check, I was misled. No, I wasn't misled, I just overlooked the fact that the Chief Highway Engineer's department had not spent its money and that's because of objections from the Environment Department.

*What did the environment department object over?*

I've no idea. They just said well, it's not value for money or this research isn't worthy and they kept that up and it all fell behind, whereas we could have had a lot of useful... if they'd only come at my level and tried to explain why they were doing that, it may have been a bit better. But Sri would have been... no, forget that. But the Chief Highway Engineer's department ought to have been monitoring, ought to have been monitoring. Derek Clark was, that's how it came to light.

*Who's Detta Clark, sorry?*

Derek Clark was Motorway Communications and Control, responsible for all the forms around the Midland Links: the traffic lights and guidance, signing and lighting, because lighting's important for safety reasons.

[10:54]

*I was wondering if you could give me some of an idea of what sort of things you actually had to do as Chief Highways Engineer, what does the job actually involve?*

Well, it involved oversight of the traffic engineering and control, oversight of traffic engineering, oversight of all the units which were in the Chief Highway Engineer's purview. And I used to hold meetings with the laboratory and try to decide on the course of the research and the Head of the TRRL and I would meet and try and produce a programme of research which suited our needs.

*Did you have to deal with any ministerial visits to other countries as well, you mentioned?*

Oh yes. I've forgotten the name of the Minister now, but took him to Saudi Arabia and that was successful and I also gave the Saudis a separate account of the Severn Bridge and conventional contracts.

*Sorry?*

Contracting. Tendering, all those procedures. And they were well interested. This is how they came to think that they would have all our help, so I had to persuade the BSI that the Saudis

needed the help and could they have people go to Saudi and set up a framework for a Saudi national standards system, which they did.

*Was that the purpose of the trip?*

Yes. It was to let the Minister as well have the opportunity of meeting with other countries. Lynda Chalker made - slipped my mind again – made a trip to Singapore where there was a conference and I had to look after her and she got on well with the Chinese there. And it all helps, if you've got a Minister going, it helps people coming behind you to get work. Now we weren't lobbying. We deliberately made the rule that you weren't to lobby for a particular firm. You may explain what a particular firm was doing, but not lobby on their behalf, you leave it to them to do the lobbying. But if you put forward a presentation of a system which is cost beneficial and clear and innovative, then you can see them saying, we'll have some of that.

*Are there any successes you'd highlight?*

The Eastern European from the Trans-European Motorway, which we promoted the TRRL set of programmes on line and vertical optimisation and they considered it better than the French programme, basically, and so we... so that it was used. Now it's also used... gives the British companies and firms an opportunity to become a consultant to the Trans-European Motorway. I never discovered how many people did, but obviously you've already set the land and ground for interchange. I must have drunk a lot of bull's blood during that negotiation.

*How much of that negotiation do you actually remember?*

Not a lot, just got... The European... government of Brussels were instrumental in getting us to do it and the European Community were anxious to help the Eastern European countries in the endeavour in the end to get the Eastern European countries in the Euro system. And we presented papers of course to the European Community as well.

*Well when abouts was this?*

Research programme was, I remember doing one in Brussels to explain why we considered the high points of the programme we had and what it was going to do, once again from a cost benefit analysis.

*Was this when you were Chief Highway Engineer or at the Transport department?*

Both. Chief Highway and the Controller of Research and Development. In fact they were two jobs like a pod and part of the job was to try and get a private company exploiting the research of the TRRL and the department employed a chap called Sharply who was an ex-contractor, to promote and to make the best use of what we were discovering and putting in tech memos, etc. But he was useless. I can say he's useless because he's probably, he was an old chap and he was in his post-retirement period. [18:03] But we did a few things and in fact it was only about £30,000 a year turnover. But we got a few jobs, one of which was to advise the North and South Ireland on the Newry-Dundalk scheme, which was a motorway from Newry to Dundalk and cross the border and it was a question of what we were going to share, how much of the line was in Southern Ireland and how much of the line was in Northern Ireland. And what I tried to do was to say you ought to do it based on the benefits. You need a traffic survey. 'Now Ron, my boy', says [Dennis] O'Keefe, head of the An Foras Forbartha Teoranta, what do you imagine, what sort of questions do you imagine we'll be asking for people crossing the border – 'Where have you come from and what's your business?' And then it was fairly obvious that we had to make up the stuff on our own because he wasn't going to carry out any traffic surveys in Ireland.

