My Professional Career

Part 1 – (1966 - 1971) – South Africa

By Jacob A. de Raadt, P.Eng., MBA.

SDG

(Completed 2019-12-19)

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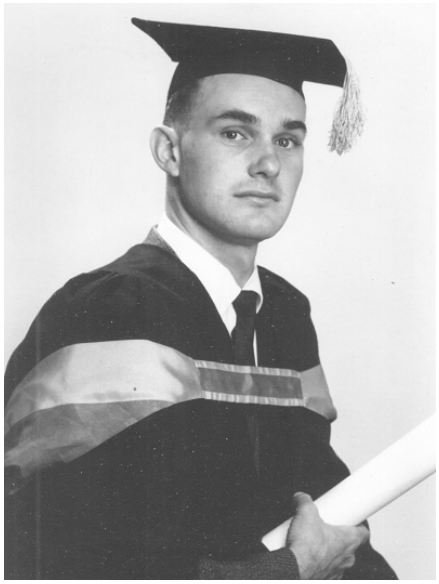

(Completed – 2019-12-19)

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Dedicated to those who first suggested that I write it all down, (and you know who you are), as a tool in mentoring, and to those in the profession (particularly the younger generation) who may also learn and profit from this – because they may otherwise never realize how things were done before.

Also somehow also dedicated to those who, during the continuation of my professional career, particularly during the first decade in Canada, did not really believe that I had already "seen all that, done all that and been there before", which lead to underappreciation and underpayment.

INTRODUCTION & ACKNOWLEDGEMENT (PERHAPS EVEN DISCLAIMER)

The letters "SDG" (meaning Soli Deo Gloria) on the front page are not shown without a reason. In centuries past, people like Johann Sebastian Bach wrote them below every music score that he had just composed. These days, it is a quite rare and pleasant occasion to see how some authors acknowledge Who gives them everything. The author of the children's book titled "Second Watch" did this a few years ago; so do I. Basically, everything is by God's grace, and simply ignoring that does not nullify the fact.

Having said that, I therefore thank my triune Lord God, from the bottom of my two-lead Medtronics pacemaker-assisted heart, for all His goodness and grace, and the opportunity to have practiced in the professional career of civil engineer for 54 years. Not every graduate (in whatever profession) may live and look back after more than half a century on what he or she has done and "accomplished". Not everybody has the wherewithal, mental ability and even guts or inclination to put pen to paper (which is now called fingers to keyboard) and give account of "what they did with their talents" in the workplace.

Civil Engineering was initially not my career of choice when I left home in January 1961: Having been accepted for Architecture on 18 January 1961, I enrolled for classes in its five-and-a-half year course. After two weeks of free hand drawing (imagine twenty 18-year old eager students, sitting on high stools, with pencils and drawing pads in their hands, around a bicycle on a stand), I realized that this was just not my kettle of fish. As a footnote explains, after eliminating that single impossible subject, I could proceed with a "**Plan B**" and still receive the scholarship that I had applied for. Did **I** do that? Emphatically **NO**. God closed a door and opened another (better) one. Thinking back now, I must thank God that He did not allow me to become an architect. I became a "Professional Engineer by the Grace of God". Queen Elizabeth II is not the only person with the letters "D.G." behind her name (as shown on older coins).

The son of one of my parents' acquaintances became an architect. Hans Wegelin took part in my froshing in February 1961, and after completion of his studies, perhaps joined the firm that designed the Munitoria Building. That edifice was completely "imploded" several years ago. I gladly note from GoogleMaps – which we could not imagine years ago – that most of the highways, streets and who knows also the underground infrastructure that I had a hand in designing or checking what the Contractor did, still stands, notwithstanding the potholes. I am well aware that some of these things have already been "improved" or "added to", so that the landscape is now different. That is OK with me, I guess; that is likely called "unstoppable progress", but I sometimes question it. Rome was not built in one day; the Romans are still building (something) today on what their architects and engineers built more than twenty centuries ago.

On 18 March 2019, Lydia and I celebrated our 52nd wedding anniversary. That "kilometre stone" (!) is one that less than 1% of people are allowed to mark and pass in their lives. Humanly speaking, without her by my side (and perhaps even as she is a civil engineer's daughter!), I could not have done in my career what I did. Behind every man stands a woman, the saying goes (and this can obviously be interpreted as "good" or "bad"), and mine is pretty good, through thick and thin (and we've had some of both!), and with the four children that God gave us. And on 6 December 2017, we celebrated being 40 years in Canada. (That is not shown in "Part 1", but I could not resist adding "Canadian content", eh?)

The text mentions the names of many people with whom I worked and from whom I learnt, through these years. I do not remember all the names or surnames, but I may perhaps recall more when reviewing your comments on this book, dear reader. As with all things, we tend to remember the good and forget the bad – or is it the other way round? Check on **Job 1**. As you may clearly see, I did some things "right" and some other things "wrong". "Errare humanum est", also where civil engineering matters are concerned. Although, biblically, Shakespeare's phrase actually ought to be: "To err is the result of human *fallenness*."

MY PROFESSIONAL CAREER – Part 1 – (1966 - 1971) – South Africa.

Chapter 1 – The first two years – B. S. Bergman & Partners, Pretoria.

In August 1965, during my fifth year after completing high school[1] at Potchefstroom Hoër Gimnasium, (the oldest Afrikaans high school in the country!), I saw a Notice announcing the annual "Job Fair", on a bulletin board on the campus of the University of Pretoria. This annual event was organized by the University's Career Counselling Office as an opportunity for final year students to meet representatives of prospective private and public sector employers, where employment opportunities could be discussed with them, prior to the final exams that would be held from late October to mid-November. Unlike others in my (all male) civil engineering class of about twenty-five students, who held scholarships that bound them to start their professional career with employers like the South African Railways and Harbours Administration (SAR&H, or SAR for short), the Department of Water Affairs, or some other provincial or central government department, I was not bound in any such way. (I had received a small government grant and the small Jacob de Jong Scholarship[2] for the first three years, but had lost both after failing a supplementary exam in Structural Analysis 3S in January of 1964, while I was already coming down with tick fever.[3] I had also received some student loans[4] from a women's organization in my hometown, called the SAVF or Suid-Afrikaanse Vrouefederasie.) I therefore decided to attend what we called the "**slave market**", in the basement of the Aula on campus, a huge hall where all various social activities were normally held, including our Folk Dancing (Volkspele) group that met there on Tuesday evenings. Adjacent to the Aula basement was the only restaurant on campus, comfortably close to the H.F. Verwoerd Engineering Building. I already had part-time employment during my fourth & fifth years of studies at UP, as follows: During 1964, I worked part-time for Mr. J.S.B. du Toit, Consulting Engineer, (which later became the firm Du Toit, Lindeque & Van den Berg) at 420 National Building Society Building, 13 Church Square, (now the PC Training & Business College) where I designed and draughted (yes, that is the proper English spelling) industrial steel structures (including the Datsun-Nissan factory at Rosslyn), and some reinforced concrete drawings for various new church buildings and even prison cells on Robben Island – perhaps the ones soon occupied by Nelson Mandela). My salary there was first 50 cents and then 75 cents per hour. During In 1965 I worked for the H.L. Fekken firm, a reinforcing steel supply and installation business, in Môregloed Industrial Park, as on-call "site supervisor" of a crew of up to twenty black workers. I interpreted engineering drawings and they did the "**steel fixing**", and I also sometimes had to drive the crew back to the yard with a worn-out Studebaker half-ton truck, after dark. [5]

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[1] In the Southern Hemisphere, academic years coincide with calendar years, with the summer vacation in between. For those who have lived in the Northern Hemisphere for all of their lives, this shift in seasons is difficult to grasp. Very few semester courses existed in those days at Universities and Colleges, and absolutely none at high schools.

[2] Mr. Jacob de Jong was a Dutch immigrant and building contractor in Pretoria, whose firm had erected various large buildings on campus like the Merensky Library, and had then gifted the University. In 1961, I became the first civil engineering recipient of that scholarship; my predecessors had all been students in architecture. I met Mr. de Jong that March at the home of his daughter and son-in-law on Charles Street in Menlo Park. Strangely, on an early afternoon in August 1961, on the Devenish Street railway station, (on my way to a practicum) I picked up and read a newspaper with the funeral notice of Mr. de Jong. I then ran back to my lodging at 230 Silver Street, grabbed my bicycle and rode all the way to the Pretoria-West Cemetery, arriving there just in time for the funeral.

[3] In January 1964, a tick ("bosluis") bit me in the groin while doing field survey near Rust de Winter. This was for an earth dam for a proposed fluorspar mine, as part of my compulsory vacation work after my third academic year.

[4] Interest free while studying, and a simple 5% interest rate after completion of the course. I paid this off very soon.

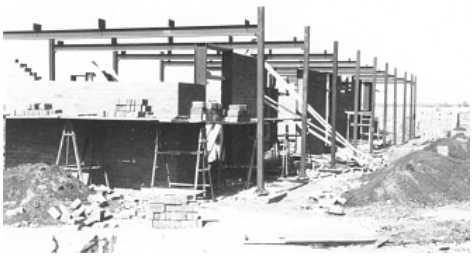
[5] My first experience with a consulting engineering firm had been the two months for J.W. Stein and Partners, two men of German background, at the Bauhaus Building on Andries Street in downtown Pretoria (December 1963 and January 1964). I mostly draughted concrete columns and beams, some even for the control tower of the brand-new Windhoek (SWA) Airport. (The firm also had an office in Windhoek, in the pre-WWI German colony now called

1961 - Silver Street, photo taken by Jaap Zuidam,

(Photo of my 1956 Francis Barnet motorcycle (or my 1951 Ford Anglia car) to be inserted here.)

	Theoretic	Economic	Aesthetic	Social	Political	Religious
Self.	34	45	42	33	36	
Ing.	44.75	46.25	35.45	30.85	43.50	
Tokkelok	38.00	32.95	34.85	39.40	38.90	

1963 residents of Boekenhout koshuis, main floor. Jaap Zuidam sits second from right.



Datsun-Nissan, Rosslyn, 1965. This is one of the minor buildings.

↑ Results of my early 1961 UP career. "**Self**" means my own score, "**Ing**" is what a typical engineer's score might be, and "**Tokkelok**" is what (they said) a typical theologian's score might be. The six test criteria of this series of questions are translated at the bottom; I do not recall if I "passed" this test, or even what it was called.

Namibia.) I did not like this work: I found it tedious and I was not good with pen and ink. But I liked doing calculations about reinforcing steel bars, for what is called "shop drawings" in Canada. I was supervised by a young ex-Tukkie Wally (W.G.) Haese, who owned an almost brand new Hillman Super Minx with a Peugeot 404 engine, a South African "unicum" in automotive engineering. Toward mid-January, nearing the end of my summer employment, I was sent out of the office for an out-of-town survey project, under the supervision of a retired engineer from the Department of Water Affairs. This Mr. Lingnau, who had qualified at the University of Braunsweich in Germany in 1928, was still working in his retirement years. A few days after my return from Rust de Winter, with tick fever in my body, I wrote the supplementary exam. Later that afternoon, I moved my belongings from Boekenhout Hostel to 1069 Church Street, Hatfield, the Silpert residence, and then, very tired (for reasons that I did not know), drove to Potchefstroom with my 1951 Ford Anglia, passing out on arrival. My parents called the doctor and I was in bed for a whole week. On my return to Pretoria, I discovered that I had failed the exam. It was then too late to request a sickness ("**aegrotat**") exam. Purely out of necessity, I then sat down with prof. D.W. de Vos, and it was jointly decided to "stretch" the four-year course into five years, and then to work part-time (if possible) during both years. I took and passed all minor 4th year courses during 1964, plus two that I had been lagging with (= Structural Analysis 3S and Electricity 3S), and I took **and passed** the five main courses in November 1965. I did not write my Seminar 4S presentation on work at J.W. Stein and Partners, but on what I had done in 1964 on the Datsun-Nissan project with J.S.B. du Toit.

J. W Stein and Partners
4th Floor, Barclay Square, Rissik Street,
Pretoria (P.O. Box 204)
⊿ J. W. Stein, PrEng, BSc(Eng), AMSAICE
⊿ E. A. Steinhobel, PrEng, BSc(Eng), AMSAICE

Working at J.S.B. du Toit & Partners, Sept. 1965, and with my mother on the flat roof, looking east.

UNIVERSITEIT VAN PRETORIA

REGISTRASIEBEWYS

BINNEMUURS

1961

Hierdie kaart is nie oordraagbaar nie en moet op versoek getoon word.

Dit moet telkens getoon word wanneer daar aansoek gedoen word om Spoorweg konsessiesertifikate.

V. & H.–P.ta

Registrasienommer: 23656

Inskrywingsnommer: № 608

Hiermee word gesertifiseer dat

Mnr. J. A. de Raadt

'n geregistreerde student van die Universiteit van Pretoria is.

Registrateur.

11 FEB 1961

Datum.

GOEDKEURING REGISTRASIE ONDERHEWIG AAN VOORLIG-GING: MATRIEKSERTIFIKAAT VOOR 15 MEI AANSTAANDE

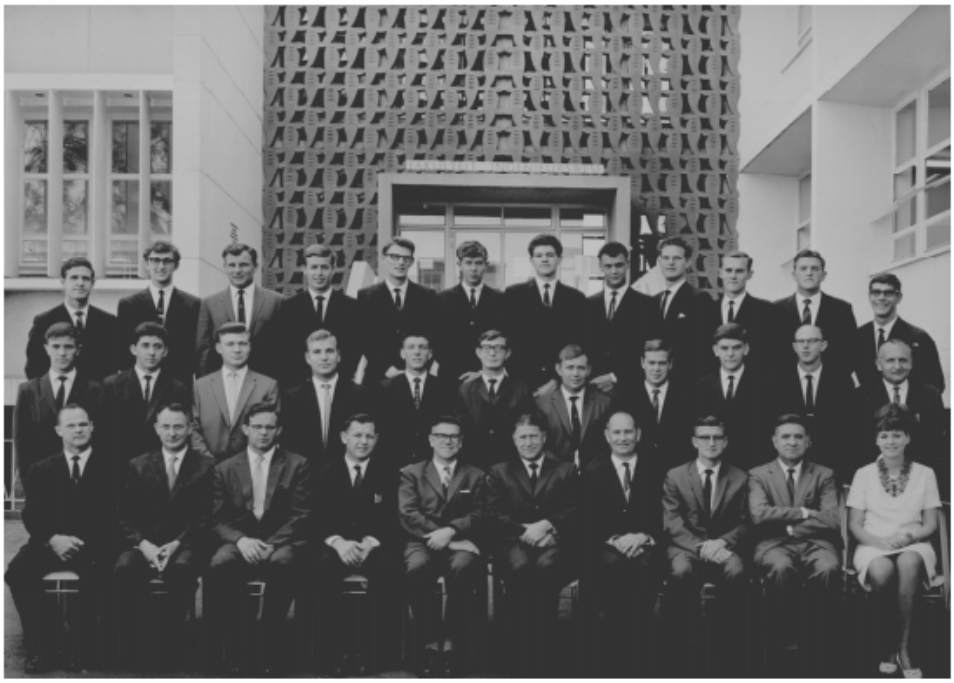
Annual document with my number 23656.

UP Folk Dancing Group, after winning the third competition at Johannesburg

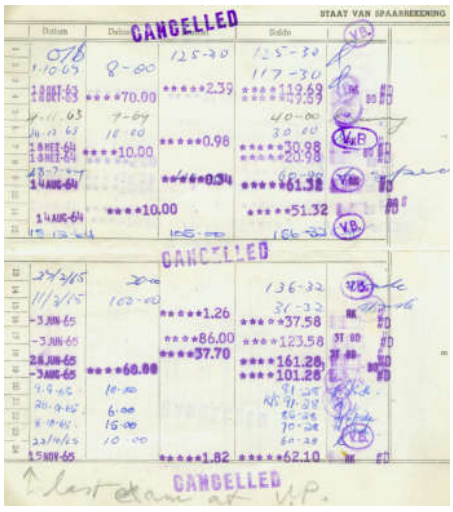
My Graduation Day, on UP campus. Photo taken at the entrance near the Engineering Building.

Arie's Graduation at the PU4CHE, April 1966. Studo photo at Fotokuns.

FINALEJAARKLAS IN SIVIELE INGENIEURSWESE - 1965



Voor: Mnr. S.R. Harrison, Mnr. B. van Tinteren, Mnr. D.G.S. Wolmarans, Dr. M. van Rooyen, Prof. D.W. de Vos, Prof. C.A. du Toit, Prof. G.P.R. von Willich, Mnr. C.J. Wessels, Mnr. C.N.L. van Huyssteen, Mev. S. Hamilton.
Middel: J.C. Stears, N. van der Walt, F.K. Zapke, C.W. Sonnekus, J.J. Smit, L.C. Esterhuizen, C. Stapelberg, P.J. van der Walt, W.M. Louw, S.M. Coogan, Mnr. W. Devos.
Agter: H.J. van Jaarsveld, J.L. van den Heever, J.S. van Rooyen, J.H. Zuldam, G.S. Engelbrecht, S.W. Burger, J.P. Verster, W.S. Blom, J.A. de Raadt, P.J. Strauss, D.J. le Roux, I.L. Rademeyer.



Volkskas Beperk Savings Account – April 1961 to November 1965.

Above is the **disclosure** of my financial statements during my student days – my Savings Account Book. I mostly used cash. I was a poor student (financially), and not much more than an average student (academically), although completing the four year course of studies below the average of five-and-a-half years. I still had a lot to learn when "they" let me loose on an (unsuspecting) employer that would teach me the ropes. What I learnt, is the topic of this book and of the parts that follow.
I do not recall if on that day, I spoke to anybody who manned the exhibits of the Transvaal Provincial Administration (TPA) Roads Department and some of the other public and private sector employers. But sitting quite alone at a table was a Mr. Marthinus Christoffel (M.C.) Botha, who introduced himself as a

partner in the Pretoria office of the consulting firm B. S. Bergman & Partners. I heard from him that this was the first time that he attended this job fair. His office was small and only two years old, and was a branch office of a firm that had been started in 1957 in Johannesburg. With one draughtsman and not even an office-based part-time secretary, a substantial basic planning[6] project for two urban expressways directly north of the City of Johannesburg was being completed at that very moment, and he said that he needed one or more newly qualified civil engineers for the detail design of this project (to be done in phases), as well as for a few newly assigned rural highway design projects for the TPA Roads Department, which projects had to date been designed in the firm's Johannesburg office. After a follow-up office meeting with Mr. Botha, I was offered a position in the Pretoria office, (at the JBS Building, now the Rentbel Towers) in January 1966, at an annual salary of R 3,000-00 (x R 300), plus a shared fee medical fund and 20 working days vacation per year, pending the successful completion of my studies and the outcome of possible conscription into the South African Defence Force. This salary was somewhat more than the current "going rate" for engineering graduates, and also comparable with salaries recently being offered by government departments – the guideline used at the time; see the excerpt from "The Civil Engineer in South Africa" on the next page. Mr. Botha told me that he had completed his engineering studies at the University of Stellenbosch in 1949, and had completed a long career with the central government's[7] National Transport Commission (NTC), where he still had very good connections.

It was obvious that there were advantages for employment in Pretoria: I would not need to move away, and could also even start with graduate studies. So I accepted the written offer of 1 September 1965, signed by Mr. Bergman. I also advised Jaap Zuidam, my former roommate from 1961 to 1963[8], about all this. He had married Magda Brouwer in December 1963, and they lived in an apartment in Queenswood. Jaap met Mr. Botha shortly afterwards, and also agreed to work for the firm, also in Pretoria. He was the recipient of a full South African Chamber of Mines scholarship (amount unknown), for which he was eligible because his father worked at Welkom Gold Mine in the Orange Free State. This scholarship did not bind him to any future employment with mining firms after completion of his studies.

In June of 1965, Jaap and I had both been notified by mail that we had to have medical examinations done, for selection by the South African Defence Force, at the red brick Drill Hall on Artillery Row, just south of the railway underpass on Potgieter Street – near the Pretoria Gaol. My parents had taken me to South Africa with their emigration from the Netherlands in July/August 1952; I had become a naturalized South African citizen on 28 September 1960, during my last high school year and prior to my 18th birthday. Likewise, the Zuidam family had emigrated from Epe (Gelderland) in the Netherlands in 1956, and Jaap had become a South African citizen in March 1961, just after we had started as first year students (called "Ienks" at UP), and boarded at the Van der Laan family at 230 Silver Street, Muckleneuk. Since naturalizing, I had become well aware that I had skipped the 1960 draft before my university studies started. A period of "national service" was still likely for both of us; this period had in the meantime been lengthened from 12 months to 18 months.[9] On an evening in early August, we had both gone and been checked over physically. We were told that for civil engineering graduates like ourselves, military duty would mean "basic training" and then joining the Engineering Corps in Kroonstad, OFS. I have always

[6] "Basic planning" was the terminology then used in South Africa, for what I later learnt under various other terms – e.g. "functional design", "preliminary design" and even "predesign".
[7] Like the (federal government's) Transport Canada, or the Federal Highways Administration (FHWA) in the USA.
[8] In 1962, Jaap and I boarded with the Wilcocks family at 495 Prospect Street, Hatfield. Three other students boarded there; the twin brothers Danie Louw (studying law), Jan Louw and Kalfie Steenkamp (studying medicine).
[9] In February 1963, when Jaap and I moved into Tukkies' brand new Boekenhout Hostel on Lynnwood Road, it was almost filled with first-year students, who had just completed their 12 months of national service and were therefore only a single year younger than us, having matriculated in 1961. Some seniors came from College Hostel.

privately suspected that I did not (really) pass this medical examination[10] that evening, although this was not ever divulged to me in so many words: All I received by mail was a form letter – that the South African Defence Force could not use me in 1966, and that I did not need to continue advising their office of my address, like I had been required to do until that time. So that is what I did.

From "The Civil Engineer in South Africa" – October 1964, page 193, I would like to copy the following:

Communications from Council

ADDENDUM TO MANUAL OF PROFESSIONAL PRACTICE FOR ENGINEERS

The Council has decided that the following be published as an addendum to the Manual of Professional Practice for Engineers:

The following conditions and basic salary scale for posts below that of Department Head or Partner or posts with senior Executive responsibilities, are recommended where engineering staff are in salaried employ: —

(i) Acceptance of the principle that recognised engineering qualifications shall be a requirement for professional engineering positions, and that professional engineers should be eligible for appointment to administrative posts.

(ii) Freedom of movement of professional staff between engineering undertakings (in this connection members of the Institution are expected to act in a responsible manner in the employment of staff).

(iii) Conditions of service appropriate to professional work.

(iv) Recommended minimum salary progression (in 1964): R 2,400 x R 200 – R 6,000 over 18 years.*

DEGREE CERTIFICATES

Council draws the attention of members to the fact that it may be in the interest of the Institution if they display their membership certificates in their offices or other place of work.

(Inflation caused these numbers to change soon!)*

My Volkskas savings account book (with the balance of R 62,10) shows that my last exam was on 15 November. I passed all five main courses that I needed to pass simultaneously, but Jaap Zuidam did not. He became ill during the final exams, and received the opportunity for sickness (aegrotat) exams for four of his main courses: Structural Analysis 4S, Hydraulics 4S, Civil Engineering Practice 4S and Civil Design 4S. The hand written note on the back of my framed print of our 1965 class photo shows that he passed all of these except Hydraulics 4S, so that he was then allowed to write a supplementary exam after that, later in 1966. (That still counted for "simultaneously.") In any case, he did not graduate with 16 others and me on 25 March. Additionally and importantly, he was called up for 18 months of "National Service". This upset him a lot, (perhaps because Magda was pregnant at the time?), and he made a drastic decision to renounce his South African citizenship – which obviously got him off the hook permanently.

Jaap therefore could not accept Mr. Botha's initial offer – although he shortly afterwards accepted a work offer (likely for a slightly lower paid position?) and was my colleague during the first half of 1966. During that time, he spent much more time than I in the firm's Soils Laboratory in Pretoria-West. He graduated in September 1966 (together with medical practicioners, architects and others with courses that had half year completion dates, and doctoral degree candidates, even honorary degrees) and then left B.S. Bergman & Partners to join the firm Jeffares & Green in Johannesburg – because he was not at the firm's 1966 Christmas Party, at the Soils Laboratory, which I attended with my (then) fiancée – see below.

[10] My double jointed knees and very flat feet may have been the reason, or alternatively the albumen that had been discovered with urine tests for a (small) government loan in 1961, and caused insurance application enquiries afterwards. I had had two bouts of "St. Vitus Dance" in 1954/1955, and remaining heart problems were suspected.

After the final exams, I vacated the room where I had boarded that year with a Mr. & Mrs. Lombard[11] at 59 Vlok Street, Sunnyside, and temporarily moved all my belongings and furniture[12] to the residence of my second cousin, Mrs. Hanny Trennen, who with her husband Kor lived at 100 Starkey Avenue, Waverley. In mid-December, I took a vacation[13] with my 1951 Ford Anglia, to visit a friend Duidlief Viljoen[14] and his parents on the farm Soetfontein just west of Postmasburg, Cape Province. My first vsit there had been in December 1960, after completing Standard 10 at Potchefstroom Gymnasium High School. I returned via Boshof, Orange Free State, but that's also another story.

