The Institution of Engineers, Australia

Engineering Heritage Australia

National Engineering Oral History Program

INTERVIEW TAPE LOG

Interviewee: Norman Sneath **Tape Numbers: IEA EHA: MP 21 to 26**

Interviewer: Dr Margaret Park **Number of Tapes: 6, Sides A & B**

Place of Interview: 3 Holyrood Drive, Vermont, Victoria 3133

Dates of Interview: 8 April 2005

Restrictions on Use: None

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Interview recorded on Sony DAT Recorder TCD D100 professional portable digital recorder.

Tape: IEA EHA: MP21, Side A		
Time/ Counter	**Subject**	**Proper Names & Keywords**
000-013	Provides full name, date and place of birth.	Norman Sneath on 20 August 1926 near Derby, Midlands, England
014-040	Talks about his mother and father: a hard-working, working class family. Norm was one of three boys brought up with a 'modest standard of living'. Eric Sneath, younger brother moved to Australia and was a consulting engineer in Brisbane; other brother, Don Sneath, also moved to Australia, settled near Norm in Melbourne and worked as a quantity surveyor. Norm's mother (lived to 93) moved to Australia after his father's death.	Sneath Family Eric Sneath Don Sneath
041-073	Growing up in England – went to secondary school. War broke out when Norm was 12 – recalls the war years "hungry a few times". In the air training school waiting to be called up, but the war ended, attended university instead. Born at the start of the Great Depression – father was always in work in the mines. Started work at 16 as an apprentice in the steel works. Provided with a variety of tasks in the structural field while studying at the technical college. Talks about why he went into engineering – parents wanted him to pursue banking.	World War II Derby, England Air Training School Great Depression Appreniceship – steel works Engineering - Structural
074-134	Gained a scholarship, went to technical college and achieved an intermediate BSc, then went full-time with scholarship to Cambridge. The Company (Butterley) gave him the scholarship. Describes his course at university – all structural engineering. Cambridge engineering degree was	Technical College Scholarship Butterleys Co. Ltd. (England) Cambridge University Engineering Degree

	considered a 'pure degree' with minimum practical exposure. In later years appreciated this basic knowledge of mathematics. Later assisted Norm with complex mathematical analysis in his engineering work. Norm was excused a year at Cambridge due to his credits from his BSc. England had government sponsored scholarships for returned soldiers.	
135-162	Explains why he pursued structural engineering – company's orientation. Talks about his attendance at Cambridge – rowed, played tennis, but had to give this away to study hard. Met his wife, Dorothy, at the Technical School. Became engaged and married in 1948 when Norm left university. First child born, David. Dorothy was a dress designer – worked with ICI.	Structural Engineering Cambridge University Marriage – Dorothy Sneath David Sneath
163-207	Institution of Civil Engineers charter, a life member with 50 years; 50 years with Institution of Engineers Australia in 2006; and 50 years with Institution of Structural Engineers in 2005 (life membership). Had been a member of the US Society of Engineers, but no longer holds membership. Required 2 sponsors – was introduced by Professor Baker to Ralph Freeman – "the real designer of the Sydney Harbour Bridge". Freeman, Fox and Partners were prominent in the Westgate and the Milford Haven failure, the company was founded by Ralph Freeman. Dorman, Long & Co. were the contractors.	Institution of Civil Engineers, England Institution of Structural Engineers, England Institution of Engineers, Australia American Society of Engineers Ralph Freeman Sydney Harbour Bridge Dorman, Long & Co.
208-220	Returned to Butterley Company after University and worked in their design office for a year on structural steel design – roof trusses, bins, etc. Then worked with FC Construction Company – a reinforced concrete company – to gain basic reinforced concrete design: beams, columns and footings.	Butterley Co. Ltd. (England) Structural Steel Design FC Construction Reinforced Concrete Design
221-273	Explains why he moved to Australia – had a great appeal. Needed structural engineers – recruiting campaign at Australia House, London. Bill Brown interviewed Norm; he was the head of the Commonwealth Experimental Building Station in Ryde (Sydney). Had the choice of working at the Department of Works, Canberra or the Commonwealth Experimental Building Station in Ryde, or the Snowy. Norm chose Canberra – they offered him a house. Saw the prospects of growth in Canberra – diverse use from water supply, bridges, industrial buildings, Expos. Climate was also a factor. Describes his family's response – philosophical. Dorothy was hesitant, but would go where Norm went and was a good support.	Australia Bill Brown C'wealth Experimental Building Station, Ryde, NSW Department of Works, Canberra Snowy Mountains Scheme
274-312	Describes first impressions of Canberra – "like Shangri La". Arrived in 1951. Travelled to Australia on a migrant ship – a '10 Pound Pom'. Describes the journey through the Suez Canal and the colours and landscape of the journey and upon arrival in Australia.	Canberra, Australia 10 Pound Pom Migrant Scheme
313-339	Commonwealth Public Service – Department of Works in Canberra. Describes the office – highly organized: excellent library for technical service information, a car pool, good procedures for designing, writing specifications, calling for tenders – all well ordered. Offices were located beyond the Hotel Kurrajong – called 'The Woolsheds'.	Commonwealth Public Service Department of Works in Canberra The Woolsheds Hotel Kurrajong
340-390	Started as a new graduate graded engineer. Felt very welcome – received regular promotions. Talks about the 'displaced persons' from Europe scheme and growth in the	Graduate Engineer Displaced Persons – Europe Institution of Engineers.