*Why?*

Well, because, you know, you're going to look into the cars for guns and explosives and a dangerous business really. 'What's it got to do with you?' So O'Keefe and I made up the figures to say to the Northern Ireland Secretary, well, it's not what you expect it to be but we actually are getting the best of the line, and it was reversed in Southern Ireland. And said, well we've not got everything we want but we've got most of it. And so we aided and abetted in building the Newry-Dundalk road.

*How did you actually come up with the estimates at all, if you couldn't do the survey?*

Oh, the estimate was not difficult. The estimate for the construction cost was not difficult, but working out the benefit in traffic was more difficult, but we had observations on the side roads and what interchange there was likely to be, and so we could make a reasonable estimate. No-one's complained since. O'Keefe who was my opposite number in Southern Ireland was a bit of a comedian and I remember him giving evidence to a European committee. I don't think they could understand a word that he said. It was all good stuff though. [21:20] And tried to take a patent out on strengthened earth because I think I've told you about the interchange with the French on reinforced earth and we had a difficulty over the copyright or patenting the system and using the patent to prevent any British initiative in strengthening earth. So I had a meeting with... the inventor of reinforced earth. Forgotten his name for the moment. Vidal. Henri Vidal. And challenged him on describing an area which was the reinforced earth area and anything which was outside the three or four limits we gave was a free area to be used by the British, because we didn't want them interfering with polymer sheets, polymer grids which you folded into the earth, or using ordinary reinforcing bar with a hook on the end of it, and you concrete the hook in which gave you the anchor, so anchored earth was a new... But fair play, Vidal has been very efficient and they won most of the jobs that they were competing for anyway. So we were getting value for money, it kept the cost of reinforced earth in check and it enabled British firms to compete in that particular field. So at one time the French Minister of Transport said, more or less instructed me to go to Paris to see what it was all about, and I said it was a matter which could be dealt with in the British legal system and if he wanted to see me he'd have to come to London, which was a bit cheeky, but nevertheless it worked and they were anxious to resolve the difficulties. So we've now got British standards, British standards on the reinforced earth strength and earth, polymer grids, so on.

*How important were these techniques at the time?*

Well they cheapened it, you see, the other way of building a wall is through block face backed by massive, mass concrete, which is not exactly the most cheapest form of doing it. Whereas what they were doing were polymer faced with straps going back into the earth holding the earth back. Now that's where in Cardiff we did a lot of work, because we had the biggest shear box in the world. Shear box, you put the steel in the earth and the earth is contained in a box which has got two halves, and you do that with it.

*What's that movement?*

Shear. So you try to shear the bar and see what the deformation of the bar is so that you can design the strength bar, not the shear, as the shear, the way a wall fails is you've got a wall like that and you've got the earth behind it and you have a tension crack and a slip, which is a long spiral as I recall it, and one of the things... you put the reinforcement, flat reinforcement steel bars horizontally in the Vidal system, but I was thinking that you could put them in at an angle and we had a scheme for firing nails into the ground, which when I was with Freeman Fox... Mitchell Cotts, we were going to make a business out of it, but I was allowed to walk away with a patent because nobody was going to make a business out of it. We did several schemes by using the local contractor to Cardiff University, but Cardiff University then sold it to Freyssinet, a French firm, and Freyssinet buried it so as not to be competitive.

[26:45]

*Were there any other big issues of your time as Chief Highway Engineer?*

No, it was still the certification. And the big issues were turning research on to traffic communications and control, I got an interest in that and we got – what do you call it with the lasers... instead of big copper cables use...

*Optic fibres?*

Laser... optic fibres. Optic fibres to provide for the telephone links around the M1, Spaghetti Junction and right around that circle. And that was underway. And observation systems for measuring weight, distance between lorries and so on were all installed and it was a subject which you could go overseas and talk about because the congestion overseas is... And we did a lot of work on human behaviour, as I was saying, and one of the projects which was interesting was South Africa, because if you were a bus driver in Johannesburg you were at risk more than any other bus driver in the world because the degree of accidents was enormous. And so they started screening the drivers and they screened the drivers for drink, which made them extrovert, and for extroverts and introverts. And they measured near misses as well and they got rid of all the drunks, they got rid of the... And finally they halved the number of accidents in Johannesburg by observing personalities and the way in which they drove.