And so it happened that just after New Year's Day, on Monday 3 January 1966, (as New Year had been celebrated on Saturday)[15], I entered the offices of B.S. Bergman & Partners, on the 8th (top) floor of the Johannesburg Building Society (JBS) building, located on the corner of Church Square and Bureau Lane, to start my career in civil / highway / transportation / traffic engineering. That first phase of my career would last two full calendar years, during which I learnt very much, was mentored wonderfully by Mr. M.C. Botha and others, and was also given ample leeway to get into a huge variety of planning and design functions which I believe, laid a solid foundation for work in the many years that followed.

When I started to work at the firm, I actually became the third person in the office, and when I left two years later, about ten people worked there, five of them professional engineers. I am quite aware that the firm also grew substantially since that time – which was during the real boom days of South Africa, in terms of highway design and construction. Warren Gabriel Sam (his full Christian names) Verster was the draughtsman to whom I was introduced on the first day of work. He had already worked for the firm for about two years, since the opening of the Pretoria office. He had formerly worked (and been trained) at one of the Randfontein gold mines. In those days, all draughting was manual, and his various types of lettering were just "perfect". Chamber of Mines training in South Africa was known to be excellent. The office consisted of three separate but connected teak parquet floored offices in an eighth floor suite, with three windowed access doors from the hallway, and the washrooms down the hall. There were two lifts from the heavily pink marbled building foyer with brass staircase railings and entrance doors off Bureau Lane. For ventilation, we just opened the windows, but there was an electric heating system in the winter. The JBS branch access itself was off Church Square, on the main floor, and they used some office floors as well. (In South Africa, the "first floor" is the main or ground floor, unlike in North America.) The private corner office was Mr. Botha's, and it had a west view on Church Square as well as a south view into Bank Lane, leading south toward Pretorius Street. The two other offices had south facing windows across Bureau Lane, and we were above the top floor offices across this narrow one-way street, so we had ample daylight and an excellent view. Soon after my arrival, Mr. Jan Kleynhans, an engineer from the Johannesburg office, visited me twice, acquainting me with "**the TPA way**" of preparing highway design drawings, including geometric design standards and the like. Mr. Botha also showed me a blue hardcover book during my first week at work, called the "1954 AASHO Blue Book". "This is what is used by the TPA," he told me, "but a revised edition is currently in the mail." As an aside, this book was the 1965 AASHO publication: "A Policy on Geometric Design of Rural Highways". The 1965 edition came by

[11] Mr. Lombard was a retired South African Railways worker from Eastern Transvaal, and their son was a big shot in the South African Police in Pretoria North. The house at 59 Vlok Street was already found demolished in 1991.
[12] I must have borrowed a pick-up truck (bakkie), because of my 5' x 3' desk and a large three-door upright dresser.
[13] Ticketed for R 20 in my home town on 10 December, I appeared in Court on the 24th facing a "trumped up charge" of crossing a (non-existing) solid line. The policeman was not in Court, and his colleagiue somehow "testified" that my battleship grey Anglia was red! That did it for the judge. "Case dismissed, it's Chrstmas Eve."
[14] I first met Duidlief during the Gereformeerde Jongeliedevereniging congress at Potchefstroom in 1960. After his army service, he studied law at Potchefstroom University for Christian Higher Education, lodging in Dawie Dup Hostel, and often visiting my parents. He later practiced law in his hometown, eventually becoming Town Clerk.
[15] In 2017, Canada's "150th birthday" year, Canada Day (which had originally been known as Dominion Day) fell on a Saturday. Medical titioners' offices were closed on Monday 3 July 2017. How things have changed!

mail a few weeks later. Throughtout my career, I have obviously used it (and its "**derivatives**" in Canada) for many years. [16]

There was no lunchroom in the offices on Bureau Lane; Warren and I normally walked to have lunch in the restaurant on the 13th floor of the south block of the TPA building complex, where we sat along the windows and had a marvellous view of the city, either to the south or to the north, and many construction cranes rising to 25 storeys or more in the downtown. The cost for a plate of nutritious food (fish and chips or shepherd's pie, with a variety of vegetables and thick gravy), served on real dishware and with real cutlery, plus hot chocolate, coffer or tea, was only 13 cents in those days; heavily subsidized of course for the sake of the hordes of provincial government employees in that complex. After a one-hour lunch break, (1 to 2), I once raced Warren down, by taking the steps, while he took the lift. I won handily, but perhaps not fairly; I pushed some buttons on the way down, racing around the lift shaft from floor to floor! But sometimes we lunched at the Department of Labour building in Andries Street, where one had to walk straight through the main foyer of the building, and the hot lunch meal cost there was 20 cent.

To give an indication of traffic and vehicle density of the downtown core of Pretoria in those days, I should state precisely where I parked my Ford Anglia that month. Driving in from Waverley, I was normally able to angle park on the boulevard on the south side of Vermeulen Street (which was a two-way street, south of the two-way couplet consisting of Proes Street and Schubart Street), just west of the traffic signalized intersection with Bosman Street, directly opposite the wrought iron fence around the NG church on that corner, and in between the jacaranda trees. This was only two medium street blocks away from my office! I sometimes picked up Warren on the way to work. He lived in a neighbourhood called Kilner Park, close to Waverley. Doing this allowed his wife Ingbrit to use their Volvo that day. Two-car families did not really exist among the working class in those days. Ingbrit's father was the Managing Director of the South African operations of Sandvik, (the internationally known Swedish firm making saws and the like), and lived in Johannesburg. Warren's grandmother had at age 84 climbed onto the roof of her house on the East Rand, where she had very badly cut her thumb on galvanized iron roofing. "Just cut it off," she then said, "or I'll do it myself", and really, she grabbed a knife…… and did exactly that.

Warren made our coffee and tea on a side table in the office that we shared. When brewed, we would call Mr. Botha and spend some time drinking it in the middle office (where all the filing cabinets were), or we made some for him and his occasional visitors, taking it on a tray. I remember one episode about the coffee situation that occurred soon after Jaap Zuidam had started with us in March. We used condensed milk from cans, and did not have a fridge in the office. With a beer can opener, we made two holes in the top of the can, and poured some of the contents into a teaspoon. This is obviously a fairly slow process; one of us "**former students**" then had the bright idea to speed things up by tilting the can over the cup of coffee and then blowing air into the upper hole of the can. This worked just fine for the three of us, until the day that Mr. Botha discovered this innovative method, and almost had a fit. Perhaps due to this occurrence, but maybe also due to an increasing workload, Mrs. Margaret (neé Piso) was soon hired as a secretary / typist; she had other special responsibilities which you may guess.[17] (I cannot recall her married name – she had completed a BA at the PU for CHE during Lydia's years there.) And at the same time, a small refrigerator then appeared in the middle office.

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[16] Much later, in Phoenix, Arizona, I was given a copy of the 1954 edition, which was by then "much outdated", but I used its information in a presentation to the 2004 Annual Meeting of the Western District of ITE, the Institute of Transportation Engineers, held in Sacramento, California, (and particularly the data in the Table on page 441).

[17] In Government offices in those days, there was always a (black) "**tea boy**". We were originally too small an office to warrant one. There was the joke of the lion on Meintjieskop, the rocky range directly north of the Union Building, which was kept in a wild state as Nature Reserve. This beast supposedly caught and ate a civil servant for lunch every day, and this was not even noticed by other civil servants…… until the day that the lion ate the tea boy!

Coffee was important to Mr. Botha, and it had to be black and strong. He told us that he sometimes had bouts of low blood pressure. One coffee break, he mentioned that he had almost turned back the previous day, when on the way to a meeting in Braamfontein with his four English-speaking partners. When getting "upset" about one or other thing during the meeting, he had suddenly felt "much better". We very seldom saw him upset in Pretoria. He became 40 years old during 1966 (when I was only 23½ years old), and mentioned this casually during our coffee break. He was married and lived with his wife and children in the Rietondale neighbourhood (north of the Union Building) and had racing pigeons as his weekend pastime, with participation in all kinds of club activities[18] and such. He was very proud of his birds. Around 2013, I learnt by e-mail from Mr. Ivor Evans, his partner, that Mr. Botha had emigrated (while already in retirement, or before?), and was living close to a married daughter in Perth, Western Australia.

I was asked to spend about a week or two in the firm's Soils Laboratory on Mitchell Street, to do a series of physical tests on a certain waste product chemical, to see if it was useful[19] for something else. This work seams to bear no relationship at all to my design assignments. Mr. Les Marais (an industrial chemist by university training and experience) was quite sceptical about this research, and perhaps as a result of that, the tests were not successful. Although I do remember that I was required to make the testing equipment by drilling small holes through some plastic bowls, and can only guess that the capillary forces of the liquid were likely too high for this type of test.

Many consulting engineering firms sprang up in those days, while the public sector could not retain staff. One reason for this was "**inflation**", and another one the unwillingness of the public sector (municipalities and all government departments) to deal with this. The monthly magazine "The Civil Engineer in South Africa" contained many articles about this situation, the acute shortage of engineers (calculated at 600 in early 1966) and about the Straszacker Committee that had investigated these problems at length.

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Δ M. C. Botha, PrEng, BSc(Eng), AMSAICE
I. G. W. Evans, PrEng, BSc(Eng), MICE, MIStructE, AMSAICE
Δ H. J. C. Forbes, PrEng, FICE, MSAICE
R. B. Krafft, PrEng, BSc(Eng), Dipl RSI, FICE, MIMunE, MSAICE
W. H. F. Nitsche, PrEng, BSc(Eng), AMSAICE
(The partners marked "Δ" were authorized to represent the firm.)

This listing (and similar ones) comes from the South African Institution of Civil Engineers' monthly magazine called "THE CIVIL ENGINEER in South Africa" (December 1970). It shows the name of the firm and names all the partners. By that time, all of them were registered as PrEng.

One day in early 1966, there was a knock on the door, and Warren or I opened it. A quite young, pretty and mini-skirted lady introduced herself in English, and asked to see Mr. Bergman. "Sorry," we responded, "Mr. Bergman is in the firm's office in Johannesburg." "May I then please see Mr. Venoti instead?" (as we understood her) was her next question. Warren and I directly caught on that she had misread the name on the door, "B.S. Bergman & Vennote" which was in Afrikaans only. Carefully, without trying to embarrass her too much (and not being very successful at that) we told her that there was no such person as "Mr. Vennote", but that this word is the Afrikaans word for "Partners", just like the Afrikaans word for "Company" is "Maatskappy". And we also said that "Mr. Botha, the local partner[20] of the firm, is out for the afternoon, but can we perhaps help you?" It appeared that she was selling decorative globes with a diameter of about 45 cm. We then told her politely that it was our joint opinion that Mr. Botha

[18] Having racing pigeons was not an uncommon hobby in South Africa at the time, although (if I am not mistaken), it was a more common pastime among the lower classes of white people. It was also quite "regional".
[19] This might have been a type of lignin, already in use by Natal, from the SAPPI paper factory in that province.
[20] These four partners all worked in the Braamfontein office, just north of the downtown of Johannesburg.

would likely not be interested in having one of these globes on his desk, seeing the normal state of his (not very large) office, but that she could come back the next day and ask him. But she never returned.

This story leads me to the topic of bilingualism, as it was practiced in South Africa at the time, or rather, in Transvaal. This young lady, if educated in South Africa, should have known better. Under the nation-wide "two school language" system (Afrikaans medium and English medium), every white student would receive education of all subjects in one language (the home language), and have the other official language taught as a main subject. With twelve school years (Sub 1 & 2 plus Standards 1 - 10) one would receive English language at a Standard 8 level in the final (Standard 10) year in an Afrikaans medium school, and vice versa[21]. To explain the level of English that I obtained in an "top-notch" Afrikaans medium High School, it may suffice to record the three prescribed books that Miss Lohann waded through with us in my final high school year: Shakespeare's "Macbeth", Eve Curie's "Madame Curie", and "The Story of Kingsley Fairbridge by Himself". Did this give me an adequate knowledge of the English language? Determine this for yourself, dear reader. My final mark in English was a B, meaning (in those days) between 60% and 75%. In January 1961, after returning from Postmasburg, when I was considering a request for "remarking" my final exam papers, I actually discovered at the TPA Education Department in Pretoria, that my English mark had been 73%. I suspected that I might have attained a slightly higher mark[22], but I (nor my parents) could not afford the "remarking fee". Note also that at the Afrikaans medium "Universiteit van Pretoria", most of my engineering textbooks had been in English, actually "in American", while all our lectures, text notes and examinations were in Afrikaans.[23] My reports on my compulsory vacation work (after my second and third years) had to be prepared in English, though. The eight percent of English speaking students among us (according to the SAICE Presidential Address, 1969, by Prof. D.W. de Vos) were allowed to write assignments, tests and exams in English, but their reports on compulsory vacation work had to be prepared and presented in Afrikaans….. Fair?

As an aside to this, Mr. Barney Bergman visited our Pretoria office one day, introducing himself to everybody that he did not yet know. He also introduced another man as his "skoonbroer". Now while the word "skoonsuster" is proper Afrikaans for "sister-in-law", "skoonbroer" is not a word at all: the correct word is "swaer", not unlike the Netherlandic "zwager" or German "Schweger". But he got the principle correct, and our "all-Afrikaans" speaking staff understood what he meant. In bilingual South Africa, one needed to be tolerant toward people from the other language group; this obviously worked both ways.

How did this relate to operations in the consulting world? Well, that obviously depended on the client. Within the TPA Roads Department, a system that I would call "**language rotation**" was practiced. For one year, all construction project documents would be prepared in Afrikaans, and for the following year, thery would all be prepared in English. Many of the words "embedded" (for lack of a better word) on the engineering drawings (on mylar sepias) were therefore bilingual, but our design information was in one language only, anticipating the language of the construction documents. Contract Specifications would be prepared in one language only, but the Contract would be advertised in newspapers and the Provincial Gazette in a bilingual format. A few years later, when working in the public sector, I discovered that the City of Pretoria had a different "language rotation" system: All odd numbered construction contracts had

[21] This situation would be comparable to having French at Grade 10 level in western Canadian high schools with 12 grades – which obviously does not happen, has never happened, and will never happen.

[22] I scored 3 A's and 3 B's in November 1960. The A's were for Latin, History and Mathematics; the B's were for Afrikaans (higher grade), English (lower grade) – as these were called – and Chemistry/Physics. Two years later, my brother Arie Godfrey had 4 A's, but I do not know for which subjects and the marks of his other two subjects.

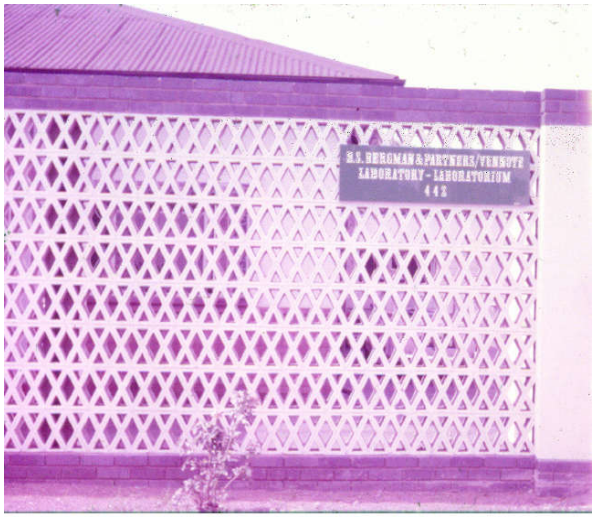
[23] Other South African universities likely had a similar language policy, but I do not know when this was started. Civil Engineering was also offered at three English medium Universities (Cape Town, Natal and Witwatersrand) and the Afrikaans medium University of Stellenbosch. (Things changed quite a lot afterwards!)

to be prepared in Afrikaans, while the even numbered ones had to in English. And there was no possibility of "skipping ahead" with numbers. Before starting with any design on a new project, I needed to obtain a contract number from the Chief Clerk of the Engineering Department, who had one thick book in which he wrote down the particulars. Even later, when working in the private sector again (for MB&S), project assignment letters from the City of Pretoria clearly stated in which language the project needed to be handled, in its entirety, with the contract number. For private sector clients, it was of course a matter of choice. The Laeveldse Tabakkorporasie Beperk (being a mostly Afrikaans run tobacco grower co-op organization in Nelspruit) would for instance obviously request MB&S that their railway siding would be designed, documented and constructed with all the paperwork in Afrikaans, while Corlett Drive Estates (a huge land development company with substantial Mining House interests, which did not later immunize it from utter bankruptcy) would clearly want to have their project work done in English. The exception to this was correspondence received from the public: This always needed to be responded to in the same language in which it was received. Which is just common courtesy, in a bilingual country.[24]

Another young engineer, Sam (S.T.) Helm[25], was hired around April or May 1966. He was senior to Jaap and me by three years, and came from the Transvaal Peri-Urban Health Board. Before that, even during his student vacations, he had worked at Van Niekerk, Kleyn & Edwards (VKE), one of the original consulting firms in Pretoria, whose offices were on the northeast corner of Church Square. He had worked in their office and had also supervised a road construction project in Eastern Transvaal[26]. Soon after that, Hennie Olivier, a seasoned structural draughtsman, joined us. Both Sam and Hennie were married, and their wives were pregnant. Mr. Ivor Evans, the partner who visited us fairly regularly from the Johannesburg office, directly supervised Hennie's bridge draughting work. At that time, three additional offices were rented on the sixth floor, so that some of us were "demoted" (!) by two floors (where it was in fact darker due to the narrow width of Bureau Lane, so that we successfully complained that winter about the poor and flickering fluorescent lights). During late 1966 already, Margaret left due to a pregnancy, and someone else replaced her.[27] During the winter of 1967, Mr. A.J.J. Marais was hired, a bachelor engineer of almost Mr. Botha's age, who had formerly been his colleague at the Department of Transport. Soon thereafter, another one of my classmates, Louis (L.C.) Esterhuizen,[28] was hired. I should also not fail to mention the surveyors that the firm had – Herklaas Botha[29] and Ronnie Botes. They came in from the field regularly, and never failed to give us quite a stack of field books that we needed to "**reduce**" and then use for plotting alignments and cross-sections. Mr. Les Marais[30], Manager of the firm's Soils

[24] Bilingualism was also a somewhat regional thing, with English being "almost a foreign language" in the rural Orange Free State, (according to Mr. Frank Sturgess), and Afrikaans hardly being used in downtown Durban, Natal.
[25] During a 1991 visit to South Africa, I understood from Warren that Sam Helm was head of the Pretoria office.
[26] This project was near Waterval-Boven, a station on the railway line to Eastern Transvaal. While preparing grade by scraping, the Contractor had exposed lots of human bones. What to do? To keep the work going, it was decided "on the spot" to just "raise the grade" in this section. Most likely, these bones of (presumed Chinese) workers who had died while building the line for the NZASM (Nederlandsch-Zuid-Afrikaansche Spoorweg Maatschappij) in the 1890's are still there. In 1971, while working near Coalbrook, OFS, I had a similar situation, solving it properly.
[27] This secretary lady had a US military husband, who was somehow attached to the US embassy in Pretoria.
[28] Louis had bright red hair, and was generally called "Koperbal" (copper ball) by us while a student. He remained with the firm for quite a long time. He was bright, one of a small group of students who completed the four-year course within four years. The "average" course completion time at that time was 5½ years, I was later told.
[29] He had been part of a group of South African mercenary soldiers in Moise Tsombe's army after the "Uhuru" of the Belgian Congo, during the upheavals in Katanga (now part of Zaire), where he had lost a thumb in battle.
[30] He had a lame arm, due to polio. I once met him later in 1971, while working for MB&S in Sasolburg, where BSB&P were responsible for the design and construction supervision of twinning the highway between Vaalpark and the intersection with the highways to Koppies and Heilbron, including the Coalbrook railway overpass. SASOL's abundant **fly-ash** was to be used for that project, as a stabilizing agent. The NIRR had done lots of research on this by-product and construction procedures. BSB&P had an office in Bloemfontein at that time.

Laboratory at 442 Mitchell Street, in Pretoria-West, did not have an office in downtown, but he visited Mr. Botha quite regularly. Below is a photo of the "street appeal" (or lack thereof) of the lab.



BSB&P Soils Laboratory on Mitchell Street

The first project assigned to me was the upgrading and paving[31] of Provincial Highway P 109/1. (I know from Google Maps that it is now called Regional Road R 542 in Mpumalanga Province.) This road runs between Breyten and Chrissiesmeer (sometimes called "Lake Chrissie" in English), two rural villages in Eastern Transvaal, and was a gravel road that needed to be improved, for a length of about 12 miles. This route was used extensively by South African Railways' road transport trucks. Breyten railway station was (and still is) the closest railway station to Swaziland, and eastern Swaziland was only served with a railway line to Lourenço Marques (now called Maputo) in Moçambique (which was called by that name but also Portuguese East Africa). I was told that up to 34 road transport trucks with trailers used this road on an almost daily basis, up and down between Breyten and Mbabane, the Swaziland capital, via the border crossing at Oshoek. These red brown trucks also had limited passenger accommodation (the front part of the vehicle) ans thus operated as a long distance bus service. Starting in the 1890's already, many Swazis had worked in the South African goldmines, for contracts of varying lengths. But there was another reason why this segment of the road system (starting a short distance north-east of Breyten) needed to be designed: It was part of a "exchange" between work under an already awarded TPA contract for a Bergman (Johannesburg) designed project, to a construction company called Nyloc (with Rhodesian owners, I was told) and similar upgrading work on the road between Ermelo and Chrissiesmeer. The latter stretch had somehow been excluded from Nyloc's contract (after the award!) because it was going to be built by the TPA's own forces (including a bridge crew for a concrete bridge just west of the village of Chrissiesmeer). The TPA obviously needed to keep its own construction crew (out of the Ermelo District office?) busy, and P 109/1 therefore needed to be designed and then added to Nyloc's contract, **tout suite**. Had someone, somewhere, made some strange error? Or was it "political"? I never knew. I was not supposed to know.

The horizontal alignment of P 109/1 was entirely straight, (**see next page**) except for one single minor curve to the right, exactly in the middle of the 600-odd 100 foot "chains"[32], and a curve to the right at the east end, where it had a T-intersection near joining the Ermelo-Chrissiesmeer road (now called Highway N17), close to the bridge just mentioned. During Mr. Jan Kleynhans' visits,[33] he showed me the ropes on how to calculate the new vertical alignment, basically at 1 foot above the existing centre line elevation. This would allow for a layer of natural gravel, a layer of crushed gravel, both to be covered with a chip seal. The typical TPA standard required a width of 40 ft. between shoulder break-points, a 24 ft. wide chip seal on a 26 ft. (or was it 25 ft.?) wide prime coat, and two 8 ft. wide gravel shoulders. This design was common for rural provincial highways, something similar to what I had seen in the OFS in 1962/63.

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[31] TPA requirements for these lightly travelled rural highways (and South African practice in general) were not for "**pre-mix**" or what is called Hot Mix Asphaltic Concrete, but rather a variety of chip seal coats, based on the original "Cape Seal" technology (from the Cape of Good Hope Provincial Roads Department) over well-constructed aggregate and/or cement and/or lime stabilized base courses. Also, tar (instead of oil-based asphalt) was normally used for layers not exposed to sunlight. Self-sufficiency of the country was the name of the game.

[32] The term "station" was not used in South Africa, (we used "**chainage**") but is extensively used in North America.

[33] A few years later, Mr. Jan Kleynhans became partner in a different Johannesburg consulting engineering firm.

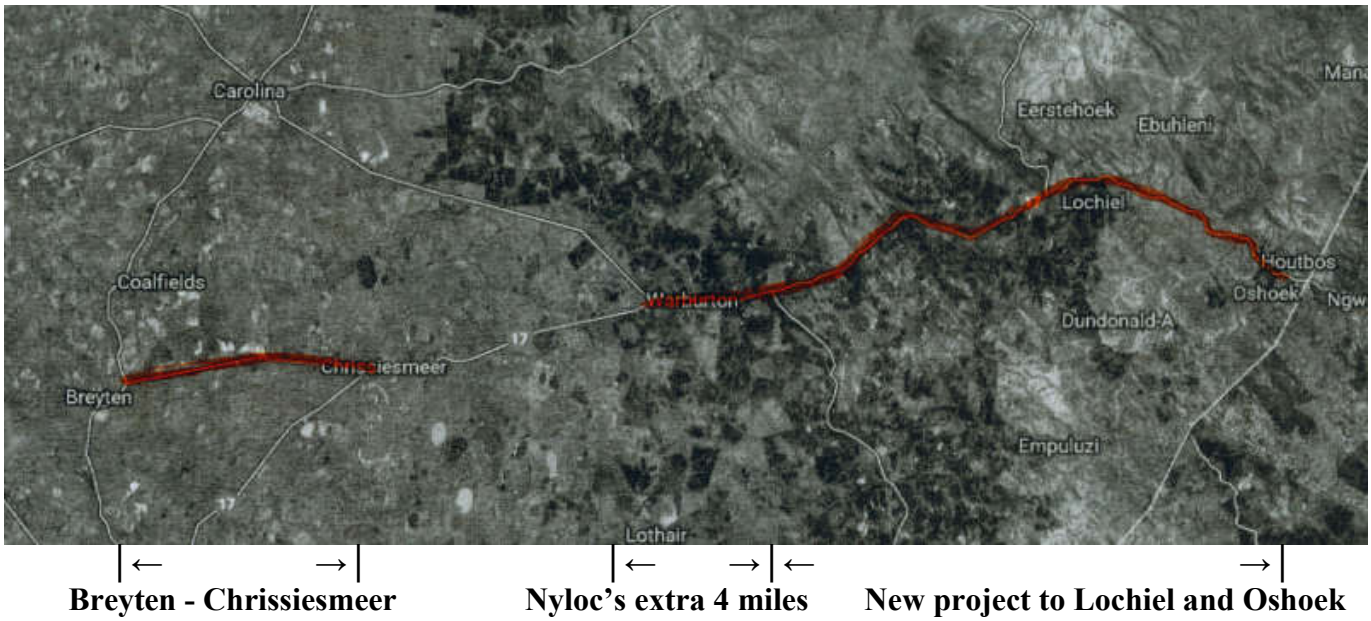
P 109/1 started with a steep 8% grade, almost directly from the T-intersection at the (west) Breyten end, and the terrain for the route was quite rolling, with some grades between 5% and 6% near the headwaters of the Vaal River (which is near Chrissiesmeer, I has been taught in elementary school; in fact, P 109/1 is the very first road crossing the rivulet.) Because the new grade line needed to "**fit**" the existing centre line elevations, it seemed a fairly simple process to strike grades about a foot above existing gravel and to meet the stipulated crest (150) and sag (50) k-values for whatever the design speed was. I think I was not even told what the "**design speed**" was (in miles per hour). At the three intersections, edge-of-lane curve radii were used from the AASHO book; I recall using "three-centred curves" with manual calculations for the intersection halfway the length of the project, challenging and complicated. These concrete kerbs (the English spelling for "curbs" in North America) are still visible on GoogleMaps. We had overlapping strips of low-level aerial photos for the route, but no aerial mapping.