	Department. Actively recruiting migrants and Institution played a major role in attracting skilled and professional engineers.	
	End of Side A, Tape 21	
	Tape: IEA EHA: MP21,Side B	
000-020	Continues with description of the Canberra Dept. of Works office. Worked with the Principal Engineer, Brian Beresford Smith. Also describes the staffing structure and various staff positions.	Canberra Dept. of Works office Brian Beresford Smith
021-062	Describes the challenges facing him upon arrival at the Department and the type of work. Started with small bridges – had to learn about the underflow and used information from NSW Department – how to measure the catchment area, the time of concentration, rainfall intensity, flow under the bridge – all aspects of bridge construction. First bridge – Wattle Street, O'Connor – "quality is remembered long after the cost is forgotten". Began pre-stressed concrete bridge work at this stage. Worked closely with Department's architects.	Bridge construction work Wattle Street Bridge
063-147	Mentions the policy of the Department to engage in 'material and methods. Department had a testing laboratory. Results were the responsibility of the Department. This policy changed when received alternatives in tenders – such as the pre-stressed reservoirs, describes this process. First in Sunnybank in Brisbane. Accepted a tender for this type of design in Canberra – results were satisfactory. Describes the construction of the Weetangara Reservoir – an excavated design.	Material and Methods Policy Canberra Dept. of Works Testing Laboratory Reservoir – Sunnybank, Brisbane Reservoirs –Red Hill, Ainslie, Hackett, Weetangara
148-261	Transferred to Construction section of the Department. Concerns with quality of concrete in Canberra and worked on improving its quality. Describes problems with concrete and how it was resolved. Investigated different sand types – located good source at Lake George – Currandooley Station. Also examined different grades of steel – describes types and grading. Close inter-relationship between designers and construction. Achieved a "marked improvement in the general practice". Condemned a construction site – the Administration Building, supported by the Director, Jimmy James. Talks about the 'factor of safety' in the design process and testing loads. "Bad concrete can be the prime cause of major failures." Describes the introduction of 'weigh batching'.	Construction Section Concrete Lake George Currandooley Station Honeysuckle Deposit Steel grading Japan Jimmy James Factor of Safety Weigh Batching
262-290	First ready-mix concrete company came to Canberra in the mid-1950s – Ready-Mix Concrete Pty.Ltd. then Pioneer, Transit Mix, etc. Worked well with Roland Pegg. They established their site close to the Department offices. Remained in Construction Section approx. 18 months.	Ready-Mix Concrete Ready-Mix Concrete Pty.Ltd Pioneer Concrete Transit Mix Roland Pegg
291-325	Returned to the Design Section – bridges, schools, reservoirs (While in Construction supervised the first pre-load reservoir – brought aggregate in from Sydney.) Describes advantages of pre-stressing and work of Monier Company in Canberra. Driven by costs most of the time.	Design Section Monier Company Pre-Stressing
338-420	Masonry blocks produced by Monier Company under license to Besser. Producing Commonwealth bricks at Yarralumla. Describes testing the flexural strength of walls. Department adopted for all schools, all buildings designed in the	Masonry and Block Work Monier Company Besser Blocks Yarralumla Brickworks