*Is that because they were cutting out people who were drunk or they were eliminating extroverts?*

They were doing both.

*You mentioned a few sort of times when, you know, you as a British transport scientist go overseas and help out. Were there any ever times you remember when information came back the other way and you learnt things from overseas traffic systems?*

I didn't, but I'm sure that many of the staff did. I was the sort of main presenter, I presented papers from what we were doing. But the committees were a feedback, the European committees were a great feedback and we used to have a liaison committee with the French and out of that was good stuff. The French have built some exciting bridges one way and another. They've got the tallest bridge in the world and that depends on the flexing of the towers to deal with expansion and contraction. And were we to build the Severn Barrage, the best bit of profit, the most valuable return, is the traffic over the top of it, because at present we have people going along the M5, sorry M4, turning off at Bristol, about thirty-three per cent turn off at Bristol, and go south carrying little bits of computer equipment and so on, between, exchanged between the businesses in south Wales and the business in the West Country. Now if you provide a barrage the route across the top shortens all those journeys very considerably and promotes the growth of industry in south Wales and west... Devon and Cornwall. Apart from that I think it's a quarter of housing stock in Wales is supplied with energy. But there are other ways of doing it other than the barrier. You create ponds, either an embankment around like that and you allow in and out from the tide. So you have turbines in the bottom of the... but that also is not thought to be very good because of the repercussions in silting up, so you come back to the barrage again. But now they're trying to devise machines to act underwater just on the tide.

[32:35]

*Do environmental concerns like this actually start to come into your work in the 1970s?*

Yeah.

*What sort of ways?*

Well, you always avoided Sites of Scientific Interest and for example, the best example is the M54 which is serving Telford New Town and we've been through that before, but we had the Landscape Advisory Committee come and see it and make recommendations and after about the third public enquiry or whatever I went to the Minister and said, you know, we're not getting anywhere with this. All we need to do is to put an architect/landscaper in an office on his own in the middle of the middle road and with money we will do things like false bunds, planting – and we had our own planting people to work out what sort of plants and trees would be used – and have the Landscape Advisory Committee saying what line we were to follow and then with all these extras the architect/landscape designer would consult with the people in the area, in the corridor and come to a conclusion on which to adopt, which not to adopt and what more to adopt and write a report for the Secretary of State on that basis. And on that basis the Secretary of State put it in the firm programme report.

*The firm programme...*

Put it in the firm programme.

*What's the firm programme?*

When you've got through the initial stages of the preparation pool and the preparation report you come to a stage where you can know that it's going to be built within the next five years or so, you put it in the firm programme report, which is the acknowledgement the Minister makes that you've got to build it. It's now in the firm programme report and a Minister would make an announcement and so then you were proceeding all belt and braces into trying to bring all the drawings in and contract into fruition.

[35:29]

*Do you remember any motorway projects that didn't happen that were of particular interest?*

Yes. The one to – oh, what was the airfield they were going to build in eastern England, in East Anglia? The something Bay. They were going to put an airport there and so we [incomp] a motorway to provide for it, but nothing ever came of either. What name was the... Because they appointed staff who were working up a new town as well. Something Bay?

*Is this the large one in the early 1970s?*

Yeah. I can't remember the name.

*Harold Wilson was keen on it wasn't he?*

That's right and they had a number of problems like unexploded bombs. So it was going to be a difficult job anyway, but the idea was to put a motorway to it so that you could service the airport pretty easily. Well now we're back to putting a barrier in the Thames. We did some work at Cardiff which would help with building islands in the channel by using big polymer bags tied across from the one side to the other and you fold it up and you float it out, drop the bag and drop stones and all the dredging that you can into the bag, which is held stable by the straps, the polymer straps across the axis. And then you put these bags around the outside of the island and fill the middle and in this way you could build an island in the channel fairly cheaply. But whether that will ever come across... Ben Barr and I published the work on calculating water straps and deformation of the bag and so on and it's now in the American Library. The last thing I was working on was aluminium. As it happens, aluminium is only used in the construction industry for sheet walls and corrugated aluminium sheets. And you can't use aluminium to build bridges because of the deflection. It's like building a trampoline.