The design drawings to be prepared needed to be drawn TPA issued grey linen (sepia) plan-profile sheets (with the plan above the profile[34]) with a horizontal scale of 1" = 100' and a vertical scale of 1" = 10' and a length of 100 inches, pre-printed with a title block and various column details. On the plan part, the centre line needed to be ink plotted more or less on the middle, with their reference pin elevations at every 500 ft. at 50' right and 50' left, and also at the BC's end EC's.[35] In Transvaal, we used an overlap of 500 feet (5 inches) between drawings. (This overlap was not shown on drawings prepared for the OFS Roads Department – and a story about that may follow later.) For the horizontal curves, we broke the alignment in the middle of the curve, and then started the continuing centre line so that it once again fit the chainages. On the profile part, the road centre line elevations were plotted. All this was done straight from the reduced field books. The 10:1 distortion on the profile part allowed the use of plastic circular curves (of which the office had a complete set in a wooden box, in inches) to draw out the parabolic vertical crest and sag curves. This method held true, even for the few asymmetrical vertical curves that I designed on P 109/1 – e.g. at a few large sag curves where existing concrete box culverts[36] existed. By an asymmetrical vertical curve I mean that the left side of a 1300 foot long vertical curve would e.g. be 600 feet long and the right side would be 700 feet long. Not that I did not try to keep the VPI's on the chainages or half-chainages – in order to decrease the manual number crunching! We only had mechanical equipment to do calculations, namely a heavy Olivetti electric calculator with a paper roll printout, as well as a hand turned "**coffee grinder**". By the latter I mean the Swedish made Facit calculator that was so handy for field work, entering 7-digit logarithms, and turning the handle forwards and backwards, until you read the answer in a little frame that looked like an odometer reading. The first handheld calculator that we knew about was the HP-35, and this had just been developed, but was extraordinarily expensive. In late 1965, we had actually been forbidden to use such device in any of our final exams, and we were only allowed to use slide rules (and 4-digit logarithm tables, of course!). I still possess my slide rule from those days, and never had an HP-35 as this was soon replaced by the HP-65 which was an extremely versatile calculator. At BSB&P, we had an HP-35 calculator, and I remember being asked one day to make a side-trip to an office building at Olifantsfontein (?) to hand in this "gim-mick" to the South African distributor, because it was malfunctioning. Sam Helm needed it urgently for calculating the "scissors" intersection (see below). While we knew something about warranties, it was actually unheard of in those days to just "return an article" and have it replaced; mechanical stuff was all "repaired", and as the son of a typewriter mechanic, I knew this quite well. These days, consumerism has caused "return policies" on almost anything to have a huge impact on the retail industry.

For cross-sections, the existing ground elevations needed to be ink plotted straight from the field books, normally at 100 ft. chains. This was done on a long roll of thin orange lined paper, (with tenths of an inch

[34] Occasionally, later and in various jurisdictions, I saw plan-profile sheets with the profile above the plan.
[35] I later recognized similar design / draughting techniques on as-built drawings in British Columbia and Arizona.
[36] We called these culverts "**cattle creeps**", obviously due to their normal usage, for cattle, sheep and equipment.

gradations) on which we drew the centre line from one side to the other side, so one could fill the roll with quite a number or rows of cross-sections. The scale of the cross-sections was 1"=10' in both directions. (Later, on municipal projects, I learnt about scale-distorted cross-sections.) Warren and I drew the cross-sections (say) 5" right and 5" left of this centre line. On this, the roadway prism was then drawn by pencil, after one had plotted the design centre line elevation accurately. We used a large brass ("**marine**") sliding ruler for cross-section work, with which one could manually "set" the slopes as 2% or the calculated superelevated crossfall, 1:1½ (vert./hor.) for the edge of the structural materials, and then the side slopes (either fill or cut, allowing for a small ditch) on each side, to touch the ground line.



Breyten - Chrissiesmeer **Nyloc's extra 4 miles** **New project to Lochiel and Oshoek**

It is actually amazing that the normal maximum sideslopes were 1:1½ (vert.:hor.) for embankments only; there were no excavations on P 109/1. These days, in North America, 1:2 is normally seen as the absolute maximum sideslope, and 1:3 is more commonly required. For shallow embankments, a variable slope was drawn (beyond the break point at the outer edge of shoulder and the existing ground elevation at a pre-determined distance from centre line). This sideslope was normally allowed to be constructed of weaker/poorer material, some of which had been excavated with clearing and grubbing and/or roadbed preparation. This was long before the "forgivable highway" concept took root, as started in Oregon USA. I also believe that we did not use a steeper (e.g. 4%) crossfall slope for shoulders in those days: the 2% crossfall (or the superelevation rate) would be identical for the 12 foot travel lane and the 8 foot shoulder width on each side, and there was no "rounding" as is commonly used in North American designs. (There was at that time quite some controversy about the value of growing grass on shoulders. Some people liked it; others did not like it; the latter group said that the grass took the moisture out of the material and thus weakened the shoulders. GoogleMaps shows Road R 542 with gravel shoulders and some grass.)

Later on, I would calculate quantities of cut and fill and sideslope material for each 100 foot chain, using a simple **planimeter**. ("Fill" would be calculated below the surface of the proposed structural layers, which we also needed to draw in after the soils lab had given its structural recommendations, based on tests of underlying materials, borrow materials and layer thicknesses – which could vary along the route. Unlike what I discovered later in other jurisdictions, the rolls of cross-sections did not become part of the drawings for the Tender Document. We had a quite basic planimeter, one that could not be calibrated; its only output was in square inches, which suited us just fine and made things easy; it also had a very user-friendly "**reset**" button; one would normally work with a part of the roll of thin orange lined paper to the

right and part of the roll to the left.[37] The "road reserve" width[38] was generally 100 ft. or 120 ft. (actually 100 or 120 Cape foot which is a bit more).[39] Roadway earthwork prisms (for cut or fill) were not supposed to encroach beyond the right-of-way limits, and this was the reason for the 50' right and 50' left bench marks: that these (iron pins within a blob of concrete, whitewashed by lime) would not be as easily disturbed during the construction activities. Additional rows on the plan-profile sheets existed where we showed the proposed paint lines and roadside markers[40], as well as the proposed road signs locations. All these road signs were to be shown on Construction Drawings and were quite detailed. There was no such thing as the much more recent British Columbia "policy" to have all road signs on 8' x 4' plywood sheets, as criticized by Mr. Bill van der Zalm, as Premier, who "ordered" (!) Mr. Jack Lisman of the MoTH to send a senior engineer to the Netherlands to research how to design highway signs! [41]

Another row existed for culvert information; smaller culverts were normally concrete pipes or precast concrete portals that would fit on a cast in-situ concrete floor. The three pipe manufacturers, "Rocla" (an Australian company's subsidiary), "Superconcrete Pipes" and "Hume", provided whatever the SABS (South African Bureau of Standards) specification required, with various classes of pipe. Drainage catchment areas were to be calculated from manual aerial photo interpretation; Mr. Botha was an expert in doing that. One needed to have trained eyes, he said, for that kind of work. I cannot remember if serious guardrail design was done in those days, although the firm "Armco" (currently known as Armtec in Canada) existed in South Africa as a supplier, also of corrugated steel pipes (called CSP, or also CMP in other jurisdictions, where the "M" means "metal".) I never designed them then, although I know that they had been used on the Swaziland Railway. Perhaps made overseas, shipped via Lourenço Marques and Stegi, even "nestable pipes" and "**multiplates**".[42] In December 1962, during my compulsory summer vacation work at the OFS Roads Department District Road Engineer's Office, I had seen a recently installed and experimental (?) asphalt coated Armco multiplate culvert on the new National Road between Warden and Cornelia.[43] During that same one-day field trip, I was also shown "**the wrong date**" on a bronze plaque on the fairly recently completed Fred Wentzel bridge across the Wilge River, just west of Frankfort, on P 36. The completion date of this bridge (built by a Contractor from Durban) was **Sunday**

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[37] We did not even know the term "**user friendly**" in those days!

[38] The North American English word for this is "right-of-way". We also sometimes used the term "road servitude".

[39] Prior to the metric system, cadastral measurements in South Africa were according to the system that had been brought from the Netherlands by the VOC, United East Indies Company (Cape feet, Cape roods and morgen). One Cape foot is 1.033 English foot; one Cape rood is 12 Cape feet; one morg is 600 square Cape roods. Only in most of Natal, English feet and acres were used. South West Africa had been metric since the German colonial times.

[40] These "roadside markers" were on-site made concrete poles with reflectorized paint surfaces; to be planted on the outside shoulder edge at specified spacings, (more on curves than on tangents) and opposite culvert in- and outlets.

[41] Mr. Lisman P.Eng. told me that himself, when I was designing the McKenzie Avenue Interchange in 1991.

[42] One 1966 issue of "The Civil Engineer in South Africa" had a very long article about this 138 km long railway that had its western terminal very close to Oshoek. Martin Harris, one of my classmates, had worked one summer vacation for its consulting engineering consortium, a joint venture between VKE and Jeffares and Green; he had reported to our class in a 40 minute session of "Engineering Seminar", in Afrikaans, as he was an English speaker.

[43] My supervisor during these 8 weeks, Mr. T. van Niekerk, wanted to see if it was still standing. A quite derogatory term – "**water tank pipe culverts**" – was perhaps difficult to get rid of. The failure of an Armco multiplate (at Wyllie's Poort north of Louis Trichardt, about 1958, which was "ripped out of the ground and concertinaed in a most spectacular fashion") did not encourage marketing efforts to the provincial road authorities. In the late fall of 1983, in Yukon, I became responsible for replacing some Armtec multiplate culverts on the Rose River (South Canol Road) that had already washed away **twice**, the second time during reconstruction. And in the summer of 1992, under "**Grassroots Consulting Services' Project 1"**, I provided engineering supervision during installation of five Armtec multiplate culverts, on Vancouver Island: Three were west of Port Alberni, one was near and west of Port McNeill and one was directly south of Port Hardy. BC's MoTH required site supervision on behalf of the supplier, after the collapse of a huge multiplate culvert during construction of the Coquiahalla Highway (Hwy 5).

10 June 1962, an impossibility in South Africa, and by the way, in December 1962 the approach roadworks had not yet been completed. This was a "Special Road" at the time, built with NTC funding.

The preliminary vertical alignment of P 109/1 needed to be checked before I was **"really let loose"** on the cross-sections and the detail design. During this process by Mr. Botha and the client (meaning engineers with TPA in Pretoria and the Ermelo District Office), I was told that I would shortly start on the detail design project that Mr. Botha had mentioned to me in August. This was the P 79/1 part of that project, with a scissors-like traffic signalized expressway[44] intersection in the middle – these roads were later called the William Nicol[45] Expressway (now William Nicol Drive) and the Hendrik Verwoerd[46] Expressway. The starting point of both roads was at the north boundary of the City of Johannesburg, and the route of P 79/1 ran through the Town of Sandton, a municipality that had only recently been formed out of the area under the jurisdiction of the Transvaal Peri-Urban Health Board. The other road (Phase 2 of the project) contined straight left near the starting point of P 79/1, and ran through the Town of Randburg, rejoining the route of P 79/1 at Bryanston Township, within the Town of Sandton, at a very skew angle. The two highways then separated again, with the same numbers, and both sections ended at the location of a future ring road that was to be a freeway[47], with interchanges.

But in the mean time, I was sent to the Johannesburg office for about three weeks of design work on two specific projects that were handled by that office:

(1) The sanitary sewer system for the Town of Keetmanshoop in South West Africa, where only a small part of the downtown system had been installed and the rest of town still had a honey wagon system. A senior Clerk of Works had returned to Johannesburg with field books for extending the system, with voluptuous notes about the suggested connection of every existing house. He told me of his recent experience: He had been trapped in a sanitary manhole, right in front of one of the hotels in town, where the guideline to wear a harness had somehow been disregarded, and he almost suffocated. I was not sure of some details in the field books, and had an opportunity to discuss this with Martha la Cock, one of the students that I knew from the Folk Dancing group who hailed from Keetmanshoop. Tukkies had a large group of students from South West Africa in those days. I was still registered as a student (see below) and attended the weekly practices in the basement of the Aula, but obviously stopped going there later (**see below**). In 1965, our group had won three Folk Dancing Competitions, starting with the one at the ASB (Afrikaans Student Union) Annual Conference at the Heidelberg (Transvaal) Teachers' College, and then also the one at the Johannesburg City Hall and the one at the Pretoria City Hall. We were very good!

(2) The water reticulation system for Phase 2 of the Village of Henties Bay in South West Africa, a very new resort town on the Atlantic Ocean coast north of Walvis Bay, which is almost directly west of Windhoek. For this project, I also reduced survey information from field books and checked that the draughtslady (or draughtswoman?) had shown information correctly on plan-profile sheets, for the water feeder main as well, which was from a proposed filtration plan in the mostly dry bed of the Omaruru River north of Henties Bay, a mile or so from where it reached the shore. I never saw aerial photos of that site, only aerial mapping.

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[44] The term "four-lane divided highway" instead of "expressway" was used for these facilities, meant to designate the provincial highways through municipal areas, with very stringent signalized intersection spacings and stipulated "access control" (which term later morphed into "access management") These were definitely not freeways.

[45] He had been Administrator of the Province of Transvaal (1948 to 1958) – like a Lieutenant-Governor of a province in Canada. Strange that he died in 1967, the same year that the highway was actually being designed……

[46] Prime Minister of the Union of South Africa and the Republic of South Africa from Sept. 1958 to his Sept. 1966 assassination. Lydia and I sat among the crowds on Meintjieskop during the State Funeral, with a transistor radio.

[47] Freeways were in those days mostly under the jurisdiction of the National Transport Commission, and not under the jurisdictions of the four provincial administrations. That changed later.

I travelled to Johannesburg by train every day, via Germiston, parking my 1951 Ford Anglia at Pretoria Railway Station, and walking to the Braamfontein office that was not far from the Johannesburg Central Railway station. During this short term assignment, I also re-met the Meurs family that had lived in Potchefstroom during my high school days; they were friends of my parents. Mr. Gijs Meurs had come from the Netherlands with his young family in the early 1950's, and had worked at Mr. Koos Nagel's business called Smithfield Dairy for a few years, after which he had become chief technologist at the laboratory of the Milk Board[48] in Braamfontein, a few blocks from BSB&P's office. He sampled / tested milk from dairy farms all over the Witwatersrand. The family lived in Melville. I remember staying over one Friday night to accompany him on his Saturday morning sampling trip[49]. Test samples of fermented milk tasted just like yogourt, although I was amazed at the differences in taste of the various samples.[50]

After these three weeks, I was requested to return to the Pretoria office, and to start work on detail design of the P 79/1 part (the "eastern leg" of the scissors that joined at Bryanston)[51] by preparing "**Compensation Diagrams**".[52] For each property – most of the abutting lands were suburban residential acreages – an A4 vellum sheet[53] had to be prepared to show how much the property was to be affected by the highway right-of-way widening – which was sometimes on both sides and sometimes on one side only, where the existing two-directional roadway would become one-directional. These thin mylar sketches (one for each property) were made directly from the 1" = 100' mapping mylars, on which the area to be taken for highway right-of-way widening was shown in bold, as well as all kinds of information like the owner, address, legal description, location of buildings, location and number of significant trees (including species) and flower beds, driveways and stone or masonry walls, gates, and of course the area of land to be taken for the project. We had the 1" = 100 ft. mapping information, but we also had copies of the low level aerial photos on which the mapping was based. The legal pins for the land acquisition were being placed at that time by the legal survey firm for the project, who had offices on Du Toit Street, near the Pretoria Technical College.

To verify that the information on these compensation diagrams was accurate, I was then asked to visit all property owners, in order to personally present them with the preliminary diagram and to discuss the details with them to see if the information was accurate. This took me a few full days, driving from Pretoria every morning and returning the same day with my Peugeot Station Wagon, for which I was royally reimbursed at a rate of **8 cents per mile**. I was able to meet almost all the property owners who lived along the route, by starting these visits around 8:30 a.m., and finding some other owners through tenants or from information (for vacant properties) from estate agents who had these properties listed. I obtained all that was needed to make these compensation diagrams acceptable for submission to the TPA as the basis of the right-of-way acquisition, by which P 79/1 would be **twinned** into a four-lane divided road, with limited access control[54] measures for private property and all existing road intersections, although this project did not quite meet the minimum intersection spacing of 800 metres.

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[48] Many sectors of the agricultural industry were highly regulated in South Africa at that time.
[49] In those days, many employees still worked a half day on Saturday. Perhaps it was the nature of Mr. Meurs' job.
[50] After those three weeks of work in Johannesburg, I had to "give up" on my 1951 battleship grey Ford Anglia, sold it to a scrap yard in Môregloed for only R 13, and purchased an olive green 1956 Peugeot 403 Station Wagon for an amount of R 550 (that needed financing) from Jaap Zuidam's father-in-law, who had an automotive repair shop (called Brouwer's Garage) on Voortrekker Road, and insured it through "Parity Insurance", yet another story.
[51] William Nicol Drive is now numbered Main Road M 51 in Gauteng Province. It has been widened and improved considerably. The other one is numbered Main Road M 71 (and called Jan Smuts Drive and Bram Fischer Drive.)
[52] South African law has very different rules for right-of-way acquisition than English Law used in North America.
[53] Metric paper sizes had recently been introduced in South Africa. The aerial mapping was on extended A0 sheets.
[54] What is currently called "access management", did not seem strange to me under its former name, most likely because the way in which (in my view) government functions were conducted, was more "authoritarian" than now.

In those days, there was no way by which a property owner could lodge complaints about this proposed taking of land; there was no way by which owners could formally oppose the project of road widening that would surely impact their enjoyment of their up-scale acreages. To my knowledge, there had not been any "public hearings" about this project, and Mr. Botha had during the previous two years only met some of these property owners during slome site trips, in which he had advised them that the firm that he had recently joined, had been given a Basic Planning project for the widening of the existing narrow road system (18 feet asphalt with gravel shoulders) which might in time result into detail design and construction of this upgrade projevct. In my humble estimation, there were several reasons for this:

(1) In general, the South African system of governance was (in those days) more authoritarian than governance systems then and currently in place in North America, likely due to former British influence.
(2) The municipalities of Sandton[55] and Randburg[56] had only very recently been created out of land previously administered by the PUHB, and the highway system remained a provincial responsibility.
(3) Under uncodified Roman Dutch Law (the name of the legal system in South Africa), the rules for land tenancy and expropriation are different than under English Law or its derivatives in North America.
(4) Most property owners likely recognized that the upgrading of these roads would be advantageous to them in the long run, and also that it was actually unavoidable due to the hectic growth rate[57] of South Africa in those days.

While I do not know if there had been any "Public Input (or Information) Meetings" or hearings[58] for the project prior to the time that detail design was done, I sincerely doubt it. I sometimes marvel at how much different this project was handled than e.g. the Pat Bay Highway in Saanich, B.C., Canada, (McKenzie Avenue Interchange) that I designed in 1989-1992 when employed by Crippen Consultants, a division of H.A. Simons Ltd. out of their Vancouver office.

On 10 December 1965, I had seen my final exam results in "Die Vaderland", the Afrikaans afternoon paper, and in mid-February 1966[59], I was told about the graduation ceremony for my B.Sc. (Ing.)(Siviel) degree. This was scheduled for Saturday 25 March in the huge Skilpadsaal ("Tortoise Hall") on the Pretoria West Showgrounds. I was allowed to invite two guests only, so I sent the two enclosed tickets to my parents in Potchefstroom. (Not even my brother Arie was allowed, but he came to Pretoria anyway. He received his B.Sc. degree a few weeks later, at Potchefstroom.) Based on this information and the type of design work that I was doing (and already enjoying), I enrolled for two after hours graduate courses that month. The one course was in Structural Highway Design and Construction, and the other course was in Sanitary Sewer Systems. These courses were in my opinion appropriate for the work I had already been doing for those few months. They would take the whole academic year to complete, as there was no semester system. Passing about eight courses like these, plus acceptance of some as yet unknown type of thesis, would lead to the M.Sc. (Ing.)(Siviel) degree. The Engineering faculty at UP had only been in existence since 1956, and it was a progressive step in starting these after hour courses for those who had completed the bachelors degree and were working for local consulting firms or government departments.

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[55] This was a municipality with a predominantly English speaking population, who would perhaps one that vote for any of the opposition parties. Civil engineering without politics is very difficult to imagine!
[56] This was a municipality with a predominantly Afrikaans speaking population, who would likely vote for the government party. (Lydia's uncle Robert van Tonder had been instrumental in its founding, I discovered in 2010.)
[57] Just mentioning the name "Corlett Drive Estates" to anybody a few years later would prove this.
[58] There is, in North America at least, a huge (legal) difference between a "Public Hearing" and a "Public Meeting".
[59] This was because the supplementary exams took place during the first week in February. It was discovered that one student met all requirements for graduation except the **First Aid Course** (which was normally taken after the exams for the first year.) He was not allowed to graduate until he completed this, and therefore only received his degree during in September 1966 graduation ceremony – likely together with Jaap Zuidam.

Classes in both courses were held on the same evening, at the Main Campus. I also continued a minor role as Demonstrator or "demi" at the University that year. During 1965, I had been a "demi" for the second year engineering draughting classes, and had to attend them for one afternoon every two weeks, between 2 p.m. and 5 p.m. But during 1966, my work was different. Third year students in Architecture and Quantity Surveying had to pass a course in structural analysis – obviously so that they could later converse professionally with their structural engineering colleagues. This evening course was given by Dr. Emil (K.E.) Bruinette, who had been in the first civil engineering student class of UP, graduating in November 1959. He had continued studies in the USA for a M.Sc. and a Ph.D., and on his return to South Africa, had become a founding partner in the firm Bruinette, Kruger, Stoffberg and Hugo.[60] My task was to mark the various assignments and tests of these students, (about thirty, I recall) and to attend an evening class in which I would then explain on how I had marked the papers. I also had to meet Dr. Bruinette occasionally (at his apartment, during an evening). The remuneration was in the order of R 300 for the year, and I guess my reason for doing this was to regain some confidence in that subject. (I had "**almost failed**" Structural Analysis 3S due to a horrible lecturer, who could not get the principles of the subject matter across, and continued talking about the mistakes that his former structural engineering partner in Welkom had made, supposedly all discovered by him when the partnership had collapsed and disbanded; and then I had **failed** the supplementary exam due to a tick, as described above.)

In January already, it became clear that my work in downtown Pretoria and evening classes at the Tukkie[61] campus in Hillcrest would mean too much travel, so at the end of February, I moved from a room at my relatives' house in Waverley to an outbuilding behind an old mansion at **169 Beckett Street**, Arcadia. Although a "former stable", there was fresh paint and a brand new ceiling, plus a good double stable door and two small windows. It was of course in the back yard, with an outside toilet; baths (using an ancient hot water system) were to be taken in the house. This mansion had in earlier decades (perhaps just after the Boer War) been owned by an important lawyer surnamed McQuarrie(?) A Dutch immigrant family Gysbers, who were acquainted with the Trennens, lived in this house with their children who were still attending high school. I was not the only student renting a room; there were two engineering students as well, both with a room inside the house. Beckett Street, the first main north-south street east of the Union Building, is quite steep to the north of Church Street, and every morning, I just walked down to the corner of Church Street for an electric trolley bus (Line 1 Hatfield or Line 5 Colbyn) at the exact limit of the first zone change (and cheapest fare!) to Church Square. This minimized transportation costs; my Peugeot remained parked among the jacaranda trees on the boulevard of Beckett Street. When some time later, I had a problem with the starter motor of this 7-seater (the rear bench had been taken out), Stanley Motors on Proes Street discovered that this car was a ***rara avis***, a vehicle built in France for the British colonial market, with different electrical components (like the starter motor) than the many Peugeots that were built in France for the South African market, or even South African assembled Peugeot 403's. The former licence plates of my car had shown TAA, and this was not (as I had thought) Barberton in Eastern Transvaal, but some place in Tanganjika, the country that had recently become known as Tanzania. My guess was then (and now) that this vehicle might well have been brought south with a white family leaving the former German and then British colony in droves, after "Uhuru" had occurred.