	architectural office from 1960. Also adopted load-bearing brickwork – a major move with masonry. Describes process and reasons for adopting process. First block of flats built this way in Griffith. Used the London City Building Regulations – brought with him from England. Built up to 4-storeys with load-bearing brickwork. In Perth, up to 10-storeys were constructed.	Besser Overseas Company National Concrete Masonry Association Portland Cement Association Load-Bearing Brickwork Griffith Flats (4-storeys) London City Building Regulations Perth, Western Australia (10-storeys)
	End Side B, Tape 21	
	Tape: IEA EHA: MP22, Side A	
000-079	Continues with load-bearing masonry and load-bearing wall capacities – all part of servicing the architects of the Department. Other works undertaken in the Section included raising the Cotter Dam by 30 feet. The Development Section planning the Lake Scheme, also Corin, Bendora and Googong Dams. Talks about the Bendora Dam – Ken Harding worked in Development Section. He suggested an arch dam for Bendora. Describes preparation, design and construction work of Bendora – a double-arched dam, including the use of early computer analysis. Inspired by a dam in Portugal designed by André Coyne. A structural model was made of Bendora dam in Italy by Professor Oberti – passed all tests. Describes the opening ceremony – Sir John Overall, NCDC (National Capital Development Commission). Ken Harding didn't attend or 'get a mention'.	Load-Bearing Masonry Load-Bearing Walls Cotter Dam Lake Burley Griffin Corin Dam Bendora Dam Ken Harding Googong Dam Computers Portugal André Coyne Italy Professor Oberti Sir John Overall, NCDC (National Capital Development Commission)
080-138	Ken Harding and Norm started Commerce Degree together at the Canberra University College – a 6-year part-time course, 2 or 3 nights per week. Both appreciated the business side of contracts and specifications, accountancy and statistics. Talks about Department's indifference to course. Describes the courses attended and influence of Prof. Arndt (economics). Highlight was theory of statistics and statistical methods – received honours. Decribes meeting Charles Bubb and Bill Melbourne when Norm moved to Head Office in Melbourne.	Commerce Degree Contracts and Specifications Statistics Professor Arndt Canberra University College Charles Bubb Bill Melbourne
139- 175	Also studied contract law. Talks about legal requirements of tendering process and provides examples. Importance of legal implications of providing information to tenderers. Introduction of 'perfomance tenders' – emphasis on the tenderer to guarantee results – issues of divided responsibilities, first in Canberra office then also in Head office activities.	Tenders Contract Law Performance Tenders
176-232	Working and supervising young engineers in the Canberra Office under the Professional Development Scheme. Advertised for Cadets offering scholarships. Norm's son, David, took up one of these. Norm was the Professional Development Adviser – given authority to move the Cadets around the Department to gain a variety of work experience. Many of the Cadets remained with the Department.	Professional Development Scheme Cadetships David Sneath
233-276	Promoted the idea of rigid frames based on his studies from Cambridge, research into Limit State Design. German engineer, Kleinlogel, produced a catalogue of different types of frames with their solutions. Norm brought this book with	Rigid Frames Limit State Design Kleinlogel Fairbairn Hangar, ACT

	him (still has it today!). Describes use of rigid frame design in Canberra: the Fairbairn Hangar, a 230 ft span; and for other buildings: schools, industrial buildings, National Library of Australia Archive Store at Fyshwick.	National Library of Australia Archive Store
277-296	Describes his professional library, had a pension for book purchase. Learned from others via literature in journals and books, e.g. American Society [engineers] journals, the *Engineering News Record* – reported on failures 'lessons of what not to do – Norm's 'Horror File'. Grew from year to year to hundreds of examples, used 50 in slides during his university teaching. Talks about his 'review work' at Head Office	Engineering professional literature American Society of Engineers Journals *Engineering News Record* Norm's Horror File Review Work
297-360	Most significant task while in Canberra Office – Montreal 1967 Expo. Worked with Department Principal Architect, Jim McCormack giving the task of designing the pavilion. First engineering design job in Canberra – St Patrick's Church in Limestone Avenue – use of laminated timber. Similar work done on Montreal Expo Pavilion. Describes the design and construction work. Talking chairs – Roy Grounds, exhibit architect designed chairs with speakers telling visitors about Canberra. Other work with Jim McCormack on 1970 Japan Expo. Unusual engineering design and construction work.	Canberra Department of Works Jim McCormack, Principal Architect St Patrick's Church, Limestone Avenue Montreal Expo Pavilion (1967) Japan Expo Pavilion (1970)
361-390	Mt Stromlo dome design and construction work, also satellite tracking stations after return from Harkness Fellowship and computer studies at Berkeley. First application of computers in 1962/63.	Mt Stromlo Observatory Satellite Tracking Stations Computer Applications
	End Side A, Tape 22	
	Tape: IEA EHA: MP22, Side B	
000-088	Continues with design work for the Satellite Tracking Stations, contracted by NASA for a data acquisition facility. Original purpose of the dish at Tidbinbilla. Became a deep space instrumentation facility later. The 'satellite dish' and information was provided for assembly but Canberra Office provided foundations and buildings. Describes the process of supporting the dish by writing a computer programming. Recsec program – rectangle section analysis – adopted by Victorian Roads, approached by Cec Wilson. Used in standard bridge piers, became known as a valuable computer program for all rectangle section analysis. Adopted in Perth, WA – then required trapezoidal columns, program modified called TRAPSEC.	Satellite Tracking Station Tidbinbilla NASA Computer Programming RECSEC (rectangle section analysis) Victoria Roads Cec Wilson TRAPSEC (trapezoidal section analysis) Frank Statham
089-127	Harkness Fellowship – inspired by Ken Harding's work on computers. Applied while attending the Canberra University College, granted an interview by three former fellows: Sir Richard Owen Dixon, Chief Justice of High Court, Sir Macfarlane Burnet, and Sir Roland Wilson, Head of Treasury and was successful (over 100 applications throughout Australia). Funding was supplied to attend university in the United States – University of California, Berkeley,	Harkness Fellowship (1961) Sir Richard Owen Dixon Sir Macfarlane Burnet (Nobel Laureate) Sir Roland Wilson Melbourne, Victoria University of California, Berkeley, USA
128-189	Describes courses – structural analysis in different forms, the use of computer analysis and experimental analysis. Appreciated new meanings in mathematics courses (numerical methods) offered at Berkeley. "Profound impact on career". Mentions this influence in relation to design and	Structural Analysis Computer Analysis Experimental Analysis Manuka Post Office Black Mountain Tower