*And this is after you retire I guess, when you're at Cardiff?*

Absolutely. And the last bit of research I ever did was to take troughing, aluminium troughing and fill it with concrete. And the concrete stiffened it up and we've done all the work for working out how to design a bridge that way. But it's not caught on. The aluminium companies don't seem to be, or didn't seem to be... approve this, although we felt we were giving them a slice of the market which otherwise they hadn't got.

[39:15]

*How did you actually come to be at the Transport Research Laboratory? To move you on from being Chief Highway Engineer.*

Aled Silverleaf retired and they were looking round for someone to do it. And they had a Chief Highway Engineer in mind, came from consultants. And I remember seeing him in 1950

Olympic Games in London, Jumping Jack, who was a hurdler and he came from consultants but he didn't last very long and then Sri took up the job.

*Which job, sorry?*

Chief Highway Engineer.

*Ah right, okay. Your replacement then as Chief Highway Engineer?*

That's right.

*Right.*

It was Jack, Jumping Jack. Oh...

*How did you come to be working at Transport Research Laboratory though?*

Because they didn't see anybody who would be, who could be Director. They needed someone with a background, in engineering as well as in research. Yeah.

*Who's they, sorry?*

Whoever decides these things, the staffing committees and so they're looking around, what shall we do, and they picked on me.

*How did you feel about the move?*

I was getting a bit exhausted by this time, I wasn't very keen on it and I'd just got the news that my blood pressure was up pretty high, so I was with TRRL a couple of years I suppose, and then I decided that I would take early retirement.

[41:33]

*What actually is TRRL?*

Transport and Road Research Laboratory.

*What does it do as an organisation?*

It carries out research into highways and bridges and traffic communications and control, traffic engineering. Does all the things that the Chief Highway Engineer does. The Chief Highway Engineer implements technical memoranda based on research outcomes from the lab, as well as from other sources, which is universities, universities provide... Nottingham has been a great provider of work in highway engineering, in pavement strength and so on. So they would be inputting quite a bit and we would be taking advantage of it.

*What sort of facilities does a traffic research laboratory have? I suppose people think of a laboratory, they see, you know, flasks and chemical equipment and...*

Well, for example, one would be a bridge slab, which is being loaded in all sorts of ways to... the M beam was going through a series of, can we make it longer, can we make it... how does it get distributed within the slab, and so on. And in fact it can... I was saying nothing had gone wrong, something did go wrong. What went wrong was we were using... we were using a GRC permanent formwork and what you do is you put this across the top of girders, bridges across the top of girders, and then you pull the slab over the top. Well, unfortunately, just down the road here at Pontypool Road station, there is a bridge which this was used and it's permanent form, which means it was left in place. A piece fell out on the road, fortunately it didn't hit a car, and so the department – I'd retired some time – and the department blanked this and said it's not to be used any more because it's too dangerous. So my job, I was asked by a former Director-General of the BSI if I would help this firm do something about the product that they were using so they could be used again. So all the analysis of their product is in here and what had happened was – oh, there's all sorts of... you don't want to look at the equations – but what had happened was, it had been allowed to get loaded beyond this limit of proportionality and as it ages its strength drops off, whereas it was being assumed that its strength wasn't dropping off. So what was done was strengthening the system so that you could stay inside the limit of proportionality, which required all this bloody mathematics to determine what the stresses were when two systems were brought together and how you could use arch technology to hold it up.

*And this is a job you did after you retired then?*

After I retired, but it was also helpful in getting the company back in the books of the... being allowed to use it again.

*Were there any big issues in your time at TRRL?*

No, not really. I don't think so. Only that one case of underspend, but the rest was just... they were doing work on arch bridges, stone arch bridges, and that was interesting because I carried on at Cardiff and we produced a comprehensive computer program to test the bridge for its strength and it was used in almost all large bridges in Wales by the Welsh Office.