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[60] Not to be confused with Mr. A.B. (Adriaan) Hugo who had lectured part of the Hydraulics 3S course to me in 1964 and who died in December 1965 in a traffic crash. (For many years, I thought that he had been co-founder of the firm.) I bought his old textbook in Urban Planning (T.B. Floyd) from his mother who lived in Hatfield. In an amazingly short time, perhaps due to political influence matching undoubted competence, BKSH (later without the H) became one of the major consulting firms in the country. As two of the original partners had doctorate degrees, it was sometimes disparagingly referred to as "**the hospital**" by those working in other consulting firms……

[61] "Tukkies" / "Tuks" is based on the name **T**ransvaal **U**niversity **C**ollege, founded in 1907 or thereabouts, just like the University of the Witwatersrand is called "Wits" / "Witsies". This TUC had become a University in 1931.

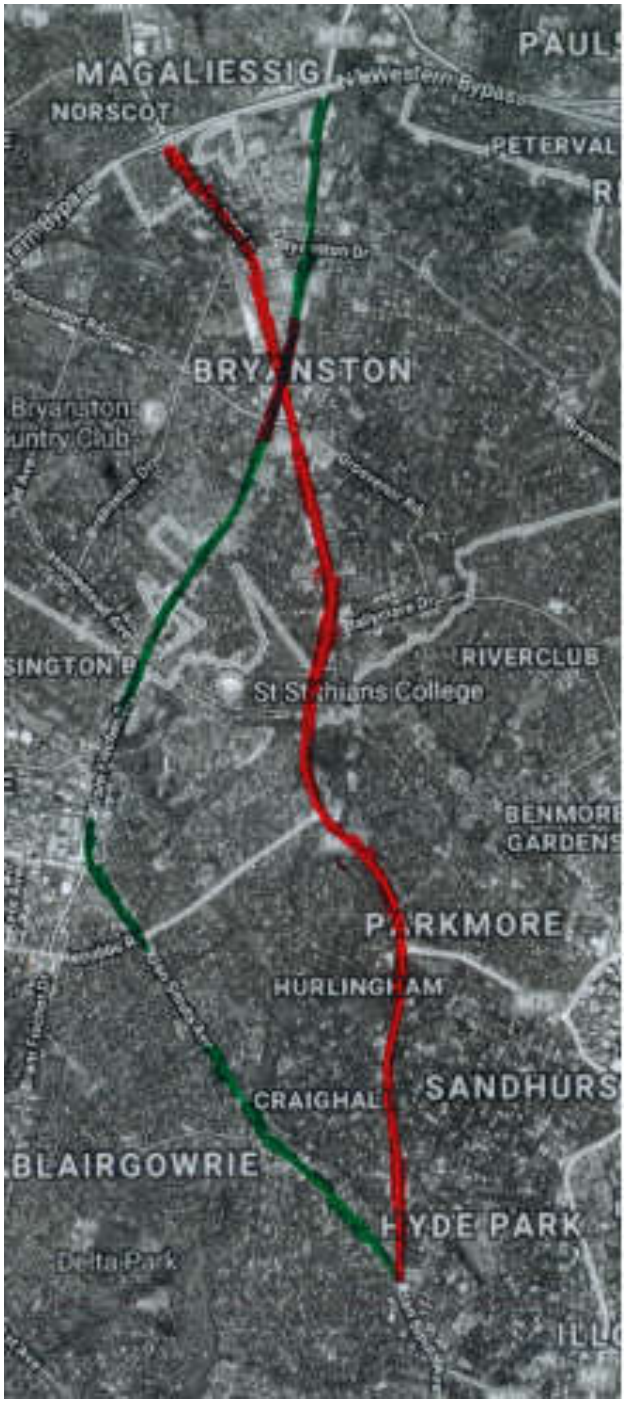
Then, on Saturday 19 March 1966, I decided to go to the annual church picnic of the Reformed Church Pretoria-Sunnyside, at one of the picnic sites at the Pretoria Fountains, a very popular spot south of the City. For each of my five student years in Pretoria, I had lived at different addresses, and had needed to go to different congregations. My recent move to 169 Beckett Street meant that I was once again in the catchment area (for lack of a better word) of the Pretoria-Sunnyside congregation of the Reformed Church of South Africa (where I had attended in 1961 when first moving to Pretoria.) Over the years, I had been quite active in the churches' Young Peoples' Societies, going to their various conferences and camping trips, and I was no stranger to the Sunnyside church and many of its people, young and old. At this Church Picnic, I met Lydia Stella van Tonder – and my world changed. She had just joined her parents who had moved to Pretoria a few months earlier from Bedford View, her 55-year old father "retiring" as City Engineer of the City of Germiston due to ill health, and taking up a post-career position with the Department of Planning in Pretoria. It was my first time at this picnic, and also the first time for Lydia, who had just become employed at the City of Pretoria library system (in the Main Library c/o Andries Street and Vermeulen Street) a few weeks earlier. Well, as it is said, the rest is history, and is not actually the topic of my career, although it can absolutely not be seen in isolation from it.

The very next Friday evening, 25 March 1966, I became the **303rd person** graduating with a baccalaureate engineering degree from UP; the number shows in my certificate's top right hand corner. In his speech, Prof. C.H. Rautenbach, as rector, reflected that evening that this was the very first occasion in which more than 2 000 baccalaureate degrees were bestowed, plus quite a number of diplomas.[62] After the ceremony, I picked up Lydia at work in downtown (she worked till 9:00 p.m.) and took her to her parents' house at 946 Pretorius Street, Hatfield. On Saturday morning, I had a "cap and gown" picture taken in Sunnyside and some family photos on campus, then returning the rented paraphernalia and picking up Lydia for a visit to the Trennens, where my parents were staying over, and she met them. A few weeks later, on a Saturday, Lydia and I drove with my newly acquired Peugeot to attend the Rand Agricultural Easter Show in Johannesburg. This was a quite special occasion, as that year's event particularly celebrated five years of the founding of the Republic, with many exceptional displays by government departments and major industries. On our return to Pretoria, I told Lydia that I loved her…. "O yes, I remember it well."[63]

While happily starting those days on the William Nicol Parkway project (although not under that name) with Sam Helm (who was assigned to do the advanced manual calculations for the "scissors intersection") and Warren Verster, there was a lot of contact with the firm of legal surveyors that had completed the original aerial mapping for the "Basic Planning" phase of the project in 1964 and 1965. Prior to completion of the detail design, the right-of-way was to be "proclaimed" in the Transvaal Provincial Gazette, based on the necessary land acquisition from the Compensation Diagrams. This required a single large drawing (to be reduced in the Gazette) with two lists (L and R) of all the coordinates along the route, including corner splays at all the intersections, as described before.

This route was somewhat unique. While it meandered running generally from south to north, it criss-crossed over the 28th degree longitude east of Greenwich. The South African cadastral survey system for all properties had since 1937 (I think) been established on the odd degrees of longitude east of Greenwich – so we had most properties to the west with coordinates under the Lo 27 system, and most properties to the east with coordinates under the Lo 29 system. There were of course complicated calibration formulae that had been in use all over the country, for u number of decades, to convert from the one system into another, with high positive numbers changing to high negative numbersand vise versa. Moreover, many properties had been originally surveyed (and sub-divided) before the 1930's. In those days, a few other local coordinate systems had been in use along the Witwatersrand, (starting from early gold mining days)

[62] The total number of UP students was about 10 000 that year, including a growing group of evening students.
[63] Maurice Chevalier's famous refrain in a song in the musical (and movie) "Gigi".



in which the X-axis was north-south and the Y-axis was east-west.[64] But some of these coordinate systems were not even on N-S and E-W axes, but at magnetic north or some other arbitrary axes.

Jan Smuts Avenue and (formerly) Hendrik Verwoerd Avenue are shown in a GREEN LINE at left, while William Nocol Drive is shown in a RED LINE.

The route of the future William Nicol Parkway ran through existing fully developed townships and through some undeveloped land, where an exclusive Private (boarding) School – St. Stythian's College - was to be developed, and it obviously needed to have a proper access road. There was also talk of a Pedestrian Overpass, near the Bryanston Library, a block or so south of the "scissors intersection". I later saw a photo of the structure. A new fairly up-scale residential Township[65] named Glenadrienne had fairly recently (under PUHB control) been developed along this road.

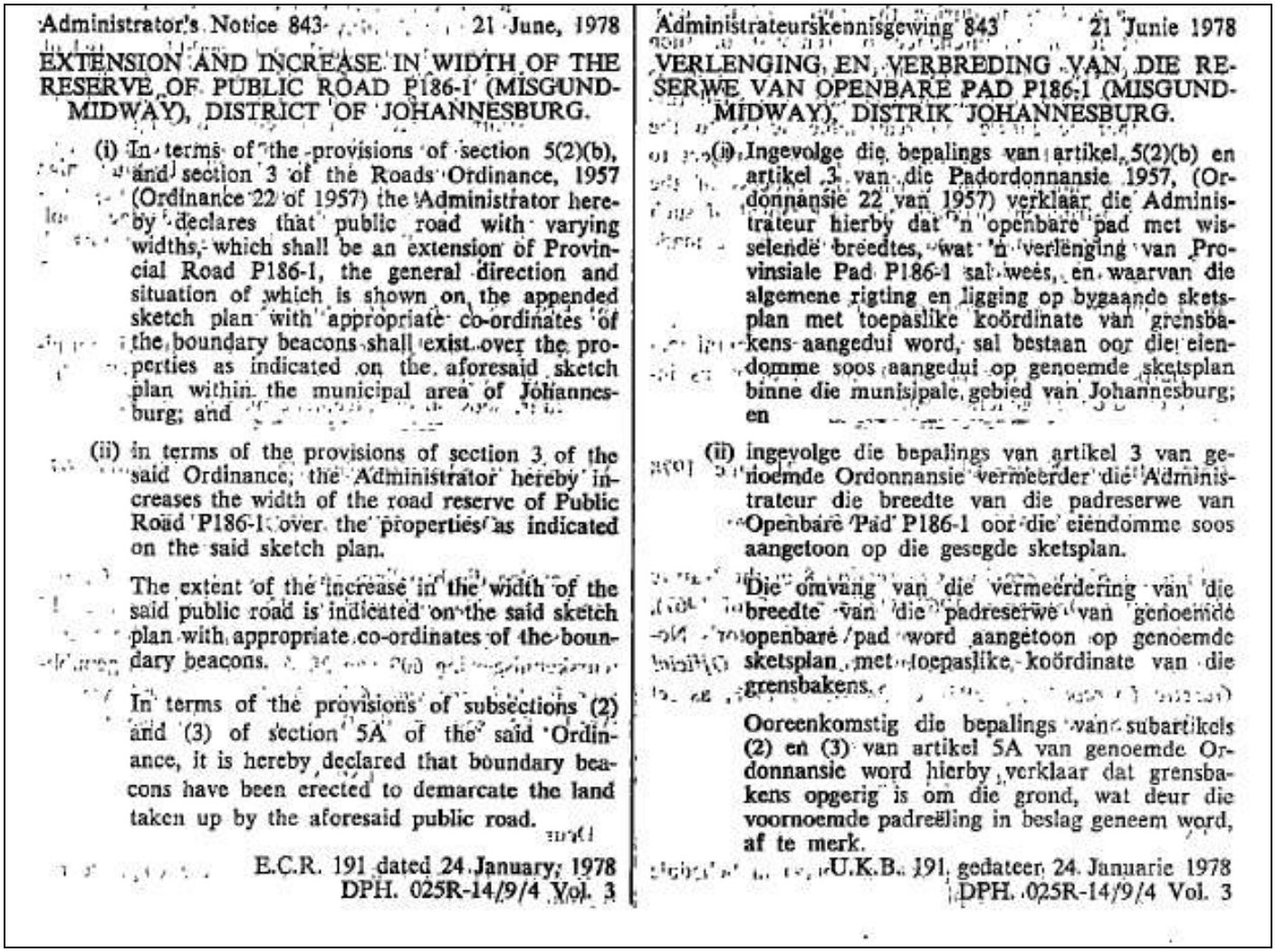
This Township had 1 acre lots backing onto the highway, with an internal street system on both sides, each with a single access point (which always makes good planning and transportation sense). But somehow, a mistake had been made: The legal survey of Glenadrienne had been registered with the Surveyor General[66] in Pretoria without allowing for an adequate TPA required right-of-way width. The discrepancy was only 6 or 8 feet, as I recall. Widening the right-of-way width would cost somebody some money, would need TPA approval and also an **Administrator's Notice (as shown on the sample below and on the next page**). Additionally, somebody would lose face. Instead of expropriating an additional sliver of land from the backyards of all the lots in Glenadrienne, on which brand new houses had already been built, each with a nice backyard garden, an alternative solution to this dilemma was found by the TPA Roads Department that allowing a minor narrowing of the depressed median width for this stretch of highway. Once this decision had been made, I then needed to "fit" the two separate roadway centre lines through Glenadrienne (with a slightly different cross-section) to both sections north and south. I did this "**pro-rated**"

[64] X-values were positive west of the odd degrees of longitude, and negative east of the odd degrees of longitude. So being exactly at Lo 28, we dealt with very high negative and positive numbers for exactly the same legal pins. Y-values were measured from the equator (and this meant they were in the order of 10 or 11 million Cape feet.)

[65] The North American terminology is "subdivision". Townships were "proclaimed" in the Provincial Gazette; subdivision of lots within an existing Township were not. (See "Part 2" for the situation of Sinovich's development at Roseville, where somehow, someone in the Provincial Government forgot to ask the Developer for a school site.)

[66] The Canadian term for such an agency is "Land Titles Office".

over the existing very long horizontal curves (both north and south), based on a single roadway centre line, without establishing a separate centre line for the other roadway. This was all carefully explained on the plan-profile that was developed – and approved. Nothing spectacular - I would not be surprised to learn that someone else, in a similar situation, had done something very similar.



Administrator's Notice 843 21 June, 1978

EXTENSION AND INCREASE IN WIDTH OF THE RESERVE OF PUBLIC ROAD P186-1 (MISGUND-MIDWAY), DISTRICT OF JOHANNESBURG.

(i) In terms of the provisions of section 5(2)(b), and section 3 of the Roads Ordinance, 1957 (Ordinance 22 of 1957) the Administrator hereby declares that public road with varying widths, which shall be an extension of Provincial Road P186-1, the general direction and situation of which is shown on the appended sketch plan with appropriate co-ordinates of the boundary beacons shall exist over the properties as indicated on the aforesaid sketch plan within the municipal area of Johannesburg; and

(ii) in terms of the provisions of section 3 of the said Ordinance, the Administrator hereby increases the width of the road reserve of Public Road P186-1 over the properties as indicated on the said sketch plan.

The extent of the increase in the width of the said public road is indicated on the said sketch plan with appropriate co-ordinates of the boundary beacons.

In terms of the provisions of subsections (2) and (3) of section 5A of the said Ordinance, it is hereby declared that boundary beacons have been erected to demarcate the land taken up by the aforesaid public road.

E.C.R. 191 dated 24 January, 1978
DPH. 025R-14/9/4 Vol. 3

Administrateurskennisgewing 843 21 Junie 1978

VERLENGING EN VERBREDING VAN DIE RESERWE VAN OPENBARE PAD P186-1 (MISGUND-MIDWAY), DISTRIK JOHANNESBURG.

(i) Ingevolge die bepalings van artikel 5(2)(b) en artikel 3 van die Padordonnansie 1957, (Ordonnansie 22 van 1957) verklaar die Administrateur hierby dat 'n openbare pad met wisselende breedtes, wat 'n verlenging van Provinsiale Pad P186-1 sal wees, en waarvan die algemene rigting en ligging op bygaande sketsplan met toepaslike koördinate van grensbakens aangedui word, sal bestaan oor die eiendomme soos aangedui op genoemde sketsplan binne die munisipale gebied van Johannesburg; en

(ii) ingevolge die bepalings van artikel 3 van genoemde Ordonnansie vermeerder die Administrateur die breedte van die padreserwe van Openbare Pad P186-1 oor die eiendomme soos aangetoon op die gesegde sketsplan.

Die omvang van die vermeerdering van die breedte van die padreserwe van genoemde openbare pad word aangetoon op genoemde sketsplan met toepaslike koördinate van die grensbakens.

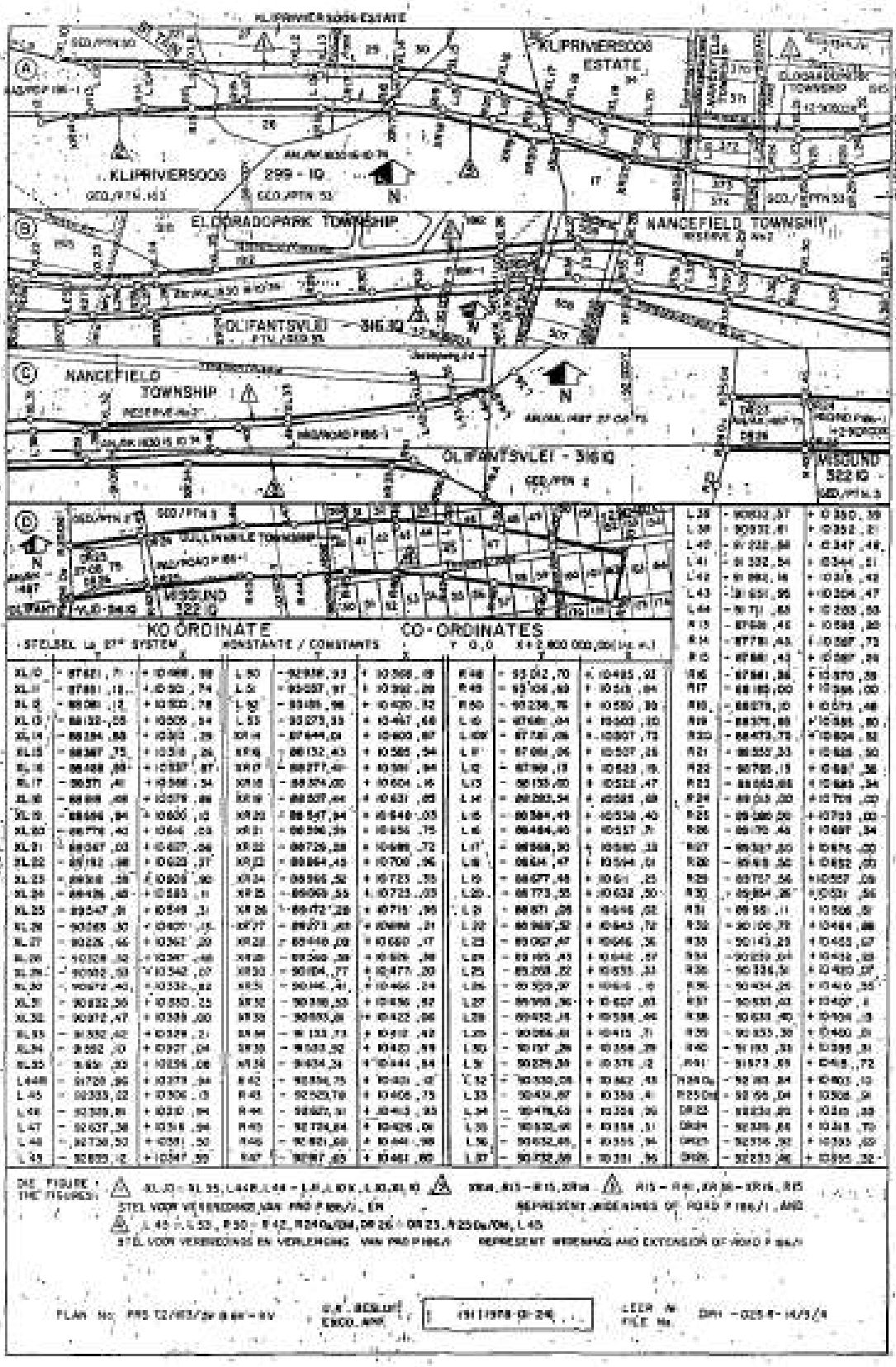
Ooreenkomstig die bepalings van subartikels (2) en (3) van artikel 5A van genoemde Ordonnansie word hierby verklaar dat grensbakens opgerig is om die grond, wat deur die voornoemde padreëling in beslag geneem word, af te merk.

U.K.B. 191, gedateer 24 Januarie 1978
DPH. 025R-14/9/4 Vol. 3

Typical "Administrator's Notice" of the Proclamation of a highway right-of-way. (Not my project)

After graduating from UP, (see photo on the frontipiece) I became a Graduate Member of SAICE, the **South African Institution of Civil Engineers**, of which I had already been enrolled as a Student Member since March 1963. This transfer was shown in the "Membership" column of the April 1966 issue of the magazine. During my student days, prof. Dirk de Vos was already on the Council of this Institution, and he became its President for 1969, the year after legislation for the establishment for the South African Coun-cil of Professional Engineers had been passed. I received the monthly magazine that contained numerous excellent technical articles. In April 1965, I had e.g. read an article by Mr. Barney Bergman, about an "**activated sludge process**" sewage treatment for the Town of Heidelberg (Transvaal). That was the first time that I became aware of him and his firm.[67] The August 1966 issue contained my "Letter to

[67] In 1978, I showed one of my bound copies of SAICE magazines to some colleagues at Reid Crowther and Partners Limited in Calgary, Alberta, Canada, who were designing an upgrade of the city's Bonnybrook Sewage Treatment Plant, with proposed tertiary treatment. This was then a novelty in western Canada, and I understood that my colleagues discussed using the fifteen-year old South African information with City of Calgary officials.



The remaining part of a typical Proclamation of a highway right-of-way. Bilingual, of course, dated June 1978, and note that a consulting engineering firm's name is not even mentioned.

the Editor" in which I lauded the ongoing improvements in the Institution's bilingualism policy, but stated that this should also be practiced by the advertisers in the magazine. Because 26 of the 76 pages of a random magazine issue contained advertisements, this letter therefore promoted a discounted rate for bilingual advertisements.[68]

The SAICE had its Head Office in Johannesburg, but between 1963 and 1977, I regularly attended branch meetings in Pretoria and Bloemfontein – which were mostly of technical interest and were well attended. I never visited the Head Office, but when working at MB&S in Pretoria, I accompanied Mr. Adrian Bergh to attend an important Johannesburg-area Day Seminar (by Dr. Michael Barnes, about tendering practices and inflation) at Sans Souci Country Club. (More about that in Chapter 2 of "Part 2", my time with MB&S in Pretoria.) When allowed, I applied for a change in my membership grade to "Associate Member" (in 1969) which later (automatically) became "Member" when the rules changed. After my paper "The Civil Engineer and Pedestrian Safety" had been read (by Mr. Alistair Jobson, PrEng, a former colleague from the NITRR) at the SAICE's Seventh Quinquennial Convention in Durban in July 1978, I let my affiliation lapse because I had already left the country in November 1977, had registered with APEGGA in Western Canada and with ITE internationally, and I lost interest in bilingual advertisements.

There was no professional engineering registration in South Africa in 1966, but the "Professional Engineers' Joint Council" had existed since 1961, promoting countrywide registration for all the subdisciplines. This needed legislation, and the Joint Council did the lobbying for that. One problem was that existing "Associate Members" of the various British "Institutions" (people with letters like AMICE, AMIME and AMIEE behind their name) would be eligible for registration as Professional Engineers, but that all future candidates would need university bestowed bachelor's degrees in engineering. This proposal was somewhat baulked at by the civil, mechanical and electrical guys in South Africa, who had originally written the exams of these Institutions; they thought it was discriminatory against their British qualifications. But this issue was resolved, and the lobbying efforts bore fruit during 1968; I registered as a PrIng (in Afrikaans, while PrEng in English) in early 1970, when living in Sasolburg. (It was a specific requirement for starting to supervise an OFS Roads Department construction project.) That registration also lapsed after my emigration to Canada, and I have since registered in Alberta, Yukon, British Columbia, Arizona and (again) British Columbia. It was only in 1978, while living in Calgary, Alberta, Canada, that I joined another professional organization, the Institute of Transportation Engineers (shortly before, known as the Institute of Traffic Engineers) as an Associate Member. With the passing of time, this grade was changed to that of Member, and I could have changed it to Fellow years ago, but didn't bother. I formally quit ITE membership in 2007, but that's another story, based on their "non-action" on a roundabout article issue. I believe that there is a huge difference between (voluntary) membership in a professional Institution and (compulsory) registration in a government mandated Regulatory Association.