	construction of the Black Mountain Tower in Canberra.	
190-241	Other subject of influence: finite element techniques taught by Professor Ray Clough – Norm's mentor. Describes global uses of finite element technique, e.g. motor car industry design. Remained in close association with Berkeley during Head Office and Monash University work.	Finite Element Technique Professor Ray Clough Commonwealth Department of Works Head Office Berkeley Studies in Engineering
242-294	Attended MIT after Berkeley – explains expert systems. Describes laboratory work at MIT funded by Japan.	MIT (Massachusetts Institute of Technology) Expert Systems
295-352	Berkeley was funded and supported by its location and money from the aircraft industries and the need for studies into earthquakes and dynamics, such as Ray Clough's work. Upon completion received a MS degree – a Master of Science Degree.	University of California, Berkeley, USA Professor Ray Clough Earthquakes and Dynamics Master of Science Degree
	End Side B, Tape 22	
	Tape: IEA EHA: MP23, Side A	
000-042	Returned to Australia after the Fellowship via England. Spent five-six weeks on board a cargo ship "Auckland Start" with family (wife, Dorothy and two children, David and Geoffrey). Visited UK family. Describes letter of support from Prime Minister Menzies and its uses.	England Cargo Ship "Auckland Star" Prime Minister Menzies
043-090	Describes returning to Canberra Works Department (1962) in his supervising position, continued working on schools, reservoirs and industrial-type buildings. Continued writing computer programs. Describes gradings and levels within the Department. Award for Engineers – declared a 'depressed occupation' by the Judge in the Arbitration Court. Public Service Board reclassified levels from five to four – senior and supervising became one level, then three from one to three. Salaries were adjusted accordingly. Describes various positions for engineers and career paths throughout Department of Works.	Department of Works Canberra Office Computer Programs Engineers Award Public Service Board
091-133	Talks about staff within the Canberra Office (recalls some names). Norm's reference books were widely known and appreciated by Works staff. Association of Professional Engineers Australia used an example from Norm's 'Horror File' in a case.	Canberra Office Staff Association of Professional Engineers Australia (APEA) Jimmy James (Department Head) George Redmond (Principal Engineer) Ben Porter (Principal Engineer)
134-175	Formation of a Computer Committee by the Department, including Charles Bubb and Ron Monro. Committee presented a report to a conference of directors. Gained approval to investigate the establishment of a computer cell in Head Office.	Computer Committee Charles Bubb Ron Monro Principal Structural Engineer
176-235	Talks about the highlights of time in Canberra: Expo Pavilion in Montreal and then in Osaka, Japan in 1970. Settling into Canberra life – all immigrants to Canberra. Lived on the outskirts of Canberra (Turner/O'Connor). "Canberra was an immigrant city". Talks about recreational and sporting activities in Canberra: tennis and golf. Turner Tennis Club and Courts were built by the Department.	Montreal Expo Pavilion Osaka Expo Pavilion Canberra Immigrants Turner and O'Connor Turner Tennis Club Haig Park Yowani Golf Club