[47:20]

*When did you actually retire and go to Cardiff?*

Well, '87 but I worked for Mitchell Cotts for a while, but predators got the company, it was getting into difficulties, and it and one of its founding companies – Key Resource International – and we were there to try and sell off old industries and buy into the new technology, which we were doing quite a lot of, but which all came to a pounding end. And so I took the opportunity to come home and look after my wife's mother.

*And this was the period as well you said you were working on the ground reinforcing?*

Yes.

*Right, okay.*

And Mitchell Cotts was good fun. I could have enjoyed that for longer.

*What did you enjoy about it?*

Well, for example, one of the things that I'd taken an interest in was called a backstacker. In Britain we use any coal in the power stations, in Europe they have selected mixtures of coal. So when you're stockpiling coal, you can stockpile coal, but you don't want to compact it because compacting it, it loses its calorific value. So what you do is you're running the coal along a...

*Conveyor?*

Conveyor belt and the backstacker drifts the coal off the conveyor belt up into a pile. So when you finish you've got a pile and you know the quality of coal in each part of it. So you can use the backstacker to bring it back and mix it in different ways to use in the power station. Now, what I thought was, we could make it in India, export it to Indonesia because that's where they were doing lots of coal work and all I had to do was get the inventor to join Mitchell Cotts. Well, Mitchell Cotts went bump before I could get him involved. So the firm never materialised, but it obviously kept going in the Continent somewhere.

*What sort of company was Mitchell Cotts?*

It had lots of interests in East Africa mostly and South Africa, and it had tea interests in Uganda, and if you leave a tea bush long enough it becomes a tea tree and what we did was got a machine which chopped them back to bushes and used the timber that was secured to fire the stations to put world tea back on the world market. And we were interested in – there was an agent who was doing all the dirty work [laughs], so we didn't have to do that – but we did get interested in providing a start to a new town because we'd expect a lot of immigrants to come into Uganda now Idi Amin had gone and use their skills in the Ugandan economy, so that it needed a town for them to live in. So we thought we'd get all that done because we had a company called Howard Humphreys, which were consulting engineers and they already had work in East Africa in large drainage projects, so we could work on behalf, or use Howard Humphreys to build a new town. Unfortunately, before any of this could happen the company had gone to the predators who were selling off all its bits and pieces.

*Sounds like quite a diverse company.*

It was.

*Did it have any particular...*

It had mining interests in South Africa and we were trying to promote little bits of invention for putting coal down a mine and that sort of thing. And it was all going quite well really.

*What did you do after it went bust?*

I left. I had a car provided by Mitchell Cotts which [incomp], bit more pension and I moved back down here and got interested in going to Cardiff, to do work at Cardiff. That was it. I also worked with GRC permanent formwork, but I couldn't stand... I was chairman for the interim between one chairman retiring and another being appointed, but it was balancing income and outgoings and debts and trying to avoid debtors or promising debtors money which has not yet been earned and I got very, very uptight about it all. So I finally resigned after a few months so that they... they had to get... and they had another bloody managing director.

*When were you...*

But I did solve their problem on GRC permanent formwork.

*When were you a visiting professor at Cardiff?*

After the Mitchell Cotts, when I moved down here and I went down to see Ben Barr who was a friend of mine and had worked on buckling of plate girders and so on, and so I got asked to be a visiting professor and work on schemes which I had in mind, one of which was the firing of the nails, islands in the channel and basically all the work on reinforced earth. Which was interesting and finally I gave up. I'd had colonic cancer, heart attack. There wasn't much I hadn't had, so I gave up. That was it. That's it.

*Shall we take a break and then move to some closing questions?*

Yes, okay.