During a slack period of work in July 1966, Mr. Botha suggested that I might be sent to Braamfontein again to complete the sanitary sewer project for the Town of Keetmanshoop in South West Africa, but it blew over and did not happen. That month, all employees received a one-page printed notice from a company called Rikent Engineering Services (Pty.) Ltd. This stated under point 1, that:

> "As of 1st July 1966, all members of the staff of B.S. Bergman & Partners have been taken over by Rikent Engineering (Pty.) Ltd., on the same terms and conditions of employment as heretofore were applicable under B. S. Bergman & Partners. The principle ***(sic)*** reason for this

[68] My very first "Letter to the Editor" had been written (and printed) in the Hoofstad newspaper in September 1965, the day after a few thousand people (including my parents and I) had held a peaceful demonstration in front of the Official Residence of the Ambassador for the Netherlands, Mr. Jan van den Berg. It had been occasioned by the Dutch Government's first vote against South Africa in the General Assembly of the United Nations Organization.

deveopment ***(sic)*** is to facilitate members of the staff of B.S. Bergman & Partners who are not partners of that firm to acquire shares in Rikent Engineering (Pty.) Ltd., and so participate in the company's operations on a profit-sharing basis. Already certain shares have been allocated to members of staff and future allocations will depend on merit, service and efficiency."

(Yes, typing errors were also made in those days.)

Under points 2(a) through 2(d), our collective employment requirements were spelled out in more detail than in my letter of September 1965. Sick leave (up to 20 days per annum, not accumulating), travelling expenses, hotel expenses ("actual expenses with a maximum of R 5-00 per day, unless previously otherwise arranged with one of the partners"), an out of pocket allowance, "telegram, telephone calls and other expenditures",[69] and a "monthly work roster" were mentioned, as well as "Office Hours" from 8.00 a.m. to 1.00 p.m. and 1.45 p.m. to 4.45 p.m., Monday to Friday. All very logical, and although at that time none of the staff had any objections, it was (as an afterthought) likely the start of an industry-wide and eventual international trend toward corporate ownership of professional firms, most of which had had their beginnings as sole proprietorships or partnerships. In other professions, this also happened over the past half-a-century; medical practitioners operate as a group of what is called LLC's or "Limited Liability Corporations". This is not unlike the trend to convert co-operative associations to share-held businesses; like bringing credit unions under the laws regulating banks; like the demutualization of insurance companies. Whether all of this is good or bad, I do not yet know. The only way in which it affected me at that time, was the heading of my monthly pay slip, that did not even show my name or (perish the thought) employee number. During 1966, my "net pay" was R 208-18, and in 1967 it became R 231-65.

Most consulting engineering firms likely started out as a "private practice" by an individual professional, or as a partnership of two or three likeminded individuals, who worked together in an amicable way, or were from "Day 1" located in different cities and towns, which made cooperation not only possible but also essential. How would a professional engineer in a rural town for instance be able to become known in a provincial capital, so that he could get a commission for some or other provincial project in that town? Multi-disciplinary co-operation was in those days also one of the reasons of partnership, with the potential of branching out into other sub-disciplines of (say) civil engineering. It would be logical to have one partner with sewage engineering skills, one with structural engineering qualifications, and one with highway engineering or geotechnical engineering or even land surveying[70] as their specific bailiwick. But this does not rule out, even working together, a partnership with electrical and mechanical engineers. Within the previously mentioned firm of Du Toit, Lindeque & Van den Berg, such a partnership seems to have existed. But this "co-operation between professionals" does not need to be within a partnership: In Surrey, B.C., Canada, I knew of various civil engineering consulting firms (companies) that had an "in-house" firm of land surveyors. To my knowledge, they were professional BCLS's, but I do not know whether they were shareholders of the consulting engineering firm for whom they did most of their work. The problem might perhaps arise if there ever were a possibility of a "conflict of interest". When operating as Grassroots Consulting Services, I regularly requested quotations from three legal surveyors, who would be paid by my clients, not by me or by Grassroots. This seemed to work well, 20+ years ago. This notice from Rikent also showed "Johannesburg, Durban, Pretoria, Bloemfontein and Windhoek", and this was obviously where the offices were located at that time.

During late 1966, a second rural highway improvement came to us from the TPA, as an "extension" to Nyloc's construction contract east of Chrissiesmeer. The survey information for this work had already

[69] The word "telegram" in the notice precedes the word "telephone", as if the former is a more important mode of contact between consultants and clients than the latter. B.S. Bergman & Partners had its own telegram address: "EFFLUENT". When last did you, dear reader, send or receive a telegram? Or perhaps a Telex?

[70] "Survey engineering" is considered a sub-discipline of civil engineering in Canada.

been obtained during 1965. This stretch was about four miles long (if I remember correctly) and ended in the middle of nowhere, just east of a side road to the north (to Lothair). The ultimate extension of the project, with a length of about 25 miles, terminating at the existing half-mile of asphalt at the Oshoek border station, was also assigned to the firm at that time. This section was intended to become an entirely separate design project and construction contract. Quite early already, it was intimated by Mr. Botha that I might be allowed to supervise that construction, once the contract had been awarded. That would have been ideal, we agreed, as I would have had all the inside information on the design and the site.[71]

The field survey on the "**Road to Oshoek**" was started by the survey crew, who stayed over at the Lochiel Hotel which was about halfway the project length, and they came home every second or third week and then visited the office for a short time on Friday or Monday, giving us the field books and shortly discussing progress, based on aerial photos. I need to mention here that the horizontal alignment of this stretch of highway needed some serious improvement. There were many curves with a radius of only 840 feet, while the TPA had the minimum radius for the upgrading of highways at 1 500 feet. Herklaas and Ronnie pre-determined this new horizontal alignment "on-site", using existing tangents for centre line where possible, and discussing this with Mr. Botha after their first weeks in the field. This route is fairly unique in that it follows the mild "ridge" between watersheds of two major rivers. To the south is the Usushwana River, a branch of the Great Usutu River (that runs through the middle of Swaziland and joins the Maputo River that drains into the Indian Ocean south of the current Maputo) and to the north is Tea Spruit, tributary of the Komati River (that runs through the north corner of Swaziland and then to Komatipoort where it becomes known as the Incomati River that drains into the Indian Ocean north of the current Maputo). Along my design project, the route just seemed to meander on top of this ridge through a number of wattle plantations and pasture. This was indeed a scenic route, even on the aerial photos that I reviewed through a **stereoscope**. We used a small fold-up one, but we also had a large one in a box – there was no aerial mapping for this project. There were hardly any cultivated lands along this highway, and also very few inhabited farms. Additionally, this route went through the "fog belt" on the east side of the Eastern Transvaal escarpment, an extension of the Drakensberg Range, down to the Swaziland border. This does not mean that the grades along this ridge were gentle; to the contrary, it was "rolling terrain", but the strange thing was that there were very few existing cross-culverts, and hardly a need for new cross-culverts on the proposed alignment (which ended up with various curves with 1 500 feet radius, although there were some curves with a 2 000 feet radius). About half a mile west of Lochiel Hotel, (which was on the south side of the road), there was a substantial excavation on the north side of a long tangent. The survey crew determined that it would be best to retain this alignment with a (minor) horizontal "kink". Quipped Mr. Botha: "This may have happened when the original surveyors went to the bar too early one day." On that "old alignment", the grade was also to be struck at about a foot above existing centre line.

At this point, something needs to be said about the "**road safety features**" that had to be shown on TPA's plan-profile drawings for the project. These included concrete roadside markers, road markings for no passing zones, W-beam steel guardrails and delineators. Concrete roadside markers[72] were normally only placed on the outside of horizontal curves, and also near culvert headwalls. The sharper the curve, the

[71] It has been my experience that being responsible for a project, whether large or small, "from cradle to grave", has normally given me great amount of job satisfaction.

[72] Concrete roadside markers were normally manufactured on-site by the Contractor, including nominal steel bars and sand beaded paint on a little insert near the top. They were known to be notoriously short-lived. In the early 1970's, the Natal Provincial Highway Department started using plastic roadside markers with plastic deflectors (made by 3M) on them. These did not break on impact, and were able to re-straighten themselves after a hit. The only problem was that they bent in the wind. I heard about this at a SAICE conference from NPA's engineer Mr. Savage, brother to the Mr. Savage who was one of the partners in the consulting engineering firm VKE.

closer the roadside marker spacing. Cats' eyes were used on the centre line, as delineators, because this particular project was in the fog belt. I cannot remember what type of calculation (if any) was needed for guardrails[73]. Road markings[74] were obviously paint, and contained glass beads that were sprinkled on the fresh layer during painting. The location of no-passing zones was designed with a "spline", which was a long thin piece of plastic with three horizontal lines on it, showing the eye height and the object height, and it also had the 10:1 distorted scale. By putting this spline on the profile part of the drawing, one could easily determine where a certain passing sight distance requirement (which I do not remember offhand) could not be met. It is likely that the 1965 AASHO Blue Book requirements were used.[75]

As an aside, I also need to state that I had no course in "Occupational Safety" while studying at UP. A 1966 issue of "The Civil Engineer in South Africa" contained a "Notice" that starting in 1967, all civil engineering students would be exposed to four classes of "**safety training**". Browsing through the old magazines, I notice an almost universal lack of hard hat usage. There is e.g. a photo of a white man with a black suit, tie and hat, standing next to an open trench in which a large section of concrete storm sewer is lowered, in an advertisement for Rocla. Similarly for equipment operators and labourers. However, I cannot recall whether "worksite accident" numbers were particularly high in South Africa in those days.[76]

The TPA was at that time finalizing the development of its first single (blue softcover, A4 format[77]) book that included their "General Conditions of Contract" and the "Standard Construction Specifications". Mr. Botha sometimes showed us a copy of the most current "draft", as he was requested to submit comments on it to the TPA. This was a novelty, because up to that time, almost all highway and bridge designs had been completed by provincial civil servants, and had been constructed by Departmental work crews. We call that "in-house" these days. It was a time of great changes from a "public sector dominated" society to one in which the private sector participated significantly. Reasons why a professional public servant would leave a secure position and join an existing consulting firm, or even start one by himself, are after many years (and a lot of distance) not clear to me. Remuneration may only have been part of the puzzle. What I do know is that only ten years earlier, highway consulting engineering firms had hardly been in demand in South Africa, because most of such work was done "in-house". My future father-in-law told me e.g. at that time that he first knew Barney Bergman as a sewerage engineer, working for a municipality (or as a consultant for various municipalities?), and that one of his earlier Afrikaans speaking acquaintances, Mr. Fred de Waal, had experienced some very lean years after starting a consulting firm. This firm had by the mid-sixties already grown one of the major consulting firms called Scott and De Waal[78], but my father-in-law had retained "job security" and "benefits" within the public sector.[79]

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[73] It was in Calgary, shortly after December 1977, that I became much more involved with interpreting the content of the "**little yellow AASHTO book**", the one about road safety measures, concrete barriers and the like.

[74] South Africa used centre lines in yellow and shoulder lines in white – the **opposite** of North American usage.

[75] During 1971, during construction of P 30/1 between Coalbrook and Koppies in the Orange Free State, passing distances needed to be manually verified prior to striping, with a long rope and two sticks (showing eye height and height). This verification was one of the special duties of the Resident Engineer, assisted by a black labourer.

[76] During my stint of work for Fekken (1965), a crew of labourers placing rebar in the footing of a retaining wall had a close encounter with disaster when the formwork suddenly collapsed. It was on a site in east Muckleneuk.

[77] One of the typical results of "**hard metrication**" in South Africa was the change-over to metric paper sizes.

[78] Later, when at MB&S, handling projects for the City of Pretoria, I encountered and perused the water reticulation drawings for Valhalla Township, which had been developed by a private developer within the jurisdiction of the Peri-Urban Health Board. These watermains had been designed by Scott and De Waal, around 1949.

[79] Johannes Jacob van Tonder (1910-2002) completed his studies for a B.Sc. (Eng.) (Civil) degree at the University of the Witwatersrand in 1932. His professional career was solely in the public sector, first with the City of Johannesburg, then with the City of Germiston, then with the Town of Brakpan and then (again) with the City of Germiston. During the 1950's, he served as President of the Southern African Institution of Municipal Engineers. His retirement at the end of 1965 was due to poor health, caused by ulcers from dealing with dumb municipal

I cannot remember anything about "right-of-way acquisition" for these rural highway upgrading projects. I guess that the farmers gained or lost some land with the curve improvements, but it was all for the better; they benefitted from the improved access to get their wares to and from the silos and auctions. In urban areas, however, right-of-way was first "proclaimed", and then surveyed and purchased.

It must also be noted that in those days, projects were assigned to consulting firms based on a "**hand-shake**" as well as "**political influence**".[80] The system of developing "project proposals" as used in North America starting during the 1980's (?) and in use (or should it be called "**abuse**"?) today, was completely unknown in South Africa. Seeing that many firms had former civil servants among their founders and principals, it might have simply been a matter of trust between former colleagues, that determined if a newly established firm would "get" its first (likely easy and run-of-the-mill) project. On the basis of its successful completion, this firm would then be considered for further work of a similar nature, or for one of a more challenging type.[81] Being unsuccessful with the first project would likely have the opposite result; it was known that consulting firms were sometimes "**black-listed**."

Excerpt from: "Manual of Professional Practice for Engineers" (1963 version – due to decimalization).

Percentage of Cost of Work

The following rates and methods of payment are recommended for services rendered under average conditions in connection with:

A. Works of a General Engineering Character and Works of a Building or Structural Character where the Engineer is the principal agent of the Client:

(i) The basis of calculation shall be in accordance with the appropriate line in the following tables:

Cost of Work From	Cost of Work Up to	Fees
	R 20,000	10% of Cost of Works
R 20,001	R 60,000	R 400 + 8% of Cost of Works
R 60,001	R 100,000	R 1,000 + 7% of Cost of Works
R 100,001	R 200,000	R 2,000 + 6% of Cost of Works
R 200,001	R 500,000	R 3,000 + 5½% of Cost of Works
R 500,001	R 1,000,000	R 5,000 + 5% of Cost of Works
R 1,000,001	R 2,000,000	R 10,500 + 4½% of Cost of Works
R 2,000,001	R 4,000,000	R 15,500 + 4¼% of Cost of Works
R 4,000,001 and over		R 25,000 + 4% of Cost of Works

Note also that the fee schedule for professional duties, written in formal Guidelines by the South African Association of Consulting Engineers[82], was not based on hourly rates for specific classes of work done (like principal, junior engineer, draughtsman, typist). It was based on a (fixed) percentage of the estimated construction value of the project, with a sliding scale. And these percentages differed between e.g. a civil engineering project and an electrical engineering project, because a civil project might likely contain a very expensive excavation that is very easy (and quick) to design, and an electrical project might contain an inexpensive part that is very difficult (and also time consuming) to design. As design work progressed, these construction estimates became "closer to the truth", (e.g. from a Class C estimate through a Class B estimate to a Class A estimate); the consulting firm would e.g. be paid 20% of the total fee (based on the first cost estimate) on completion of the "Basic Design" and another 60% (totalling 80% on that day)

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councillors… He enjoyed a long additional career with the Department of Planning, and later involvement with Chris van Tonder, my brother-in law's consulting planning firm in Pretoria, till he was almost eighty years old.

[80] In Chapter 1 of "Part 2", I hope to describe how MB&S landed the design and site supervision assignment for a major fish hatchery project on the Orange River, just west of the Hendrik Verwoerd Dam.

[81] The TPA had three "panels" of consulting firms, called the "A", "B" and "C" panels. And … a black list.

[82] This was likely based on ancient British Institution of Civil Engineers procedures, or alternatively on guidelines by FIDIC, the Fédération Internationale des Ingénieurs Conseils. The SAACE was a member of FIDIC since 1952.

of the total fee (based on the most recent cost estimate) on completion of the "Detailed Design" and Tender documents. The remaining 20% of the total fee would then be paid out after submission of the as-built drawings, based on the final "as-constructed" project value. Perhaps there may have been "interim fee payments" to the consulting firm while a project was "being designed" or was "being constructed", but in general, I believe that this system really promoted efficiency. For supervising a Contractor, during construction, there were also set fees, which were "over and above" these design fees. These site supervision fees were, however, much **too low at the time**, not reflecting actual costs by a long shot. I was already aware of the February 1964 issue of "The Civil Engineer in South Africa" that contained on Page 50 the percentage scale of fees, which I have copied on the next page – as an example how "simple" and "straightforward" the system was, and how this promoted "efficiency" of time spent on a project, based on "**ingenuity**". All Engineering Institutions in South Africa were signatories to this "fee schedule". However, for site supervision by consulting firms, there were also scheduled rates, but these had not been updated since 1955.

Based on this "Fee Schedule", skipping forward a few years: During early 1972, while already living and working in the Bloemfontein office of MB&S, and with their approval, I wrote a "**thesis**" for my MBA degree based on this particular "site supervision fee" problem, as a case study. I used real numbers from the 26 months that I had supervised the P 30/1 Sasolburg-Koppies highway construction project on behalf of my employer. It became clear that the R 750 monthly fee (based on the 1955 rate) which the firm had received from the Provincial Government, did not even cover the basic salary costs for the two employees, Louis van Wyk and myself. After approval of the thesis, Mr. Sturgess presented a copy to the Provincial Roads Department's Chief Engineer, and lo and behold, the remuneration system for supervision services was changed soon thereafter. I never received formal confirmation that my thesis might actually have been the "last straw" in prompting a necessary and long overdue change, but anyway.

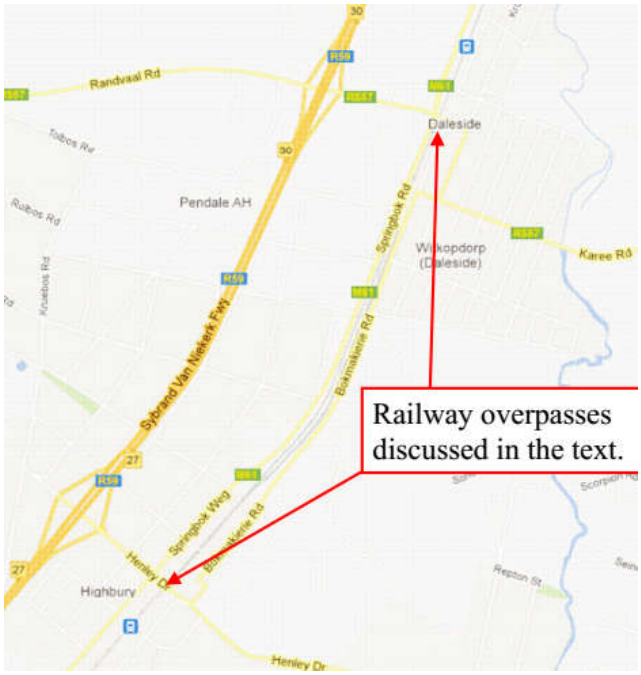
The last straw? How vain of me, to even think that way! "The Civil Engineer in South Africa" had already published much about this. Rereading this in February 2018, I notice that the April 1968 issue contained, within the "Annual Report and Balance Sheet for the year ended December 31, 1967", under the heading "Professional Practice", the following paragraph: "A sub-committee of Council is negotiating with the Transvaal Provincial Administration, regarding payment of Consulting Engineers for site supervision." In 1969, the magazine mentioned a "Committee for Consulting Engineering Fees for National and Provincial Roads", with Prof. D.W. de Vos, Mr. F.J. de Waal, Mr. A. van Niekerk, Mr. L.C. Reynolds and Mr. J. Fulton as members. Who knows what had already been organized since then, also with the other provinces and the National Transport Commission? At that time, I was still a young engineer.

All design drawings that Sam, Warren and I produced were supposedly approved by Mr. B Smook at TPA, somewhere in that huge four-block Provincial Building. I never met him then, (and only once later) but knew that Warren had met him once, when delivering some drawings. Obviously Mr. Botha dealt with Mr. Smook. The Director, I knew, was a Mr. D.L. Krogh, but I also never met him. But I had met Mr. Christo Kuun, also with the TPA Roads Department, at the SAICE Pretoria Branch Meetings.

The firm's Soils Laboratory in Pretoria West became involved in the geotechnical investigations to determine the borrow pit locations for this project. The gravel road was quite slick when wet; partly because decomposed dolerite had been used for the natural gravel sub-bases. The upgrading required lime and/or cement stabilization for the sub-bases, while the base course material was to be crushed gravel, topped by a chip seal. At that time, the TPA was a great believer in the California Bearing Ratio method of pavement design, and in particular of stabilization by lime, cement or a cement/lime mixture for sub-bases.[83] This had occurred after Mr. A. van Niekerk, (then with TPA) had visited the USA in 1947, before he

[83] Stabilization by lime decreases the plasticity index, while stabilization by Portland Cement increases the CBR.

became a founding partner of VKE. As I was taking a graduate course in Pavement Design and Construction that year, I attended a public lecture at UP, by Mr. Francis Hveem[84], the recently retired as Materials and Research Engineer for the State of California, who had been the developer of the California Bearing Ratio method. Under the auspices of the Pretoria Branch of the SAICE, he spoke about concrete pavements. Our Soil Mechanics professor, Dr. Marthinus van Rooyen, had studied in California for his PhD and knew Mr. Hveem personally. We did not know the current term "geotechnical engineering" in those days. Prof. Carl Monismith, from UCB in California (whose handbook I used that year) also visited South Africa (namely Pretoria and Cape Town) in August 1969. I may have attended his lecture as well, as I was still working in Pretoria (see Chapter 2).



The preliminary design assignment for two railway overpass projects came to the office during late 1966 or early 1967. These projects were at Henley-on-Klip and Daleside, two railway stations and small vil-lages north of Vereeniging, on the double tracked electrical main railway line between the Orange Free State to Germiston through Vereeniging – the one that had been such a political football in the early 1890's. The work required the preparation of General Arrangement drawings, including road and rail profiles and a variety of typical cross-sections (all meeting SAR requirements), which were my responsibility, as well as a number of preliminary structural drawings, which work was done by Hennie Olivier, as supervised by Mr. Ivor Evans from the Johannesburg office – I recall them discussing the use of "Pre-stressed AASHO beams", the first time that I heard that term. It was the first design project that I did almost "by myself", without Mr. Botha's direct supervision! This couplet of overpasses was intended to connect to proposed interchanges on a future north-south freeway about a mile west of tracks, and to the local road system (for agricultural smallholdings) east of the tracks. For one project, the concrete bridge also ran over a local road adjacent to the railway line; this was not so for the other project. During mid-1967, when completed, these drawings were handed in at the Transvaal Provincial Admini-stration, together with preliminary construction cost estimates. I do not think that the submission of full-scale reports of any kind was included with these assignments, as would be logically assumed to be included for a project of this kind today. How complicated have things become over the years! Perhaps the civil servant who had written the original professional expense allocation requests for these assignments intended to use another consulting firm for the detail design phase, or this kind of thing was just not done in those days (and not required by the SAR either). I suspect the latter. I do not think that I ever saw these two sites, except on air photos and the 1: 18 000 scale aerial mapping on mylars.

[84] A quote by Mr. Hveem, on his retirement, from the *Asphalt Quarterly* magazine, is worth the space in this book. As "an advice to the young engineer of today", he said emphatically: **"I would advise him to band together with his fellow engineers to rise up against the management experts, personnel specialists and miscellaneous paper shufflers who are strangling the whole business. It has got so that an engineer can't get on with his work in peace because almost every move has to be explained and accounted for and justified to some non-engineer who has no direct knowledge of the problems involved and no responsibility for solving them."** I firmly believe that this is now more true than then.

As an aside, more than two years later, during 1970, I worked with Mr. Ulrich Wessmann PrEng, the site engineer of D&M Padaanleg, who regularly came to my construction supervision shack at Dover, Orange Free State. On my way to work one morning, I listened to the SABC news on the radio, and it was reported that there had been a major school bus / train crash the previous afternoon, at one of these two railway crossings. Mr. Wessmann came from his home in Pretoria that morning, and I knew that he had worked for the TPA Roads Department (Bridge Division?) prior to joining D&M. At Dover, he confirmed to me that he had also heard about the crash on the radio. I then mentioned that, with BSB&P, I had prepared the preliminary designs for these two overpasses, and had until that morning been completely unaware that they had not yet been built. "Yes, I know," was his sad response, "I remember M.C. bringing in those drawings and cost estimates." It surfaced that though these two preliminary designs had been submitted, Uli (and his supervisor) had not been able to get the projects "programmed and funded" (as the term is in Arizona) or "budgeted", meaning that they would proceed to "design" and eventual "construction" stages. As happens so often, due to this high-profile mishap, in which several children and I believe also the school bus driver lost their lives, both these two bridges were then somehow "fast tracked" during late 1970. The Provincial Government somehow found a way to get a Contractor on site within the shortest possible time.


One of our wedding photos.

With all this work, I ought not forget to add that Lydia and I became engaged on 8 October 1966, her 25th birthday, and that we got married on 18 March 1967, one year minus one day after we had first met at the church picnic. In fact, the Pretoria-Sunnyside church re-scheduled its annual church picnic that Saturday for a few weeks later; many people from the congregation attended our wedding in the historic Paul Kruger Church on Church Street West. After a two week honeymoon at Golden Gate National Park in the Eastern OFS, we occupied a bachelor apartment for 6 months in Trevenna Court, 35 Greef Street, Trevenna, and then a 1-bedroom apartment in Montague Flats on Mears Street, Sunnyside, directly opposite the Pretoria Teachers' College. I continued to go to work by bus. Lydia had quit her work at the Pretoria Public Library in December 1966, she made her own trousseau, and after our marriage, was occasionally employed by B.S. Bergman & Partners for property record research in various offices like the PUHB and the Surveyor General. She became pregnant in August 1967.