		Tennis Golf Soccer Hockey
236-249	Design/construction supervision of the Canberra Olympic Pool. Tells story of problems with leaking. University assisted with tests to locate leaks which were subsequently patched.	Canberra Olympic Pool
250-302	Work with the NCDC (National Capital Development Commission), in particular with Commonwealth and Kings Avenue Bridges. Discussed house footings with Sir John Overall – major contracts for subdivisions and housing developments. Liaised with Peter Funda, responsible for construction at NCDC; and Bill Andrews.	NCDC (National Capital Development Commission): Sir John Overall Commonwealth and Kings Avenue Bridges Peter Funda Bill Andrews
303-348	Clients were other Government Departments – such as advice on floor loadings. Made an assessment of the Melbourne Building after a fire; discusses relation of fire to steel frames.	Government Departments Melbourne Building Building Fires Steel Frames
349-373	Importance of 'no failures' of structural works in Canberra.	Canberra Buildings "No Failures"
374-394	Move to Head Office of Commonwealth Department of Works. Describes feelings about the move, in particular, conscious of promotion above others in Head Office.	Commonwealth Department of Works Head Office Melbourne
	End side A, Tape 23	
	Tape: IEA EHA: MP23, Side B	
000-050 (small break)	Continues with views on the move to Head Office in 1966. Family were supportive of the promotion. Norm lived in Hotel Victoria for six months while the children finished school in Canberra. Located land at Vermont in a new subdivision and lived at first in rental house while house in Vermont was under construction. Norm drew the plans and employed a contractor. Dorothy was ill at this time. Talks about children's schooling, including new Wyndham Scheme for David.	Commonwealth Department of Works Head Office Melbourne Hotel Victoria Vermont, Victoria Wyndham Scheme
052-075	Appointed Chief Structural Engineer, Head Office – rank in Public Service was Assistant Director General, by time of leaving was Assistant Secretary. Describes role – when asked for a definition of responsibilities was told: "you are responsible for all structural work in the Department".	Chief Structural Engineer Assistant Director General Assistant Secretary
076-105	Reviewing work in regional offices – travelled at least twice per year. Invited to Perth regularly, went to Sydney when it was 'desirable', Darwin was relatively a rest until Cyclone Tracy. Talks about work with Dave Skewes in Perth Office, Frank Statham and Jim Buchanan	Regional Offices Computer Programs Perth Office Dave Skewes Frank Statham Jim Buchanan
106-193	Describes Limit State Design and rigid frame structures. Computer program: LIMFRAM – limit analysis for frames. Expressed the need for new philosophy in looking at an 'extreme event'. Also important to examine working loads for performance. Advocated by Professor Len Stevens at University of Melbourne and chairman of SAA (Standards Association of Australia) on Limit State. Failure of cooling tower at Ferrybridge, UK. Provided Prof. Stevens with computer programs for his students while still at Canberra Office.	Limit State Design LIMFRAM (limit analysis for frames) Working Load Performance Professor Len Stevens University of Melbourne Standards Association of Australia Limit State Committee Ferrybridge, UK

194-248	Describes first tasks in Head Office – Mascot and Tullamarine Airports. Reviewed drawings for Tullamarine buildings, found major problems and describes these. Subsequent visits and normal reviews. Responsible for the control towers – in particular problem with glazing.	Mascot Airport Tullamarine Airport
249-278	On the panel that judged the High Court Design Competition. Only concern in the winning design was the large window wall required careful design and consideration – successfully done. Remarked on the failures of such walls in other buildings such as the T & G Building in Sydney; Hancock Building in Boston, Massachusetts, USA.	High Court Design Competition Sir Garfield Barwick T & G Building, Sydney Hancock Building, Boston
279-310	Expo in Osaka, Japan. Describes the structural design of the Pavilion and requirements of JAWA (must withstand cyclone conditions and earthquakes). The Pavilion was moved after the Expo to a Japanese Port. The approval for funding ($3million to $6million) was delayed by Australian Government due to death of Prime Minister Harold Holt.	Osaka Japan Expo (1970) Jim McCormack Japanese Authority for World Exposition (JAWA) Prime Minister Harold Holt
311-417	TRITRUSS – computer program was used to frame the design and wind tunnels tests conducted on models made at University of Melbourne. Describes mission to Osaka to seek approval for the pavilion design. Professor Tsuboi, well-known in Japan heard the submission for wind tunnel testing and testing of loads and analysis with TRITRUSS. Japanese architect and structural engineer appointed. Asked for analysis to be checked by another computer program conducted in Japan on a NEC computer mainframe which confirmed original results.	TRITRUSS (triangular truss analysis) University of Melbourne Wind Tunnel Tests Osaka, Japan Professor Tsuboi NEC Computer
	End side B, Tape 23	
	Tape: IEA EHA: MP24, Side A	
000-032	Completes story of Osaka Expo Pavilion contract. Viewed finished result, toured Japan and reported back to the Department.	Osaka, Japan Expo Pavilion Japan working tour
033-130	Head Office projects: Cyclone Tracy. Talks about the cyclone damage, those who accompanied him to Darwin, getting to Darwin, feelings upon arrival, seeing the devastation. Investigated the event and the resulting damage in relation to engineering. Describes wind loads on buildings and chain of integrity – failures at every stage (traditional Darwin houses: asbestos walls and corrugated iron roofs). Conducted tests and explains reasons for fatigue failure on the roofs.	Cyclone Tracy, Darwin (1974) Charles Bubb Professor Len Stevens John Fowler Wind Loads and Roof Failures
131-213	Information from tests and recommendations distributed via a report – design shortcomings and construction. Circulated throughout the Department. Used by Charles Bubb in Ceylon. Danger of debris impacting on fibrous cement walls and other information gained from talking to people affected by the cyclone. Visited schools where people were sheltering and other refuges. Liaised with George Redmond, Director of the Darwin Department of Works and Jack Gamble, Principal Structural Engineer. Report was done in record time, presented on 4 January 1975.	Cyclone Tracy, Darwin Test Results Report to Department Charles Bubb and Ceylon Housing Damage George Redmond Jack Gamble
214-319	Continued involvement for years afterwards. Specialists from USA contributed to meetings. Report was presented to Cabinet in March 1975. Resulting in upgrading of the Darwin Building Regulations. Extra precautions in new Telecom buildings. Risk assessment and probabilities of another	Cyclone Tracy, Darwin Professor Joe Minor Dick Marshall Darwin Building Regulations George Warwick Smith