[end of track 10]

[Track 11]

*Could you tell me how you became involved with the Motorway Archive please Ron?*

Yeah. One Sunday, rainy Sunday morning, I had a phone call from Sir Peter Baldwin who had been Permanent Secretary of the Department of Transport, and he said he was watching the raindrops run down the glass and it occurred to him that everybody knew who'd built the railways, nobody knew anything about who had built the motorways, and what were we going to do about it? So I suggested we put together an archive and in order to do that I got two other friends to meet with Sir Peter Baldwin in the Institute of Highways and Transportation; Professor Tom Williams and John Cox. John Cox was a director of Tarmac and Tom Williams was a professor at Portsmouth University. And we got together and we decided that there would be regional general rapporteurs and specific subject oriented rapporteurs. So I agreed with the three of them who the rapporteurs would be. And I took on the role of project manager in writing to all ex-friends and people who were important in some aspect to be either a general reporter of the region or a specific reporter of a particular set of subjects, like computers. Now, Brian Hawker at Cardiff was one of my early devotees in the computer world and so I gave it to him to write up the history of computers, which he recruited then people to provide him with bits and pieces within a framework of where computers were used. So we had contributions from Durham, from Cheshire and so on and they were put together in a chapter called 'Computers and their Influence' or something of that sort. So it was a matter of selecting people for those sort of things like pavement design. John Porter, I remember John Porter. He was joint editor of volume two with me and we started work. Now, Peter Baldwin took on funding, finding the funding, and the idea was that he used local repositories for things like inspectors' reports, inspectors' reports and reports for the firm programme, etc, and these were kept in a depository in a local authority area in which the RCU had run and a computer program was drafted to give access, to say where all these bits of information were. And by the time we'd finished we had eleven books and a whole basket load of papers in various records offices throughout the country. In fact, there wasn't anybody who didn't come... who wasn't successful in... We were lucky in South Wales, Dennis Hall, who was Chief Highway Engineer in the Welsh Office, said he would do it and all that sort of thing, and Jack Evans as well, who's a friend of mine. But they didn't. They packed it in, found it too difficult. But Brian Hawker didn't. Brian Hawker and Howard Stevens managed to do the Welsh book quite easily. They formed a committee office, Brian Hawker and... well, we were lucky, everybody else turned up trumps, but Brian Hawker I've got a lot of time for.

[05:25]

*Eleven volumes is quite an achievement, why did you...*

It's volume one... let me go through them, I don't know if there's eleven or twelve at the moment. Volume one was the history from Churchill's post-war committee which decided that we were going to have motorways, right through to the folding up of the RCUs, and Peter Baldwin and his son wrote that volume one. Volume two was an amalgam of finding papers from all sorts of people and putting it together in a technical policy document, so that was volume two. Volume three was motorway communications and control and maintenance. Then each region also provided its own history. Scotland was yes, Devon was yes, so that's one, two, three volumes and one... the number of regions – one, two, three, four, five, six, seven. Seven and three, ten. So it's ten.

*Why did you think it was so important?*

No, no, no, eleven because Northern Ireland was successful.

*Why did you think it was important to put all that effort into producing this archive?*

Well, it's a... it's sort of giving a nod to the people who worked on it and they've got every reason to be proud of what they did. And so the volumes are there for future generations; my grandchildren have got copies and so I'm sure have many of the other people, their grandchildren got copies of it. And it's there as a work of reference, because it tells you why loading is what it is, why the certification process was so important, and so on.

*Do you think that the motorways are an under-recognised achievement?*

Oh yes, but that's because, unrecognised because people... they're getting all jammed up again. See, while we've got immigrants coming into the country, cars are in demand and you can plot – have I been through this with you before? So you can plot it. So you can see that fifty million vehicles won't go into the motorway programme, motorway network as it is. So somebody's going to have to do something about... So there are many solutions; one is that you provide more motorways, not that everybody's going to be happy about that. And you abandon all the

administrative system that was necessary to build more motorways. But build more motorways is one, but then cutting down the headway by having responders... you see, you've got thinking distance, braking distance and so on, and you've got two chevrons apart of the traffic. You could be able, it could be possible that you could run the cars at a closer interval by having something to make up for the thinking time so that if the car in front slows down, yours is slowing down because it's automatically programmed to do so and therefore you can get more traffic into the stream than you had in mind. Ultimately, I suggest that we're going to have cars which are self-drive, no driver at all, and you don't really need much to be able to know what's in the lane outside you, what's in the lane inside you, how fast they're travelling and was there a gap you can get into. And the car can be deciding that for you, so long as you specify what speed you want to travel at. But there's got to be something like that in order to be able to deal with the great volume of traffic that we've got.