A lower-standard rural highway upgrading project came to my desk at that time. This was Biesiesvlei-Lichtenburg (currently Regional Road R 52 in North-west Province), an existing gravel road that needed to be chip-sealed while at the same time, checking, verifying and improving its drainage. This far Western Transvaal location experiences much less annual rainfall than e.g. sites in Eastern Transvaal, and the terrain is very flat. In the original drainage concept, (when the road was first built), stormwater had been lead to ponds adjacent to the fence on both sides of the highway, so that there was no need for any cross-culverts – for which there was in fact no (vertical) room anyway; detailed survey information and cross-sections confirmed this. The longitudinal grades were exreemely flat, and all vertical curve lengths were minimal, 400 or even 200 feet. Quantities for sub-surfacing and surfacing were quite minimal.[85] I never visited the site; after Mr. Botha had visited it once, close to completion of the exercise, when he visited the Regional Engineer in Lichtenburg. During the coffee break the next morning, he mentioned that the maize was over eight feet high on both sides, for most of the road. I believe that this project was built by

[85] In 2005, while preparing a Project Assessment Report for Passing Lanes on SR 95 south of Bouse Wash in western Arizona, I discovered from as-built drawings that SR 95 had been designed using the same basic geometric and drainage principles, with dug-outs next to the fence, for the rare occasion of rain in the desert.

a Provincial crew, and is still there, with grass almost next to the blacktop. Check these out on GoogleMaps!

An explanation is needed about the quantities that were to be calculated for the "asphalt surface", which was, as stated before, a multi-layered chip seal for the lightly trafficked rural highways, but a layer of hot-mix asphalt for the urban expressways. For the chips seals: On the crushed gravel base course, a prime coat would first be sprayed, normally Iscor No. 1 Tar in Transvaal, which was a by-product of the coke ovens at steel plants located at Pretoria and Vereeniging, and later also at Witbank and even Newcastle in Natal (or Wankie in Rhodesia). An application rate and temperature was specified, as well as the weather limitations for spraying, and the width was normally 6 inches wider on each side than the width of the chip seal. This tar was supposed to be sucked up by the base course for a few days; a penetration of "half-an-inch", which one could easily determine with a penknife, was considered "adequate". The multi-layered chip seal would then be placed on this prime coat. This would consist of a bitumen tack coat, which would be immediately covered by an application of clean, hard and very angular competent crushed rock, normally ¾" dia. This crushed rock (with hardly any fines) would be rolled into the tack coat with steel rollers of a certain mass and by a maximum number of passes. The next layer of bitumen tack coat would be sprayed on top of this, with an application of (say) 3/8" dia. rock, once again without any fines, and rolled in. The third layer would be a sprayed bitumen emulsion and an application of ¼" dia. sand called "crusher dust". This final layer would be hand-applied (by shovel, straight from the back of a truck) and would be hand-swept into all the voids of the underlying layer, and then rolled with rubber tyred (tired) rollers only. The result was sometimes astonishingly good; some black labourers were real experts. For hot-mixed asphalt: A pre-mixed asphalt layer was seldom more than 1½" thick.[86] This needed a prime coat and a tack coat.

In early 1967, I became involved in a project in the province of Natal – detail design of the upgrading of the Umzimkulu Lime Works road, for which preliminary design (based on aerial mapping, with no field survey) had already been approved. This was a steep and very twisty gravel road, turning north off the highway between Port Shepstone and Kokstad, and leading to the Oribi Gorge Natal Provincial Nature Reserve (area 1 800 ha.), a very beautiful tourist attraction. There were 13% grades down into the Umzimkuluwana River gorge, crossing it by a ford (that consisted of a non-reinforced concrete slab over some small concrete pipes), and thence winding up with 13% grades on the other side, up to the entry of the Lime Works (as shown **white on photo on the next page**) and beyond. My involvement in the project was to sort out what to do with the (many) existing property accesses along the first part of the route, where there were banana plantations and various Indian farm worker residences. There was hardly a tangential segment of road between the horizontal curves! I made a number of suggestions in order to confirm that sight distance requirements could be met. Shortly afterwards, the survey crew went out to do

[86] South Africa is/was not oil-rich, and at that time tried in many ways to reduce oil-dependency. The fuel-from-coal project SASOL was a successful way; using tar (from local coke ovens) instead of asphalt (from imported oil) was another way, and since 1951, bitumen products research had been a priority at what became the National Institute for Road Research at the Council for Scientific and Industrial Research in 1955 (NIRR at the CSIR). This research was totally independent of foreign "pavement design procedures", and, in my humble opinion, "better".

the layout of centre line and cross-sections. They stayed in a hotel in Port Shepstone, only returning to Pretoria for a weekend once in three weeks, invariably bringing a stack of field books to us, to reduce for detail design purposes. One Monday (or Friday) during a coffee break, Herklaas remarked that he had re-met a former survey colleague, who had become a bar owner in Port Shepstone. Dryly, Mr. M.C. Botha commented that this is what happened more than often, by saying: "Some surveyors just change place, from the one side of the bar to the other."[87] I sometimes wondered why this project was handled in Pretoria, and not by BSB&P in Durban. And by the way, how did Mr. Botha manage to liaise with the NPA Roads Department? [88]

At GoogleMaps, onc can see that the Port Shepstone – Kokstad (at the bottom of the **photo at left**) is now a divided highway (with a concrete barrier on the median) with much residential development on both sides. Their imagery does unfortunately not go down to Oribi Gorge from the signalized intersection. Which is a pity.

In the winter of 1967, I became involved with the actual start-up of another provincial highway upgrading project, namely of P 131/1 between the towns of Delmas and Leslie (currently called Regional Road R50 in Mpumalanga Province, while Leslie is now called Leandra). I accom-panied Mr. Botha on a one-day exploratory visit to this project site, with his black Austin 90 car, which (I think) he might have kept after leaving the Department of Transport a few years earlier[89]. That day, I learnt the value of the use of a tape recorder during a site visit. Mr. Botha had one of those (first generation?) portable battery powered Philips tape recorders, for which one had to manu-ally insert a tape from a reel on the one side, into a slot on the other side of the machine. He asked me to just add to what he spoke into the machine as we drove along, and "never mind interrupting me if needed, we'll sort it all out later." We left Pretoria early and drove the route from the start of the project, which was somewhere east of Delmas at a minor realignment. This was an existing gravel road consisting of long tangents and large radius curves, on level terrain with a lot of clayey material, through the pastures and black ploughed land for summer crops like corn, (meaning maize) sorghum and sunflowers. Very little realignment was needed, not even at an existing (and fairly new?) railway overpass for a coal mine railway spur on the farm Haverklip, about halfway the project. That overpass is still there: GoogleMaps shows it as "**Brug 2211**" [90,] about halfway the project **at**

[87] Pat Jackson, a surveyor who worked for me in Yukon in the mid-1980's, who was of Hawaiian origin, quit YTG and then bought a bar in Kelowna, BC. It was he who once told me that he was to spend the winter in "the best place in the world", meaning Waikiki, to which I responded impromptu: "I thought, Pat, that it was YTG".

[88] During December 1969, two years after leaving B.S. Bergman & Partners, Lydia and I vacationed in Southern Natal, and made a day trip to Oribi Gorge. Great was our surprise to see the BSB&P survey team there, close to the entry to the Nature Reserve. The project length had been extended, and was to be detail designed and built soon.

[89] As part of their pay package, senior civil servants were normally issued with an "official" car, to use for a few years and then get a new model. They could then keep or dispose of the older one as they thought fit. Through my father-in-law we later bought the Mercedes-Benz 280S that had been used by Dr. Rautenbach, Director of Planning.

[90] South Africa had been quite progressive in the early 1930's by legislating "No more level railway crossings **AT ALL**". Mining companies (like Delmas Coal in this case) and factories had to finance and build railway overpasses or underpasses if their railway siding would cross any existing highway, even if the estimated train traffic volume was only one train per day. But it also worked the other way! Delmas Coal was still open when Google was there.

left. But at the Leslie end was a possible realignment to the west, where the challenge became how to establish access control through a large area of an old "proclaimed" Township without a single developed lot.[91] (I do not think that this realignment was ever built; Regional Road R 50 currently becomes an urban street when entering Leandra.) On our return, we saw how "high speed" the existing gravel road already was: a northbound Citroen DS19 (the model that looks like a barbell fish and was supposed to be impossible to roll over) had gone dead straight at one mild curve to the left, had then gone **head over heel** when it left the road, and was lying on its roof next to the fence. It must have sped a lot. The December 1969 issue of "The Civil Engineer in South Africa" shows Louis Esterhuizen's application to transfer from "Graduate" to "Associate member" of SAICE, and that he lived at Leslie. It is very likely that he completed detail design of this road, and then supervised construction, just as Mr. Botha had first intended that I should do at Lochiel.

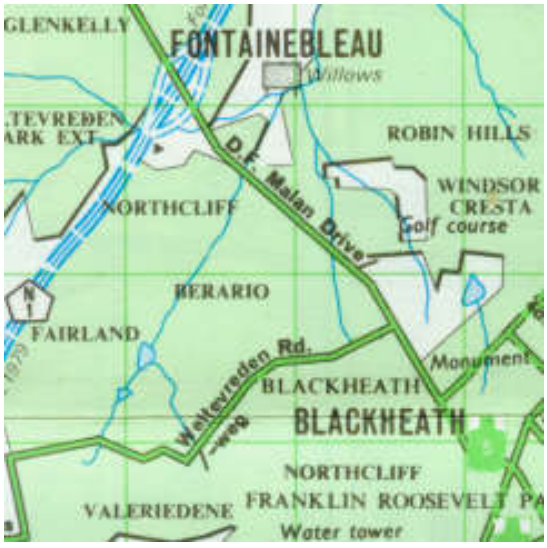
I should not forget to mention that I gave up on both graduate courses at Tukkies soon after our engagement. I completed the course work for both courses, but did not write the actual exams. On the Structural Roadway Design and Construction course, (Padbladontwerp en -konstruksie); in a June 1966 assignment of 15 pages, I wrote a report on exotic, expensive and uncommon stabilization with resins, water glass, calcium acrillate and others; electro-osmotic stabilization, as well as stabilization by thermal, drainage, membrane and cementation techniques. I realized that I could not really use any of that information, valuable as it was, for the geometric design that I was getting pretty good at (in my estimation, at least!). Reluctantly, I felt that I needed some construction experience prior to be able to discuss the topics intelligently with others. Regarding the Sanitary Sewer Systems course, I did not find that adequately interesting either. I had not done any sanitary sewer design since the few weeks in Braamfontein. I also found the lecturer, Mr. V.A. Shaw, from one of the Institutes at the CSIR, not very helpful with a specific assignment report that I had to prepare, with a vague title, "Sewerage Networks". Additionally, though, and more importantly, I guess, I was too much in love in those days; I am (still) sometimes told that I spent a lot of evenings at 946 Pretorius Street, both before and during our engagement!

During the winter of 1967, I also became involved with a large project, the upgrading of the extension of the D.F. Malan[92] Drive, outside and west of the Johannesburg City limit, through the townships of Northcliffe, Windsor and Ferndale, ending at the proposed ring road around the Johannesburg area, near an existing Drive-In Theatre adjacent to a river. This area was still under the jurisdiction of the PUHB at the time. This project was similar to the Bryanston projects, but in this case, we handled the preliminary

[91] After the Second War of Independence, (a.k.a. the Boer War), some British military surveyors remained in South Africa and surveyed Townships for the owners of many farms. Thousands of residential lots were advertised in London newspapers as "close to the fabulous Witwatersrand gold mines" and some of them even sold in Great Britain and elsewhere, but they were never developed and not even taxed. Around the Witwatersrand, when development eventually started, there was no method to provide even the most basic services, until the establishment of the Peri-Urban Health Board in 1944. Even then, development was sometimes sporadic.

[92] Dr. D.F. Malan had been Prime Minister of the Union of South Africa from 1948 to 1955.

design stage. So after a week or so of collecting all the legal plans of the many Townships in the area, we went out with AJJ's Volvo for a long day of exploratory investigations. This was a Volvo just like Warren's, and I remember one coffee break statement quip from AJJ in those days, when discussing the price of new automobiles. "**I'll never pay more than R 3 000 for a car**", he said, "**not even a Volvo**", likely not realizing that prices were already getting out of hand by the end of that decade, (for reasons that are definitely beyond the scope of this book). His Volvo might also have been a former Government car (like Mr. Botha's), while Warren's had come "used" from his Swedish parents-in-law.



SE project limit at SE corner of mapping.
NW project limit at driveway theater.

During this site visit, we discovered a strange situation. Windsor Township was one of those early surveyed townships where nothing had happened for ages; but in 1967, houses were being built all over on all the square (100 Cape foot x 100 Cape foot) lots along streets that were named after English nobility titles: Duke, Duchess, Prince, Princess, Marquis, Lord, etc. All these streets were laid out at a 45 degree angle to the main road, in days when proper urban planning principles had not yet been devised. During our excursion, a house builder came to us (Did we look professional enough?) with a question: "Could you please verify the number of a specific vacant lot in this area?" We could, because we had a copy of the survey plan of Windsor Township with us, and after finding it in our roll, we drove right up to it. "Thank you, gentlemen!" This man then told us that a few months earlier, he had had a truckload of mampara[93] bricks delivered to a vacant lot, but on the wrong street. These brick trucks held either 3 000 or 4 000 bricks, straight from the brickyards, and had been end dumped. All he needed do, after he had been alerted by somebody about the error, was to instruct a black labourer to wheelbarrow all these bricks through the other vacant lots and dirt tracks, to where they were supposed to have been offloaded. That could definitely not be done in North America these days.

Something should be added about the availability of "topographic survey plans" and "legal plans" to us in those days. The Surveyor General's office (for Transvaal), on the northwest corner of Church Square, was where we could review and order all these plans. For the whole country, 1:250 000 map sheets existed and were available, according to the "odd longitude degree east of Greenwich" system, which meant Lo 27 and Lo 29 in Transvaal. These map sheets showed all farms[94] with a name and number

[93] The colloquial "mampara brick" was an economy style kiln fired clay brick (size 9" x 4½" x 3"), used for walls that were to be mortar plastered. "Face bricks" were much more expensive, and were never delivered by dumping. Lydia's father had suggested the Afrikaans name "siersteen" (for "face brick") to the South African Academy of Arts and Sciences, of which he was a member; he also wrote an Afrikaans children's book about civil engineering.

[94] Originally, in the South African Republic, any 16-year old white male was eligible to obtain a farmstead, with an area of more or less "one hour by horseback" by more or less "one hour by horseback". In the presence of the local Field Cornet, this was needed to be ridden (no speeding!) and marked by rock cairns that would be placed at the proposed corners, near river banks, or where existing farmstead boundaries were met. Actual surveys of these farmsteads was started much later, around 1880, and by that time it was discovered that many "slivers" of land remained unclaimed between the farmsteads. These lands became government property (and were given strange farm names like Pylpunt, Flint and the like). At that time, it was also realized that there was no farmstead land left to be granted within the ZAR boundaries. "Burgher Rights erven" (meaning lots in extensions to existing towns) were then granted in many of the then existing towns, but once again, these were only for eligible 16-year old white males. The numbering system for subdivisions of the farms (in terms of the Roman Dutch inheritance law) first

within a specific grid, as well as east-west and north-south identification letters, the first half of the alphabet for the one direction and the second half of the alphabet for the other. Farm numbers within a map sheet started in the (north-west) top left hand corner (e.g. Matjiesfontein 1 LP), proceeded to the top right hand corner and then restarted at the left boundary of the sheet south of Matjiesfontein 1 LP, and so on and so forth till the bottom right hand corner of the map sheet was reached. It was a great system, very user friendly and foolproof. There were no road rights-of-way between farms, as they sometimes exist (all over North America, between 36 square mile "townships" and 1 square mile "sections" of land). Topographical map sheets at a scale of 1:50 000 also existed, based on the same grid system, just like 1:50 000 topo sheet maps in Canada and somewhat like the older "quad sheets" in the USA (which cover an area of 7½ minutes longitude x 7½ minutes latitude – and therefore differ in actual size from California to Maine – at a scale of 1:24 000.) Some older topographical map sheets, at a scale of 1:18 000, were also available for some of the urban areas, but this system had not been kept up to date and did not exist for the rural areas. All these were available at the Government Printer on Bloed Street, while "legal plans" were available as prints at the Surveyor General office. This was before Xerox, and one needed to wait for a few days for any photographic prints. Prints existed as white lines on a black background, for subdivisions and "proclaimed" Townships alike. In general, a small development adjacent to an existing "named" Township (say Sinoville) would be called Sinoville Ext. 1, and the lot numbering would continue with the lot numbers used in the original Sinoville. Other developments in that area would then become Sinoville Ext. 2, Sinoville Ext. 3, and the like. Perhaps this was done to limit the proliferation and future confusion. This system worked fine; everybody knew how what could be doine with them.

By the winter of 1967, Nyloc had completed their "**twice amended**" construction project, including the four eastern miles, and I met the Resident Engineer (for BSB&P) on that project. He was a Mr. Smyth (or Smythe) who had graduated in Britain in 1929 or 1930, at a time when work was very scarce (at the start of the Great Depression), and he had been looking for work for a long time before he landed employment with a county. The salary was pitiful indeed, but he was allowed to use a motorcycle for work, as a fringe benefit. That just did it for him! As an aside, the memoirs of my father-in-law, who had graduated at Wits at the end of 1932, mention on page 30 that he became employed (as a student engineer) by the City of Johannesburg – with a salary of £12-10-00 per month – "as a result of my father's position as City Councillor[95], and the fact that I then had an engineering degree behind my name". (As translated from Afrikaans.) The detail design of what actually became the "first paved road to Swaziland" was then being completed by Warren and me. I finished the calculations for estimated quantities of all pay items, including the various road signs, based on the specific lettering needed and instructions from the TPA. I made one (long) day trip to the Ermelo District Office, to have these and many other details confirmed, and at that occasion also looked at feasible housing and construction camp sites, driving the route up and down and meeting some farm owners, including a certain Mr. Opperman and his son. When TPA decided to proceed with the work, they prepared the tender[96] documents and advertised the project in the newspapers. One pay item was called "Accommodation for Resident Engineer" and there were various possibilities to make use of this "free housing during construction, for the duration of the project". Mr.

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followed capital letters, then normal numbers, then lower case letters and then lower case roman numbers. A parcel would e.g. be called "Portion ii of Portion c of Portion 2 of Portion A of the farm Rietfontein". In the 1930s's, this had fortunately all been rationalized into a single numbering system, based on the day of registration, so that this above hypothetical parcel became known as "Parcel 59 of the farm Rietfontein" – and one could trace the history of how this had all come about through the many decades. At the Surveyor-General's Office, I once saw piles of huge old leather bound books with all the hand-written entries. These were ready to be sent to the Archives, I was told.

[95] His father, Mr. J.J. (Hansie) van Tonder, one of the first three Afrikaans speaking City Councillors of Johannesburg. Before his election in 1930, he had been a translator at the SAR, and examiner for Afrikaans to clerks in Port Elizabeth, Cape Town, East London and Bloemfontein, but he also had cows and "Cedar Dairy" in Auckland Park!

[96] The words "bid" or "bidding process" were not used in South Africa.

Smythe lived in the Village of Chrissiesmeer, but that was considered "too far away" for this particular project. There was only one vacant farm house along the route[97], but Mr. Botha suggested that fairly recent improvements in pre-fab housing units would likely provide a better alternative – there was one type that folded out after it was delivered to the site as a single truckload, and this could be placed in a "camp" by the Contractor. He himself had lived (as a bachelor) in a clock tent in the early 1950's, designing and building the National Road in the northern Cape Province, south of Aliwal North, in charge of a government construction crew. Lydia and I would just need to see what happened after the Contract had been awarded. I attended the "Pre-tender meeting" with Mr. Botha and senior staff from the soils lab, as my very first experience of the process. Attendance of prospective tenderers was compulsory for all TPA projects. They all signed a record of attendance and a sheet confirming this, which was to be attached to their tenders. I was required to make lots of notes for preparation of the Minutes, which would be typed and go out under Mr. Botha's signature.

This Pre-tender meeting was well attended by contractors, equipment dealers, material suppliers, trucking outfits and of course the TPA District Engineer. We met at the start of the project (end of the chip seal, just completed by Nyloc), and proceeded with various stops at prominent features, including borrow pits. It amazed me that at every stop, the trunks of some cars were opened, which revealed solid and mostly liquid snacks! The opportunity was given at every stop to ask questions; formal Minutes were afterwards prepared and sent out. I remember we had a "late lunch" at Lochiel Hotel, after returning from Oshoek, the east project limit. I remember hearing a story from someone in those days (or even that day) that the SAR policy for conducting pre-tender meetings was quite different that the one used by TPA and most other jurisdictions: One railway engineer was supposedly notorious for answering almost every question by stating: "That, my dear sir, is for you to determine, at your own good time." As a result, I was told, railway projects were sometimes priced pretty high, even by the "low tenderer", because information (particularly geotechnical data, of which I heard some actual horror stories) was not provided in the tender package, and prospective tenderers each had to make their own decisions based on assumptions. The following joke went around: "The word "pre-tender meeting" is a suitable name, because every tenderer pretends that he knows everything, but asks questions as if he pretends to know nothing at all."

It was somehow expected (by everybody?) that Nyloc would be the firm with he lowest tender, so that would then complete the construction to Oshoek – which would have been logical, because some of their equipment was still in the area. Various people actually asked Nyloc representatives about this possibility during the pre-tender meeting, but did not get a response at all. It was quite a surprise to discover that when tenders were opened (by TPA, in Pretoria), Nyloc's tender was absent.

By the grace of God, Lydia's first pregnancy went well, but we were imagining possible problems with the very isolated accommodation and the likelihood of very cold and foggy weather during he time when Lydia would be due with our firstborn child. Particularly Lydia's father, a career municipal engineer, was of the opinion that we should not go so far away, but rather remain in Pretoria.[98] In early November, he showed me a newspaper advertisement from the Pretoria News, in which the City of Pretoria recruited for civil engineers in their Roads Engineers Division[99], for which an annual salary of R 3,888 per year was offered for someone with two years of experience. Staying at BSB&P, my gross salary in 1968 would be R 3,600, so Lydia and I decided that I ought to at least apply for this position. Remaining in Pretoria would have been nice for another reason. In 1966 already, I had joined the Bach Choir Pretoria, and even

[97] This older house was on a farm with the (prosaic) name Brandyball, but it was quite a distance from the road.
[98] In 1936, he had been strongly advised by his father-in-law not to take a position with the City of Port Elizabeth when "just married", as it was too far away from all the relatives on both sides (and there were many of them)!
[99] For the sake of convenience, I use the word "Division", although it was not called that in either official language. Roads Engineer Department – as part of the City Engineering Department – is an anomaly / tautology / oxymoron.

during and after our courting days, while I quit studying, I kept up the weekly practices, held at Pretoria Boys' High School, practicing Handel's oratorium "Judas Maccabaeus" under the direction of Bruno Peyer. I liked singing (as tenor), and we performed the whole work on Wednesday 1 November 1967 at St. Andrews Presbyterian Church on Andries Street, with orchestra, organ and soloists, including Gert Potgieter. Little did I know of the near future: Within 2 months, I would become a "civil servant"; within 4 months, Lydia and I would live too far from where the Bach Choir practiced.

After I applied, I was granted an interview with a Mr. W. Thoms from the City's Design Engineering Division, (of Dutch ancestry) and was then conditionally hired by the City. My starting day would be Tuesday 3 January 1968, pending the outcome of a medical examination by the City's Chief Medical Officer (or whatever his actual title was). He examined me, and said that I would not meet the City's requirements if I had applied for a position as a bus conductor, due to my flat feet and double jointed knees. But as a civil engineer, I was supposedly OK and "fit for work".

When I took courage and got my act together to break the "bad news" to Mr. M.C. Botha, he was quite disappointed in what he saw as my foregone conclusion to leave the firm already. I had been almost two years in the office, as the first locally recruited graduate engineer, who had already gained some level of minor "seniority", and (by the way), the staff and workload was growing by leaps and bounds. But when I put it to him in writing on 11 December, he was gracious to accept it on the 14th, wishing me "all the best in my career". (No compulsory "one month" notice needed!) I left B.S. Bergman & Partners without any hard feelings, and during the next years, Lydia and I kept contact with Warren Verster and his wife Ingbrit, and also with Hennie Olivier and his wife (whose name escapes me). We regularly played canasta on a Saturday evening at each other's residences; it appeared that whenever one of the three women was pregnant, they won the men by far. But as soon after the babies were born, things changed.

The Annual Report in the April 1968 issue of "The Civil Engineer in South Africa" reported that at the end of December 1967, the SAICE had a total of 2 943 members. (There were 4 honorary members, 365 members, 1 983 associate members, 2 affiliates, 329 graduate members and 260 student members.) And the Institution's (balanced) budget for 1967 had been R 39,634-81. It was actually quite a "small world".

To put some context to what happened in South Africa during December 1967, it ought to be mentioned that on the 3rd of that month, Prof. Dr. Christiaan Barnard and his team, at Groote Schuur Hospital in Cape Town, performed the world's very first heart transplant (on Mr. Louis Washkansky, who lived for 18 days after the operation). The South African media became ecstatic about this marvel of medical technology and skill. During the Annual Meeting of the SAICE (in 1970, I think), Prof. Barnard was the guest speaker, where he boldly proclaimed that in his view, the civil engineering profession had done much more for society at large than the medical profession had, considering all the advantages like sewerage treatment, water purification, safe buildings and the like. Which statement was of course gobbled up by all those present, and reported with glee in "The Civil Engineer in South Africa".