	cyclone justified increased costs of cyclone protection work.	Charles Bubb Risk Assessment Cyclone Probabilities Cyclone Protection
320-390	Rebuilt Darwin in five years. Large contracts were issues incorporating the improved cyclone condition construction requirements. Established cyclone testing laboratory in Townsville. Comments by Professor George Walker on the demise of the Commonwealth Department of Works, especially in relation to its work reconstructing Darwin. Problems of housing design and construction prior to Cyclone Tracy. Visited Onslow, Western Australia – experience of cyclones and failures and subsequent strengthening of housing design.	Rebuilding Darwin Building Contracts Cyclone Testing Laboratory, Townsville Professor George Walker Onslow, Western Australia Cyclone Resistant Housing
	End Side A, Tape 24	
	Tape: IEA EHA: MP24, Side B	
000-006	Continues with Cyclone Tracy work and modern disaster planning	Disaster Planning
007-083	Restructuring the Department and establishing a team of six structural specialist positions. Lists a few of the engineers on the team and their roles and responsibilities in the fields of welding, foundations, pre-stressed concrete, computing, masonry and cladding and analysis of complex structures. Regional offices began requesting their help with projects. Took two years to compile the right team – describes qualifications of specialist engineers. Made effort to keep them involved in their specialties in Australia and overseas.	Charles Bubb Ted Pitt John Lloyd Structural Engineering Specialists: Peter Taylor Mervyn Frost-Drury – welding specialist Brendan Corcoran – pre-stressed specialist David Gunasekera **–** shells analysis Don Lindsay – masonry and cladding Graeme Belcher – computer analysis
084-128	After establishing team, still short on reviewing roles – hundreds of reviews in a year. This demand continued through Norm's time at the Department, speculates one of the problems leading to demise of the Department. Details staffing structure and organizational chart.	Reviewing Roles Public Accounts Committee Staffing Structure
129-208	Small jobs were handled by day labourers – temporary workmen and tradesmen for small jobs and maintenance. Reads out figures from 1968 as reported by the Minister. Weighing up quality control against costings – always difficult. Efforts were required at lower levels for checking, reviewing and supervising – these needs weren't met. Continual concerns about checking and reviewing. "Yes, it must be done, but at no extra cost".	Day Labourers and Maintenance Section Departmental Budgets and Costings Quality Control Checking and Reviewing
209-236	Geehi aqueduct incident – series of failures, reported in press in June 1972. Small team of experts – Jim Antill, consulting engineer from Sydney, Ted Pender, Snowy engineer, Ken Andrews and Norm – asked to investigate the failure using resources of the Snowy Mountains Authority. Gathered in former residence of Sir William Hudson, became their accommodation and conference rooms.	Geehi Aqueduct Snowy Mountains Jim Antill Ted Pender Ken Andrews Sir William Hudson Snowy Mountains Authority