[10:45]

*How much of an engineering achievement do you think the motorways have been in Britain?*

Oh, very considerably.

*Could you give me some idea of how considerably?*

Well, when the motorway programme first started, queues to Southend and other [incomp] resorts where you were sitting in the car for four hours or more and, you know, it was beginning to break down the economy because you couldn't get goods from one place to another as you would like, not free running anyway. Well, now we're getting back to the same stage and there's something we must do about exhaust fumes, which is, you know, the green nation. You need a car that doesn't spew out noxious fuel, gas. So ultimately there's bound to be governments who'll try and make different cars more... will presumably give a subsidy to doing it. But they seem to appear to feel that trains are going to supplement cars at present. I doubt that.

*Why?*

Well, I just think that people find, they find a sort of mental... they're drawn to their cars more than they're drawn to traffic on the railway line. It's something which is yours, you're in the

womb, listening to the radio, time passes and it's got something which travelling by train hasn't, although I prefer to travel by train. But then I would because I haven't got a licence.

*You started off mentioning the situation before the motorways with four-hour traffic jams, and what difference do you think the motorways have actually made to life in Britain generally?*

Well, it's been economic as environmentally I think we've done a good job. But economically is the benefits, the benefits are delivering goods and making the best use of trips which people are able to do. I mean how would you be if you were back in the fifties? You must recognise some benefits since then.

*I wasn't around in the fifties.*

No, you weren't around in the fifties.

*What benefits have you seen in comparison? Because I can't really picture what it was like before the motorways.*

No. Well, it's definitely that you can... you get longer trips, you visit family more, you can get around the country quicker. All that, but all that's being lost by increasing the volume of traffic. So there must be some solution to that, which I won't be part of. But there is a good bit in the volume two about that. I mean, you know, we already have, we already produced a program so that you can have a satnav, although it's not updated well enough is it? I mean you can find yourself going down a country lane when there's no need, because it's not updated often enough.

[15:18]

*Thinking about your career as a whole, all these many different jobs we've discussed, when do you think you were happiest at work?*

I think Cardiff University was as good as anywhere. I had a hands-on job, you could make up your own mind what you were going to do, there's nobody instructing you to do anything else and early on, hands-on building bridges, that was something. You got a bit wary about dealing with Ministers. You always had a different problem, which was good fun, but it wasn't hands-on.

*What do you think you've actually enjoyed most about your job as a civil engineer?*

Bridge design in areas of mining subsidence was a breakthrough. Computers were interesting and got promoted quite a lot. That was two things which were hands-on.

*I got the impression you like doing hands-on things, could you explain the attraction to me?*

Yes. When I came back from West Africa I and my brother-in-law built two houses brick by brick; plumbing, tiling, plastering, all weekends and evenings. That was hands-on. Keeping up with a plasterer takes a lot of doing. Mixing – we had a hand mixer to start off with, we soon invested in a mechanical mixer.

*I notice you've taken up painting in retirement. Is that part of the same hands-on thing or...?*

Yes, it's always been an interest, mostly on the drawing board. But yes, I've done a lot of work with paints.

*Seems a bit different from engineering.*

Well, it's absorbing. You get lost in it. You've seen most of the paintings around the wall I guess.

*What do you enjoy about painting?*

Oh, creativity. I've got paintings, my daughters' houses are full of paintings of one kind or another. And now my grandchildren.

*I was going to ask as well, have you made any arrangements to deposit your paperwork in an archive somewhere?*

No. It's all over and done with now. I mean the Motorway Archive is what it is. I mean anything that I did that was significant is in the Motorway Archive. No, I don't imagine doing much else, other than painting. I'll be eighty-three next birthday.

[18:44]

*How have you actually enjoyed doing these interviews, or not enjoyed? It's wrong of me to assume anything really. How have you found them, would perhaps be a better way of putting it?*

Interesting. Stimulating my memory quite a bit. How have you found them?

*Interesting. I've learnt a lot about civil engineering I didn't know before, it's...*

Yes, I suppose so.

*Is there anything you'd like to say before I hit the stop button?*

No. Press the stop button.

*Thank you very much Ron.*

[end of track 11 – end of interview]