In retrospect (2019), I am thankful and glad to have received a solid basis of varied design expericience at B.S. Bergman & Associates, a firm that has long vanished frm the scene. I believe to have used the abilities that were taught me and learnt by me in those years. This was entirely of the Lord God's doing, which I could not have foreseen when visiting the Aula in August of 1965. Sometimes, an inevitable question arises: "What would have happened if I had remained at the office in Bureau Lane?"

An entire "change of ambience" and working enviroment awaited me in the public sector, and this was just as challenging and good to shape my mind and hone my skills for the continuation of my career.

Chapter 2 – Becoming a Senior Engineer – Roads Department, City of Pretoria.

When I arrived at the South Block of the Munitoria Building[100] on Vermeulen Street, on Tuesday morning 3 January 1968, there was some confusion with Mr. Thoms on the west half of the 8th floor. He had assumed that I was going to work under him and in the office of the Chief Design Engineer, who was a Mr. T.A. Wade. They designed main sewers, water mains and I do not know whatever else. The Senior Engineers working under Mr. Wade were also Mr. V. Tabone and Mr. D.H. Marx, who regularly attended SAICE meetings. But the advertisement had not said that I was to work there, and I was then taken up to the east half of the 9th floor, where Mr. R.L.S. (Bob) Weir was the Chief Roads Engineer, Mr. G.W. (George) Gie the Assistant Chief Roads Engineer, with two Senior Engineers under them, Mr. C.C. (Charl) Durand and Mr. H.C. (Maans) Nell. Around and for them, an entirely all-male environment existed: Mr. du Toit, a typist, Mr. Botha, an accountant, and Mr. Ueckermann, who handled the complaints desk and was somehow retired or on disability from a former "outside" position. Two other technical people worked there: An old-timer senior draughtsman, Mr. G.J. Boshoff, and a senior technologist, Mr. Jan Strang, who had been transferred to the City from the Peri-Urban Health Board in 1964. In that year, substantial developed and undeveloped areas around the City had been annexed to the City of Pretoria,[101] including two former municipalities, Pretoria North and Silverton. As a former long time PUHB employee, Jan was the person that I (and others) regularly liaised with about anything that dealt with the "New Pretoria"; he knew a lot about those areas' as-built drawings, which were still separately filed. "Old Pretoria" files were under the control of Mr. Boshoff. The Road Superintendent was Mr. van Staden, and there were various foremen under him. Municipal work crews did much of the construction work. The City Engineer was Mr. A.N. Sandenbergh, with an office in the middle of the 8th floor; the Assistant City Engineer, Mr. J.D. Weilbach, had an office directly across the passage from him, and there were two other "Division" heads – the Chief Water Engineer, a Mr. A.J. McFadzean, on the west half of the 8th floor, and the Chief Traffic Engineer, a Mr. Chris van Niekerk, on the west half of the 9th floor. His secretary/typist was the only woman on the floor! Mr. van Niekerk had been the Moderator for the little thesis that I wrote in 1965 as part of the Civil Engineering Practice 4S course, under Mr. C.J. Wessels as Group Leader. It dealt with changes in noise levels at various intersections, as a "before and after" study, using sites on the very first E/W one-way arterial street couplet through the downtown: Visagie Street and Skinner Street. See **at left** for a sample of my way to measure decibels (sound levels) at an intersection! Using 8mm b/w film technology to read an audiometer on a tripod at a busy street intersection is likely considered "extremely dinosauric" today, and

Audiometer at c/o Potgieter and Visagie Streets – with one-way rule, on 8mm b/w.

[100] This building contained an entire street block. The South Block (on Vermeulen Street) had twelve storeys and two levels of under-ground parking as well as "open-air parking". The West Block (on Van der Walt Street) had eight storeys and a Council Chambers block; it was still under construction when I started working there; the official opening of the complex was on 28 February 1969. A North Block (on Proes Street) was still being investigated, but I think it was never built. Part of the building (mostly the West Block) burnt down on 3 March 1997, and the whole edifice was imploded in 2013. Just google in "Munitoria Fire" and get the whole story.

.[101] I cannot recall if this amalgamation was a "top-down" decision by the Provincial Government, or a "bottoms-up" decision by the people. I later discovered that the Town of Pretoria North had been virtually bankrupt, due to their massive street construction program when not economically warranted, and the lack of property tax revenues to fix them later. But I always found (and said so in those days) that it might have been better in the long run to have allowed the Town of Pretoria North to annex large swaths of land north of the Magaliesberg Range, so that it would become a viable city, including e.g. Sinoville and Wonderboom. Perhaps the same could have been said of areas to the south, Valhalla and Erasmia, which could have become part of the much later established City of Verwoerdburg, based on the PUHB's areas of Lyttleton and Irene.

there were other ways (much more expensive) to measure noise than to use one's father's Eumig movie camera! The City Surveyor Division (with its own "legal" or land surveyors), the City Building Division and the City Urban Planning Division were not under the control of the City Engineer; they were on floors below the 8th, but still in the South Block.

Munitoria – **not as it was** when I worked there for two years.

There were lifts and staircases near the east and west, and a set of stairs in the middle, which did not go down to street level (for security reasons?). The **photo at left**, taken in a southeasterly direction, shows what remained of the South Block of Munitoria after the fire, in which the western 1/3 of the South Block, as well as all of the West Block, were completely destroyed. My first office was on the north side, visible in this photo, near the middle; I later moved to a larger south-facing office on the opposite side of the hallway. The official entrance was where the South Block and West Block met, and the Council Chamber was in the West Block.

The City's "Roads Engineer Division" was actually a combination and merger of two earlier City Divisions, the (original) Streets Department (self-explanatory) and the Mason's Department, meaning those who dealt with stormsewers). After a major flood in the Apies River in 1909, a system of major stormsewers had been designed and built in the downtown, e.g. on Church Street east and west, leading to the Apies River to the east and Steenoven Spruit to the west, and similarly for all other downtown streets, Paul Kruger Street being almost at the apex of a mild north-south ridge. The as-built drawings for these huge pear-shaped brick stormsewers were still being used to determine where new high rise buildings in the downtown were to have new pumped stormsewer connections for their underground parking garages. "The Stables" was the original depot of the Mason's ("Messelaars") Department, near Marabastad, that contained a premix concrete plant and all kinds of storage. I cannot remember where the original Roads Department had had its depot, although I remember that draughting had been done in the building that was the City's Vehicle License Office in 1968. Before the completion of Munitoria, the Engineering Department had occupied offices in the north wing of the City Hall on Paul Kruger Street. Pretoria's electric trolley bus system was at that time still in operation, operated by the office of the City Electrical Engineer – also responsible for the City's power stations at Rooiwal and Pretoria West. The electric tram system (abandoned for many years already) had had its original depot on Van der Walt Street and Schoeman Street, and there was one intersection in the downtown where rail ends were still sticking up sometimes, promptly to be paved over when noticed.

I first occupied a small north-facing office, one over just west of the staircase in the middle of the South Block, almost directly opposite the tea / coffee room where o yes, we had a tea boy. This office was quite hot as the windows could not be opened and the air circulation (was it air conditioning?) was not great. When I requested to be allowed to use a 3x larger south-facing vacant office, where filing cabinets with as-built drawings and cadastral maps lined the walls, it was approved. This helped me a lot in my work.

My very first assignment was to handle "**Contract No. 21592, Resurfacing of Roads in various suburbs of Pretoria (Approximately 350,000 square yards.)**". This was for chip sealing streets all over

the City, for which tenders had been received on 3 November 1967 – and had not yet been awarded! Mr. Weir instructed me to review the tender documents. The low tenderer had written a letter, alleging that he had made a substantial error in his tender, and he wanted R 10,000 more than the amount of R 111,000 that he had tendered. I was asked to re-search this allegation, based on prices of the firm's similar projects of two earlier years. I could see absolutely nothing wrong with the unit prices, the extensions or anything else. There were no sudden price jumps in the price of tar or emulsion or wages, it was the same equipment. Based on this, Mr. Weir then wrote a letter to the Clerk of Council, recommending acceptance of the tender "as is". So the Contract was awarded, and the work was completed, for which I needed constant (sometimes on a daily basis) contact with the Clerk-of-Works[102] who was a Mr. Klasie Venter, a long time City employee. Based on his mostly verbal reports, I wrote up the monthly payment certificates. During my two years with the City, I handled one more chip seal contract from beginning to end, and got another contract advertised in the spring of 1969, just before I left the City. The work meant: Developing a list of likely candidate street sections that needed to be resurfaced, having this list approved, obtaining a contract number from Mr. Sandenbergh's Chief Clerk (Mr. Olivier), writing the Specifications, Special Conditions and Tender Form, preparing the Tender Advertisement through the Chief Clerk, conducting a Pre-Tender Meeting, writing the formal Minutes of the Pre-Tender Meeting and sending them out to all attendees, attending the Tender Opening (still at the City Hall in those days), evaluating the tenders received, recommending a Contractor, and the whole process of site supervision through Venter, including preparing monthly payment certificates, based on his verbal reporting. (The Contractor did not even submit a formal "claim" every month; contract duration was only about four or five months.)

To prepare for new projects of that kind meant that I had to do my own research. I found that although I liaised with Mr. van Staden and Jan Strang (and others), it was important to ask the right questions, (e.g. when was this particular street last resurfaced, and by whom; what does the surface look like, compared to what it should look like after such a period; what has changed since the last time this street was surfaced; should this street perhaps receive a hot-mix layer of asphalt instead?) and I needed to visit these sections and walk up and down. Documentation was sometimes found lacking, particularly for the areas of "New Pretoria"[103], and I developed a system to integrate two sets of records, and a checklist as an aide to "predetermine" which street segments would perhaps need to be included for next year's program, because "after all, this street has never been resurfaced since 1947 and when built, it was surfaced with tar in the top layer, so that its surface should be extremely broken up and brittle by now – let's go out and look at it closely." (This was an actual case, in a little used north-south cross street in Pretoria West Industrial Park, called Lloyd Street.) Jan Strang was of great help with the documentation. Doing this investigatory work, I also discovered that for a number of City or PUHB awarded projects, some consulting engineers had received "final fees" but had never submitted any as-built drawings. When I mentioned this to Messrs. Weir and Gie, they decided to put some written pressure on those firms, to correct their oversight. Maybe some of this was an unfortunate result of the City's annexation. Piles and rolls of as-built drawings then suddenly appeared, which was much appreciated (!!!) by Jan Strang and Mr. Boshoff.

Handling a resurfacing project (basically a maintenance operation) was not difficult work, but it gave job satisfaction, seeing the end result after only a day's work. The chip seal was a triple layer, with tar and ¾" rock as the first layer, bituminous emulsion and ½" rock for the second layer, and emulsion and diesel coated ¼" crusher dust to be hand swept in. The contract documents were in English, and I kept them that way, reasoning that an Afrikaans translation of the Special Conditions did not exist and was not worth preparing for this typical project. Interesting was that there were three types of competent crushed rock sources around the City: (1) **Norite** to the north (Bushveld Igneous Complex), (2) **Quartzite** in the middle

[102] This is originally an English term. I do not think that it is used in North America.
[103] There were hardly any records for the streets in the former municipalities of Pretoria North and Silverton, and the PUHB's records only existed for a few recent years. Not that I expected them from the year 1944 onward.

(Magaliesberg Range), and (3) **Dolomite** to the south (and I cannot remember the exact geological formation). All these rocks are competent and their flakiness is low (quartzite could be a flakiness problem in some quarries). But for some of these rocks, an anionic bituminous emulsion needs to be used, while other rocks need a cationic bituminous emulsion. Making a mistake on this detail creates a big mess because "**it just doesn't stick**". Fortunately, this is only hearsay; on the various contracts tghat I handled, no mistake was ever made. I also learnt from an occasion in which I needed to deal with Mr. Venter, who was obviously incapacitated due to alcohol, which resulted in his suspension for a few days (by Mr. Weir, fortunately) and caused my personal day long site supervision. A resident had reported him "drunk on the job", by phone. When finding him on the west end of Malan Street, he could not even stand straight, and faked his condition by trying to show me some minute detail in the chip seal. While doing that, he conked over and got his hands sticky. As a brother in the Lord, I felt sorry for him.

This is the bottom right corner of the City Map that I used for Contract No. 20569, signed on 1969-09-18.

Traffic control for these projects was mostly easy; and the public was understanding. In those days, the public understood the "authoritarianism" by the City differently than nowadays in North America. It was Mr. Venter's duty to advise residents along a street section of the work proposed, and if they would please move their cars before a certain time on a certain day. Scheduling the work could of course be impeded by rain, but I cannot remember if we had any major problems. I normally "lumped together" certain street sections that needed to be surface treated, for a project – so that it would be a single day's work or two or three days' work, to minimize the Contractor's mobilization costs. I handled Contract No. 21627 (for approx. 310,000 square yards) that way, advertised on 6 November 1968, on which an "Addendum" was needed, about a minor change in the Specification, requested during the Site Inspection.

Another early project dealt with the construction of the concrete driveway to the official residence of Mr. Strauss, South Africa's Postmaster General. This house was on a huge parcel of land on a very steep and narrow chip-sealed road in the posh Waterkloof Ridge Township, I think it was Rigel Avenue or the one next to it. The problem was that the crossfall of the right-of-way was even steeper than the longitudinal grades, with the result that all driveway accesses were quite skew to the road, possible because the frontage widths were ample. For individual properties, city crews built these driveways and the owners had to pay the City, according to a certain formula. I was asked to go and look at the progress of Mr. Strauss' "official" driveway. So I was driven to the site and noticed that there was an overhead telephone line adjacent to the lot line. In fact, a rough dirt "frontage road" existed there. Great was my surprise to

hear that "this house does not have access to this telephone line, but there is an underground cable serving it." I do not know if this was the very first "modern" telephone system in the country, but as the Post-master General was in charge of South Africa's telephone system, telegraph system, a postal savings bank and all other postal services, including radio licences[104], it might have been fibre optics instead of copper.

Shortly before I started to work at Munitoria, when living at Montagu Flats and already sure that we would not go to Eastern Transvaal, we were unsuccessful to buy our first house. We paid a deposit to buy a house at 22 Malan Street, Riviera Township, a few blocks east of Voortrekker Road, without an estate agent. About a week later, however, the Owner reneged on the "deal", even after we had visited his weekend residence near Hartbeespoort Dam one Friday evening. He had just sold the property to somebody else, he said. We then needed to go to Small Claims Court to have our deposit (plus costs, plus some damages) refunded, in which we were successful. Before our "day in Court", when I was already employed by the City, I was allowed to review the beautiful architect prepared building plans for this house (white lines on blue linen background) at the Building Department (considering it a "fringe benefit" of City employment), and noticed that it had been built in 1924. That February, we purchased a brand new house at 221 Orsula Street, Sinoville, in "New Pretoria", from an owner-builder, a Mr. Klopper.

Quite soon after my arrival at Munitoria, I was made responsible for the design and installation super-vision (by a City crew) of the drainage system for the Reiger Street railway underpass, which structure had already been built on the main line of the (former) Pretoria-Pietersburg Railway (see below). Reiger Street was the southernmost street running east-west in Mountain View Township, and there had been a very awkward level crossing at this location, and the intersection of Haarlem Street, a rural road paralleling the east side of the track. This road ran south to the proximity of the Pretoria Portland Cement factory. Twinning of this railway line had lead to the design and construction of the underpass by a Con-tractor under a SAR contract, as well as road relocation to the east for a proper T-intersection. Under an agreement, the City was only responsible for construction of the four-lane Reiger Street through the underpass itself. I had to design a herringbone subsoil drainage system under this road, to connect to a stormsewer (leading to one of the tributaries of Daspoort Spruit) that had already been installed under the bridge construction contract. I needed a copy of the design drawings of the structure (the City did not have a copy!) and obtained these from the SAR after some search from office to office (near the Main Railway Station) ending with success. Because this work was done by a City crew, and my design was somewhat rudimentary (to say the least), I received a very unexpected comment from the Foreman, whom I met for the first time: "**We already know quite well what we are supposed to build, young man!"**

This personal contact with technical SAR staff somehow lead to a situation in which I was allowed to handle similar liaison with a Mr. Vrba[105], an older (European trained) engineerg from SAR. He brought road closure requests to the City directly to my desk; one at a substantial retaining wall at Mountain View Station, and one at the widening of the single-lane Berg Street railway underpass in Pretoria North. The City had to advertise "temporary road closures", and I handled these administrative duties. The retaining wall at Mountain View Station was interesting: During construction of the footing for this retaining wall, train traffic was limited to the west track, at a reduced speed limit of (I believe) 5 miles per hour. The west track was the "newer" of the two; the east track had originally been built for the Pretoria-Pietersburg Railway, a private line that had reached Nylstroom in 1898 and Pietersburg in early 1899; and "As soon as the Anglo-Boer War began in October 1899, the railway's assets were taken over by the Transvaal Government and absorbed into the NZASM" (C.P. Lewis & A.A. Jorgensen, "The Great Steam Trek", 1978). Drill holes showed that the embankment of the east track was very poor, due to original "side dumping" of almost "loose material". After completion of the footings of the retaining wall, new backfill

[104] South Africa only started with television services in 1976, and that was also very regulated through the SABC.
[105] His son was also an engineer and partner in a (structural) consulting firm in Johannesburg, Benard & Vrba.

was compacted in terms of current SAR standards. That was why the street had to be formally closed for a while; the formwork was built almost at the edge of asphalt. With the Berg Street underpass (east) extension, a road closure was also needed. Sight distance was very limited at this site; some improvement was made possible by installing a yield sign and a stop sign, and a minor "holding area" for westbound vehicular traffic. I notice on GoogleMaps that this railway line now consists of four tracks; I do not see a retaining wall opposite Mountain View Station because a new highway was squeezed in between the tracks and the Apies River. At a result of the same recent construction, the underpass at the east end of Berg Street has also been demolished. It was located at the north end of Ralph Street, just off Berg Street.

As a logical outcome of my growing experience with "road closures", I also became the contact person for other temporary as well as permanent road closure applications. I remember three of the latter, in which process the City Roads Department had a minor role, namely confirming the "physical closure" of a street section, by way of an initial site visit instructing a city crew to construct a fence, a second site visit after the fence had been installed, and then writing a short report to the Clerk of the Council. The first of these applications was for closure of a 10 Cape feet wide pedestrian lane between Pretoria Boys' High School and the Australian Embassy, at the cul-de-sac of Charles Street[106], Brooklyn. This narrow and unlit walkway had been surveyed decades ago as a link between the neighbourhood, Magnolia Dell Park, Sunnyside, and bus services to the city centre. A black servant girl from the Embassy had been assaulted and raped there one night, and as a result, as a good employer, the Ambassador had made the road closure application himself. The Embassy agreed to pay for the land that was then surveyed and disposed of by a City Council decision, meaning that it was consolidated with the Embassy property. A second application was for a short east-west unconstructed Lelie Street (40 Cape feet wide) between 16th Avenue and 17th Avenue in Rietfontein/Gezina/Eloffsdal.[107] The City Planning Department considered this road redundant, and the four adjacent property owners were given the opportunity to purchase the land to increase their individual lot area. On the one avenue, both property owners agreed to share the land, so that each one received a 20 Cape foot width, but on the other avenue, one owner declined, so that the other one received the full 40 Cape foot width. This extra land would actually give this property owner some "subdivision potential" in the very long term, but that's not why he wanted the land: he built a swimming pool. A third application was for a single street block length of a 60 Cape foot wide previously constructed gravel road called Broadway Street, between Jasmyn Street and the current Pretoria Street (which was the National Highway to the east before the Freeway was built). This expanded the site of Silverton Elementary School from two to three street blocks. The Transvaal Education Department (TED) had applied for this road closure, as it enabled some playground expansion.

Following completion of Reiger Street railway underpass project, I became responsible for the design and construction supervision of a number of storm drainage systems all over the City, and even a small bridge widening. These projects were designed in-house, based on in-house site surveys and drafting, and a contract document that had a number that needed to be provided by Mr. Olivier before design even started. I handled three such projects. The first one was for the proposed Kwaggasrand Township (approx. 1 400 lots) that was just starting to be developed by the City in a number of phases. This became **Contract No. 21632**, advertised on 21 January 1969. This township was located directly west of West

[106] Another house on this particular cul-de-sac was the official residence of the SA Air Force's General Verster, the father of my class-mate Jessie Verster a few years earlier. He had sometimes come to class with his father's Jaguar.
[107] These three major Townships (and others further east and west) shared very strange common boundaries, and it was common knowledge that when the original layouts had been surveyed, the owners and surveyors intentionally laid out streets so that they would not match any of those in the other Townships. Many "undevelopable" triangular lots and dead and streets existed; on the east west thoroughfares, which were bus routes, the City built minor traffic circles, around which double decker electric trolley buses had to inch their way, due to a lack of superelevation. Frates Road was later built as a main arterial road, and yes, most minor streets did not retain their access to it.

Park Township, as a "blue collar white" residential neighbourhood, close to ISCOR and the other factories and industries of Pretoria West. Other engineering divisions had already designed the sanitary sewers and the watermains, and liaison was necessary with Mr. Thoms. Unlike the normal practice in North America (which I discovered much later), South African practice was to locate stormsewers within the downstream boulevards of road right-of-ways, with the watermains generally on the opposite side of the road, also within the boulevard. Sanitary sewers were generally built in "mid-block locations" where possible; they only crossed the watermains and stormsewers occasionally. Kwaggasrand Township was on a hillside that sloped down toward Church Street West which was at its north boundary – as an arterial road, in fact a provincial highway – and there were no direct accesses to it except one at the very west end of the township. The design and sizing of pipes was done on a large print of the Township Map, with coloured pencils and the design sheets that I also used in later years for similar projects. Catchbasins were also installed, but these were somewhat temporary and left "incomplete", because the roads would not be paved in the short or medium term, but only on completion of house construction of the individual phases.[108] The stormsewer contract was for all phases of Kwaggasrand Township. It needed a "pay item" called "Accommodation for the Clerk-of-Work". For this, the Contractor built a little temporary shack, where Mr. Klasie Venter could sit and do his paperwork, and this was demolished on project completion. This was before mobile trailers existed. The as-built drawings were to be handled by Coen, I recall.

A second project was a stormsewer on two very long residential blocks of Dunwoodie Avenue, Waverley Township. This was **Contract No. 21633**, advertised 28 January, 1969. This stormsewer needed an outlet structure in Moreleta Spruit, close to where the Pretoria Eastern Bypass (as freeway) was soon to to be constructed, and I needed to find out (from the Consulting Engineers for that project) where that would be located. No environmental studies of any kind, of course. This 27" and 36" dia. pipe system was along an existing paved road, without kerb and gutter, in the "New Pretoria". During construction, liaison with property owners was needed, as their driveways were being crossed and they would need to park their vehicles accordingly for a short period of time.

A third project was for stormsewers in a brand new "Eastern Cemetery" that was developed by the City. Large blocks of future gravesites had been laid out by the City Surveyor, and within the streets between these blocks, a stormsewer system was to be installed. This was **Contract No. 21634**, advertised on 4 February 1969.[109] The site sloped slightly to the east and was located just east of the old Military Road and south of the site where a brand new Chrysler automobile assembly plant was being built. The internal roads would be paved later, and trees would also be planted prior to opening of the first block(s). It was rumoured that the very first gravesite had been reserved for the City Clerk, a Mr. Hilgaard Roode at the time. This particular contract was awarded to a contracting firm owned by a Portuguese immigrant. I remember one specific request for a Change Order on that project. Instead of building the manholes from clay bricks, the Contractor requested to build them from reinforced concrete, by way of using used tea crates as internal formwork, and the neat excavation lines as outside of the poured concrete, without actual outside formwork. "**We just make strong**", were his actual words. This request was forwarded and formally granted by my supervisor, Mr. Durand I think, and the project was completed "on time and within budget". It should be added that this "Eastern Cemetery" did not proceed at all, even after Mr. Hilgaard Roode died. On my return to Pretoria in mid-1973, I learnt that it had somehow been discovered that the ground was "too hard" for digging graves. **Did someone perhaps forget to conduct soil tests?**

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[108] Around 1974, when we lived in Schoemansville and I worked at MB&S in Pretoria-West, I attended the auction (at City Hall) for the very last remaining lots in Kwaggasrand Township, which were in its very northwest corner – close to Church Street. I bid R 1,450 and no more for several lots, but most of the lots were sold for R 1,500.

[109] Note that these projects were advertised on three consecutive Thursdays. On 28 January 1969, the retaining wall at Eloff's Cutting was also advertised, based on a design by Mackintosh, Bergh & Sturgess, (See below).

All Tender Documents were in "folio format" and with blue covers, connected at the top left hand corner. In all these contracts, concrete pipes were used (according to South African Bureau of Standards specifications) while manholes were built from bricks (and I means burnt clay bricks) for which there was a typical City approved drawing. The minimum pipe size was 18" dia., based on maintainability. There were different pipe classes, not unlike those used in North America. When crossing a street, the pipes were often of a higher class, encased or differently bedded than where they were installed in the boulevards.