237-360	Visited site and examined failed pipes. Describes the casting process of the pipes: high quality concrete pipes, wire-wound, the damage found at the explosion site and the results of their examination and investigation.	Geehi Aqueduct Piping Failure
	End side B, Tape 24	
	Tape: IEA EHA: MP25, Side A	
000-118	Continues with the theories of stress corrosion at Geehi. Met with Madame Brachet in France to discuss her theories and work in this field. Cites other failures of similar nature. Discusses disagreements on findings. Water Resource Council pursued the issue and proposal for Dr E Phillips, metallurgist and engineer, conducted a worldwide study on behalf of the Water Resource Council. Norm attended an international conference in Prague and spoke again in London, also on this issue.	Geehi Aqueduct Snowy Mountains Stress Corrosion Madame Brachet France Jim Antill Water Resource Council Dr E Phillips Conferences in – Prague, Czech Republic London, England
119-196	Connects Geehi work with the Second Hobart Bridge and work with Jim Leslie. Interest developing in pre-stressed concrete construction. Describes process of post-stressing wires in bridges with pre-cast concrete and use of early grouting. Visited Switzerland with Jim Leslie to examine match-cast bridges. Describes attempts to rectify the Geehi problem.	Geehi Aqueduct Jim Leslie Switzerland Second Hobart Bridge Pre-Stressed Concrete Post-Stressing Wires Pre-Cast Concrete
197-272	Held position of Deputy Chairman of Committee on the Second Hobart Bridge after the first bridge collapsed when the cargo SS Illawarra hit one of the piers and sank the ship. Describes the accident and the original design of the Bridge. Jim Leslie (of Maunsells designers of the first bridge – Miles Burkett was given the job of restoring the bridge.	Second Hobart Bridge SS Illawarra Jim Leslie Maunsells Miles Burkett John Laurie Second Bridge Committee
273-396	The Committee sat for five years. Describes the work of the Committee and the bridge restoration process. Involved the University of Tasmania in plotting the wreckage. Installed new piers and caissons, the Tasman Bridge was put back into service. Committee investigated 18 sites. Visited many examples of match-cast, post-stressed concrete cantilever bridges. Expresses concerns about the construction progress – describes process – and meeting in the centre.	Second Bridge Committee University of Tasmania Tasman Bridge Jim Leslie Glen McKercher
	End Side A, Tape 25	
	Tape: IEA EHA: MP25, Side B	
000-027	Continues with description of construction of the Second Hobart Bridge and concerns with cantilever process. Calling for tenders and replacement by Charles Bubb on the Committee due to Norm's retirement.	Jean Muller Second Hobart Bridge Charles Bubb
028-084	At this stage (1979) Head Office transferred to Canberra. Discusses changes and the politics of the Department. Describes meeting George Warwick Smith at the Commonwealth Club, Canberra. Position was Director of Engineering, First Assistant Secretary – lists areas of responsibility. Concerns about the demise of the Department.	Retirement Alan Reiher George Warwick Smith Commonwealth Club, Canberra

085-119	Westgate Bridge Royal Commission extracts report distributed to the Department by Norm. Describes feelings about the results of the Royal Commission and liability.	Westgate Bridge Royal Commission
120-198	Describes an average working day in Head Office and juggling family concerns. Contact with Regional Offices and access to specialists and computer programs.	Work and Family commitments Regional Offices
199-233	Appointed to First Assistant Secretary, Director of Engineering three years before retirement. Discusses the Coombs report and the demise of the Department – contracting work out to private enterprise consultants.	First Assistant Secretary Director of Engineering Private Enterprise Consultants NCDC (National Capital Development Commission)
234-259	Describes process of retirement on an invalid pension. Had to forgo Monash University income. Applied for reinstatement to the Department to remedy this situation.	Retirement Invalid Pension Monash University
260-328	Asked to bring computer programs into Monash University. Talks about wider uses of his computer programs. Association of Computer Aided Design Authority formed – Martin Jones was a prime mover in this. Alan Reiher, Director-General, encouraged Norm to participate.	Monash University Noel Murray Eric Laurenson Computer Programs ACADS (Association for Computer Aided Design of Structures) Martin Jones Alan Reiher
329-359	At Monash involved in applying his computer programs to courses. Continued to write more programs. Provides a list of programs used at Monash and described in a table prepared (1993) for the Structures Group of the Institution of Engineers.	Monash University Computer Programs Structures Group, Institution of Engineers.
	End Side B, Tape 25	
	Tape: IEA EHA: MP26, Side A	
000-070	Recalls courses taught and teaching load at Monash University. Describes a teaching day at university – interaction with students. Applied practical engineering work to university major projects. Series of lectures on bridges, reservoirs, masonry, design in cyclone affected areas, failures and legal liability. Designed a slide show on 'failures'.	Monash University Lecture Work Failures Slide Show
071-127	Met Joy (2nd wife) at Monash University. Overseas (USA, UK and Europe) sabbaticals with emphasis on computer aided learning. Chaired one of the sessions at the Fourth Bridge Conference in Edinburgh. Describes sabbaticals, travels with Joy, time spent at Cambridge University.	Joy Sneath Sabbaticals Computer Aided Learning Fourth Bridge Conference, Edinburgh Cambridge University
128-168	Changes at Monash over 15 year career there. Felt it headed in wrong direction – political influences, funding, etc. Graduate courses abandoned. Submissions made for Norm to continue beyond mandatory retirement age of 65. Continued to teaching to age 68.	Monash University Politics and Funding Graduate Studies Retirement
169-244	Advised on reservoir at Jabiru, Northern Territory and also on Victorian Arts Centre Tower. Describes these consultancies, the work and people involved. Details the Tower construction. Hans Wolfram was in charge of the Tower construction work, formerly of the Department – requested Norm to undertake a computer check on the Tower and reached agreement with original results.	Consultancies Liability Disclaimer Jabiru, Northern Territory Victorian Arts Centre Tower Roy Grounds Hans Wolfram G. H. & D. (Gutteridge,

		Haskins and Davey)
245-323	Talks about the subsequent legal issues when cracks appeared about five years later. Describes forging (De Havilland Company) of the giant stainless steel balls supported the apron of the Tower. Victorian Arts Centre Trust served 30 writs on anyone involved in the construction of the tower, including Norm, Bill Melbourne and Professor Len Stevens.	Victorian Arts Centre Tower Victorian Arts Centre Trust G. H. & D. (Gutteridge, Haskins and Davey) Bill Melbourne Professor Len Stevens Hawker De Havilland Company
324-364	Discusses the issue of 'reasonableness', liability and indemnity. No statute of limitations: ruling today – "liability doesn't extend from the time that you finish the job it extends from the time that any faults appear… you are never free of the risk of being damned". An argument of reasonableness is no defence in the case of a failure.	Engineering Profession Liability Insurance/Indemnity Reasonableness
	End Side A, Tape 26	
	Tape: IEA EHA: MP26, Side B	
000-020	Continues with engineering profession and liability and the difficulties of providing advice and opinions – no longer engaged in consultancies. Structural engineers and insurance costs.	Engineering Profession Liability Insurance/Indemnity Reasonableness
021-066	Tells the story of involvement with development and construction of Black Mountain Tower (early 1970s). Was in Iran in 1970 and was contacted by Charles Bubb urging Norm to visit Moscow to investigate communication towers.	Black Mountain Tower Iran Charles Bubb Moscow
067-149	Preliminary design of Black Mountain Tower prepared by the Melbourne Office. Describes the computer analysis, the conical shells and platform of the Tower design. Canberra Works Department looked after the contract and logistics. Probing and diamond drilling conducted by consultant, David Coffey. Discusses issue of a 'decision of judgment' when Coffey located a fault in the shale (opinion it wasn't active).	Black Mountain Tower Head Office David Gunasekera Computer Program Analysis Alan Rehier Canberra Department of Works David Coffey
150-168	Charles Bubb's with Gerhard Horoschun conducted an analysis on the affect of the fault of Gunning transferred to the top of the mountain. Describes the placement of bearings inside the steel tower to transfer the horizontal forces at top and bottom. Movement doesn't affected communications.	Charles Bubb Gerhard Horoschun Black Mountain Gunning Fault Black Mountain Tower
169-195	Telecom was concerned about the amount of interference from the mast at the top of the Tower. Describes handling these concerns. Movement perceptions and design of tall buildings, including the World Trade Centre towers.	Telecom Black Mountain Tower World Trade Centre (New York) Towers Les Robertson
196-229	Controversy over construction of the Tower. Not supported by NCDC and the conservationists. Ruling by Supreme Court – wasn't approved by NCDC. Cabinet overruled NCDC to approve the Department of Works submission. Received an Award for Excellence in 1979.	Black Mountain Tower NCDC Protests and Injunctions Supreme Court
230-237	Attended the opening of the Second Hobart Bridge.	Second Hobart Bridge Charles Bubb

238-269	Shares letters of thanks and appreciation for years of public service (provided with interview package). Returns to discussing the lectures given at Monash University.	Public Service Appreciation Monash University Higher Education Research Unit
270-379	Recreational pursuits and activities: learned to fly at Royal Victorian Flying Club after flying around Australia with David Coffey. Gave up flying in 1988 after heart attack. Describes 10 years of flying experiences.	Flying Royal Victorian Flying Club David Sneath David Coffey
380-405	Summing up – retiring gracefully! Appreciation of opportunity to be interviewed for the Institution of Engineers.	
	End of Side B, Tape 26	
	End of Interview	

Note: Many of the projects described above are demonstrated in the images on the Cd provided by Norm Sneath and submitted with the Interview Log.