Two other projects that I looked after were in reinforced concrete box culverts. One of them started east of the provincial highway to Pretoria North, almost directly opposite the single lane railway underpass at Berg Street, and ended at the Apies River. Its location followed the edges of agricultural fields with all kinds of market vegetables, owned by the Stipinovich family. For this project, the City Surveyor had already located and registered a Statutory Right-of-Way of a certain width, so that the location was already a "given". The original design calculations had also been done before I joined City staff; I only needed to supervise the construction which was done by City forces. There were some grated inlets along the way (not catchbasins) and the size of the structure obviously increased from top to bottom although the grade decreased. At the intersection points of the various tangent lengths, ad-hoc curvilinear sections were constructed. The City crew re-used all the plywood formwork as they went along from section to section, but I noticed that the design did not allow for bending moments at the four corners. Moreover, this box culvert project was built "from top to bottom", which is in fact contrary to the normal practice for constructing sanitary and stormsewers, which states "bottom to top" in order to prevent flooding during construction. Although … the work was initiated and completed in winter – which is the dry season. About half a year after completion, I had an opportunity to go and see the outlet, and when I drove down to it, I saw that it was half-submerged in the Apies River….. **Oops? How could this have happened?**

Another reinforced concrete box culvert, constructed by City forces, was located on a vacant lot directly west of the Silverton Tanneries factory, ending up in Moreleta Spruit, in the former Town of Silverton. During the design, I had some meetings with the manager of the tannery, who told me that this factory was at that time responsible for leather for all Mercedes-Benz vehicles in the world. He took me on a tour of the building, but not of the backyard (close to the creek!) where it stank a lot.[110] The City needed a Statutory Right-of-Way adjacent to the property of the tannery, next to the building that had a zero side yard setback, and the tannery needed confirmation that this was indeed possible and that construction would not have a negative effect on the operation of the building. I cannot remember if the vacant property was City owned or not. This project was successfully completed after I left City employment.

Another strange "on-site" stormsewer situation came to my attention for action. The Swedish firm ASEA had bought an industrial parcel of land in Pretoria West Township, close to both ISCOR and the City's Power Station. Huge electric transformers were to be brought to this corner property, by rail. This railway siding (on a very sharp curve) was therefore to be built on a thick concrete slab. The property, however, contained a stormsewer within an easement, for runoff from one of the minor creeks in the hills south of Pretoria West (from the area of Roger Dyason Drive, see below). Soon after construction started, a broken concrete pipe was found, and when this was dug up, the City crew found that it only contained some chicken fence wire as reinforcing, not meeting the South African Bureau of Standards (SABS) specification at all. Old-timers then told me then that this pipe had been installed around 1938; there was no as-built drawing or correspondence at all. No wonder that a suitable section of pipe, close to the track, was replaced with an SABS-approved pipe that could withstand the load of a heavy loaded railway car.

The small bridge widening project involved an existing structure on Charl Celliers Street over Daspoort Creek, between Daspoort Estates Township and Mountainview Township. I was asked to design a "beam

[110] I was given two red leather cushions, "for rugby matches", which have to date never been used for that purpose.

and slab" bridge widening. The project was already under construction by a City crew, and the abutments were widened on the west side of the existing bridge by huge "recycled" norite curbstones. These had come from various road widening projects where they had been replaced by concrete curbs. The norite curbstones had originated at the City's Bon Accord Quarry, north of and outside the City, adjacent to the National Road to Warmbad. Some of these heavy blocks might well have been hand hewn many years before 1968, perhaps even during the Great Depression of the 1930's. Widening of Charl Celliers Street was Mr. Durand's project, and it also included the reconfiguration of individual lot irrigation sluices from a minor canal within the east boulevard of the road right-of-way, for the Daspoort Estates Irrigation Board. At that time, there were still various other such irrigation boards operating within the City.

Mr. Durand's Christian names were Charl Celliers, named after one of the Voortrekker leaders from the Great Trek era. He lived in one of the northernmost east-west streets just east of Voortrekker Road, close to the Magaliesberg. He also handled the City's (hot-mix) paving program, which was for resurfacing arterial roads and only operated during the winter months. This was because of the heat, but I remember driving by the "paving" of Frates Road one day, seeing all (white) staff in white overalls. During every December and January, (the summer vacation months), the paving equipment (and I cannot remember if it was Blow-Knox or Barber-Greene) was completely stripped and rebuilt at the workshop at Bon Accord Quarry. Mechanical engineering students from Tukkies did their compulsory vacation work there, and I later met various UP mechanical engineers who had done just that work in their student days. Mr. Durand also handled the Daspoort Tunnel project, which was under construction at the time ("being built by a Main Contractor who thought that he had an excellent tunneling Sub-Contractor, and a tunneling Sub-Contractor who thought that he had an excellent Main Contractor, and both of them are now starting to think that they were wrong", he quipped one coffee break.). He also knew everything about more than a dozen other proposals for crossing the various ridges within the City by way of minor road passes and road links. One of these was Frates Road, on the boundary between Rietfontein Township and Villieria Township, an arterial road that could perhaps be used as the south approach to a future tunnel leading to Montana Agricultural Holdings. (This was almost next to Lot 1, Montana, where Mr. Jan du Toit lived. I had done "house-sitting" there in December 1964, climbing to the crest more than once. I believe that this project was just a pipe dream!) Other ideas were about a possible minor pass over the ridge between the east end of Riviera Township and Gezina Township. Progress on these projects was supposedly very slow; individual property owners clearly did not want to lose their privacy on a dead-end street on a ridge within the middle of the City.

As an aside, South Africa used British Standards for hot-mix asphalt in those days. This requires more "aggregate" and almost no sand, like the US (and Canadian) "asphaltic concrete", and is much longer lasting. In Arizona, I later learnt of an aborted program (called "Superpave") from the early 1990's, to develop a hot-mix asphalt with more course aggregate. Sad that Canadian standards follow the US rules.

Mr. Durand's handling of the hot-mix asphalt overlay programme for downtown streets required major liaison with the Post Office (for telecommunication cables and vaults) and other government departments prior to resurfacing. Various government departments (central and provincial) had ducts between their buildings, crossing under the streets. I remember a coffee time discussion while as colleagues we stood and overlooked Vermeulen Street during the project. Mr. Durand boasted that he had received written confirmation from all possible agencies, "that the brand new asphalt overlay on Vermeulen Street will not need to be cut anywhere within the next year or so, because all pre-ducting has been done", at a time when the one large hole after the other was being excavated in the downtown for 25 (or more) storey high office towers. However, it was only three months after the overlay on Vermeulen Street had been completed, that the first application arrived for what we call in North America "a pavement cut".

Mr. Maans Nell handled all road and drainage work in the substantial black, coloured and Indian townships, and also negotiations with the central and provincial governments about funding for their highway routes through the City. There were several of these; after the 1964 annexation, more had been added. In terms of the South African Constitution and NTC rules, municipalities maintained Provincial Roads and National Roads within their limits, and were subsidized for doing that. When Church Street East was replaced as "National Road" by the one-way couplet of Pretorius Street East and Schoeman Street East, these streets connected to the freeway that was being designed in those years, so that Church Street was "deproclaimed" and both Schoeman Street and Pretorius Street were "proclaimed". Other developments triggered changes to be made in the subsidy funding formula, like the new connection of Ben Schoeman Highway to Potgieter Street, so that the road through the Waggon Wheel Circle was "deproclaimed", from a National Highway to a Provincial Highway. This work was all in Mr. Nell's bailiwick; he handled perhaps many other things that I never knew much about in those days. I have no idea what types of funding formulae were used between the various "levels of government".

Liaison between the City Water Engineer resulted in my responsibility for access road construction to some of the City's Water Reservoirs. The first one was in Colbyn Township, at the very north end of Glyn Street, in the neck of the eastern extension of the mountain range east of the State President's Residence. From this cul-de-sac bulb[111], a very steep (up to 24%) concrete access road needed to be built, with some minor retaining wall on the north side. The circular concrete water reservoir was not huge; I understood that Colbyn had once been a private Township. City "messelaar" forces built this project, including a fence and a gate. When I left the City's employment, the design was underway for a road to a much larger water reservoir. This was to be chip-sealed, and it was for the reservoir at Mamelodi East. I believe that this was my only involvement in one of Pretoria's two black townships (Mamelodi on the east side and Atteridgeville on the west side). As stated already, Maans Nell was responsible for everything there. I also cannot remember doing anything at all in Laudium (the Indian Township), Eersterust (the Coloured Township), or Marabastad (the old "Indian Bazaar") adjacent to the downtown.

It should be added that in January 1969, the title of my position was changed to "Senior Engineer", as shown on my first printed "business card". Two junior engineers joined the Roads Engineer Division at that time, both of them straight from Tukkies: Christo Vlok and Coen Lamprechts, the latter as technologist, because he had failed one or more final year subjects. An "almost retired" Jewish gentlemen who in fact commuted by train from Johannesburg every day, also joined the staff. His surname was Lewis and did not last long on the 9th floor; he soon went down to the Design Engineering Division. He mentioned to me that he knew a lot about concrete box culvert design, and that he had had his own consulting firm on the Witwatersrand. He was short and obese, and did not look healthy at all. I felt somewhat sorry for him, for spending the "tail end" of his career in the public sector.

Another technologist Martin (and I also forgot his surname) joined the staff. He was a follower of Scientology, (on which I refused to talk with him) and it was with him that, in the spring of 1969, an informal study was initiated for twinning, as an arterial road, Roger Dyason Drive[112] located between the ISCOR plant and the Waggon Wheel Circle. This traffic circle was on the old National Road to Johannesburg that started out at the south end of Potgieter Street, towards Valhalla Township. During our initial joint site visit, we found a number of iron pins at 100' distances, at a certain constant setback from the existing road, so we asked Mr. Boshoff. He was able to confirm our suspicion (as also backed up with correspondence in the old files, as well as some incomplete as-built drawings) that these iron pins were actually on the "centre line" of the roadway as it had been surveyed in 1948, as a "future twinned arterial road", of which only one half had then been built in 1949. Why then? It appeared that this road was pur-

[111] I later learnt that my boss, Adrian Bergh and his wife Ina, lived in the house directly west of this water reservoir.
[112] Named after a businessman and lawyer, the first Chairman of Iscor; the firm Dyason Attornetsdur still exists.

posely completed just before the official opening festivities of the Voortrekker Monument in December 1949, as the City's contribution to "traffic management" of that huge event. This roadway ran directly north of (and way below) the brand new ISCOR Headquarters Building. In the years after 1969, it appears that the other carriageway was built (as a new eastbound or uphill road) so that Roger Dyason Drive as it had existed since 1949, became the westbound or downhill road. (Remember, people in South Africa drive on the same side of the road as people in British Columbia used to do before the First World War.) There were at that time hardly any driveway accesses on this road, but there was an existing railway crossing near the entrance to the ISCOR plant – which was likely not eliminated with a "grade separation", contrary to what I always believed about the requirement. It was an impossibility as well.

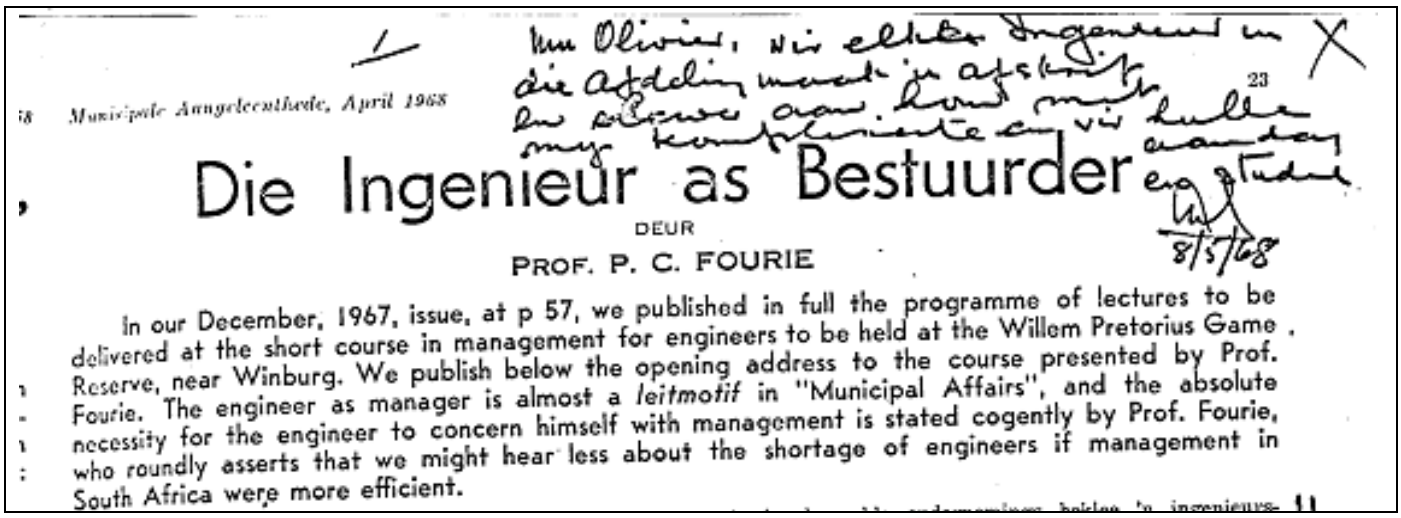
When starting to work for the City, I had to be "driven" to and from a project site (like the Postmaster General's residence) by an older white driver in a City pick-up truck. With the start of the resurfacing project, that became impossible, and I was allowed to use one of the Department's pool vehicles. My favourite pick-up truck was a dark brown 1956 International Harvester half ton. This maneuvered well and was not that large. The strange thing about this vehicle was that the steering column gearshift was on the right hand side of the column, which was the door side and not the centre side, as on a similar vehicle in North America. It had obviously been assembled in South Africa, but not quite appropriately. But in the winter of 1968, I made use of the City's employment opportunity to purchase a (second) vehicle that I would use for work, and for which I would receive a monthly travel allowance. This amount (about R 45 per month) was irrespective of the "official mileage" that I would drive the vehicle in any month. We bought a used Volkswagen hatch-back, two-tone grey, from a car dealer on the banks of the Apies River on Church Street East. From that time, I drove the VW to work, where there was underground parking. This also gave me the opportunity to visit project sites early in the morning, and Lydia used the Peugeot.

Thinking about this travel allowance situation, I should add that I did not sign a single "time sheet" or "mileage sheet" while at Munitoria, nor at BSB&P, nor at MB&S, nor later at the NITRR. Nobody did: We all received a "straight salary" for our (say) 8 a.m. – 5 p.m. jobs, with a lunch break from 1 to 2, and two 15 minute tea or coffee breaks. Mr. Weir would perhaps be remunerated for attending City Council meetings during the evenings (if he did, which I doubt), but that would rather be by giving him "time off" in lieu of "time worked", on a 1 to 1 basis. Anybody sometimes needs to have "time off" to go to the dentist, and this was given when requested. And if I needed to drive my car to the City boundary three times a week for three weeks in a row, while my colleague would only need to drive his vehicle to project sites near the Railway Station or in Queenswood, well, that just could not be helped; "tough luck for you – a few months from now, things will be different." However, to my knowledge, nobody was out to abuse the system; everybody trusted each other to serve the citizens of the capital city in a worthy and professional manner. Excepting the single situation with Klasie Venter that I witnessed and mentioned before, I am not aware of any other "discipline" or "suspension" cases during those two years. There was a "collective agreement" and a "union" for municipal workers, and I paid the compulsory dues. But it was a time in which people normally trusted each other. In fact, it was in Alberta, Canada, that I submitted my very first "time sheet", in December 1977. But, once again, that is another story, for now.

One more "time off" detail. In 19 May 1968, I used a recently adopted City Council policy of (what we called) "papa leave", when our son Theo was born. It allowed an absence from work for **2 whole days**! And on 19 August 1969, I used this progressive provision once more, when our daughter Plonia was born.

The City of Pretoria was quite progressive in another specific area. The City Engineer tried to ensure that his engineering staff was able to act like managers. Below is the top part of what I and all my colleagues received from Mr. Olivier in May 1968. In translation, Mr. Sandenbergh's note reads: "Mr. Olivier, for every Engineer in the Department, make a copy and provide to it to him, with my compliments and for their *(sic)* attention and study." The 2½ page article (in Afrikaans) obviously started out with many details

about the Straszacker Commission, and had lots of underlined sentences. "The Engineer as Manager" was its title; Mr. Sandenbergh wanted all of us to become good (project or program) managers.



58 Municipale Anngelecenthede, April 1968

Die Ingenieur as Bestuurder

DEUR

PROF. P. C. FOURIE

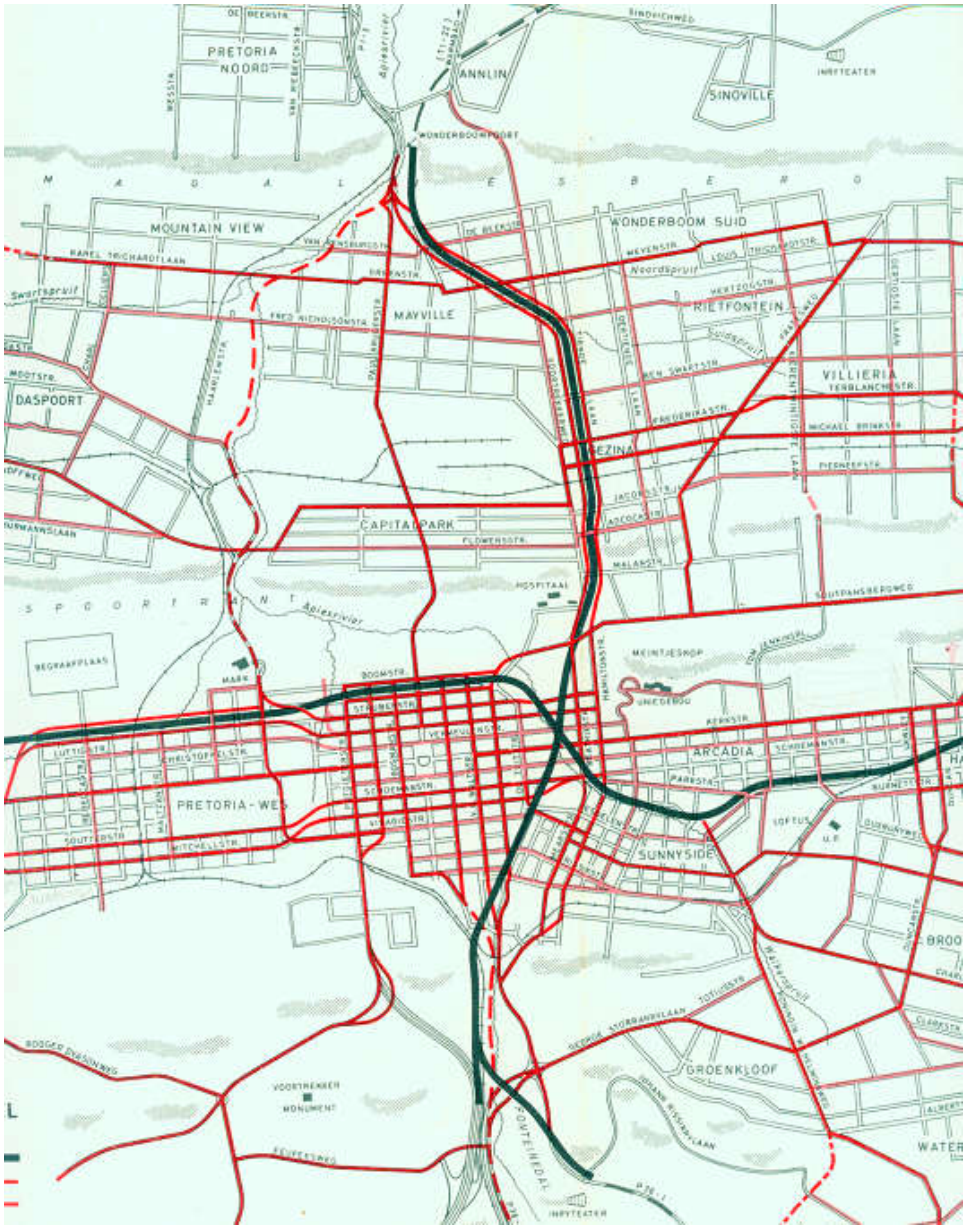
In our December, 1967, issue, at p 57, we published in full the programme of lectures to be delivered at the short course in management for engineers to be held at the Willem Pretorius Game Reserve, near Winburg. We publish below the opening address to the course presented by Prof. Fourie. The engineer as manager is almost a *leitmotif* in "Municipal Affairs", and the absolute necessity for the engineer to concern himself with management is stated cogently by Prof. Fourie, who roundly asserts that we might hear less about the shortage of engineers if management in South Africa were more efficient.

I was given specific responsibilities to comment on urban planning proposals. This was a new activity, likely due to the substantial expansion of City limits, particularly in the southeast of "New Pretoria", and also due to an increase of "private sector" land development at that time – which had been mostly initiated by the public sector for many decades, and for the much earlier developments by the private sector, situations had also changed. On behalf of the City Roads Engineer, I needed to provide comments to the Clerk of the Council (after having had liaison with the City Planning Department and Mr. Weir) on all applications for "Township Establishment" as it was called. My comments needed to deal with road grades, storm drainage situations and property access. If the proposed road location was e.g. too steep, I could suggest that the layout be reconfigured to so that the steep road section could be eliminated. I was also allowed to suggest "red lines" for access restrictions.[113] These "red lines" would be shown on the approved Layout Plan for the Township, in the Surveyor General's Office, and in the Conditions of Establishment of the Township, in the Provincial Gazette, would e.g. be written: "Lot 89 will have no access to Street A, as per the red line on the Plan." This gave me great job satisfaction, particularly because many of these applications were for relatively small developments that were all in the same general area. Their township numbering would be according to the original farm name, like Bapsfontein Township, Bapsfontein Ext. 1 Township, Bapsfontein Ext. 2 Township, and the lot numbers would continue through those extensions. As development of an "Ext. 13" might sometimes proceed faster than that of an "Ext. 8", one always needed to keep track of what was already "proclaimed" by the Provincial Administration. After the year 2000, an urban planner wrote a thesis on the National Party's politics of the period that I worked at Munitoria, and how the Planning Department had in fact supported them. I knew nothing about that, but recognized some names when I read one chapter of that thesis, that also commented on the supposed reasons for the Munitoria fire.

This leads me into the road design and construction that I did while working for the City of Pretoria. My first exposure was the widening of Hamilton Street in Arcadia, a north-south arterial street that was destined to become part of the (north-south) Beatrix Street / Mears Street and Hamilton / Troye Street one-way couplet, with a new bridge over the canalized Apies River where Schoeman Street becomes Park Street. The City's design was rudimentary and based on a distorted scale plan view only. This resulted in being able to see a road section (on the left to right axis) with a length of numerous street blocks on one drawing, while the right-of-way width would be shown on the top to bottom axis. There was a section for road grades at the bottom. On this plan, the various underground and overhead utilities were also shown,

[113] The term "access control" was in use at that time, more recently "access management" is used.

including street trees and access driveways. This cute type of design tool enabled lane continuity for the project. I was asked to design a new stormsewer for this road widening (only north of Church Street) while the Design Engineer's Office were to design a new watermain, and this while road construction had already been started by a City crew. This area of Arcadia was the hub of property redevelopment at that time, with major apartment buildings and an indoor multi-storey mall called Arcadia Centre. One day, I received an emergency phone call from Mr. Van Staden, to come to the site because they had unearthed a major electric cable. This had not been shown on any of the drawings, so that all activities were stopped until somebody would establish if it were alive. Nobody in the City Electrical Engineering Department even knew, until an old-timer remembered that many years ago, there had been an electric tram from downtown to the Union Building, and that this cable might perhaps have served that long abandoned system. Problem solved. "As built drawings only prove one thing: that something was built, some time."



The conversion of the traffic circle at Voortrekker Road / Beatrix Street and Zoutpansberg Road was at the north end of that proposed north-south couplet of ene-way streets. I did not work on that project. Why then mention it? In 1967, the City Council had approved the "Pretoria Transportation Study" (by Bruinette, Kruger, Stoffberg & Hugo) that proposed a major freeway (and part of it expressway) around the downtown, as well as free-way links, one-way systems and new roads. One of the major systems was a proposed freeway to parallel Voortrekker Road in the area near 9th Avenue, in Gezina Township, with a link back to Paul Kruger Street just south of Wonderboompoort. At the 1968 SAICE Convention (at UP, in the Aula) this "1967 Plan" had been presented in a paper by Mr. Chris van Niekerk and Dr. P.W.B. (Bingle) Kruger. At left below is part of **Figure 4** from that paper. The above traffic circle is right in the centre of this proposed freeway! But the Driessen Report of May/September 1974 by the "Committee of Inquiry into Urban Transport Facilities in the Republic of South Africa" noted that this 1967 Plan had been discarded, based on the backed-up reasoning: "**The City just cannot afford it**." In my days, Mr.

van Niekerk, assisted by his deputy Dr. Dalgleish[114], mostly handled regular traffic counts and the acquisition of land for this future and grandiose (?) system. Land acquisition was on a minor scale, as it became available on the open market as e.g. in estates, and there was no formal budget or idea when (or where) the first part of this system would be built. Some preliminary City projects were in fact planned to accommodate this "future" freeway construction, and in one really overzealous act, excavated materials from a number of huge downtown building sites (and some of them had four underground parkade levels and 25 floors above ground) were being dumped at the Bell Ombre site, off Paul Kruger Street and opposite the Pretoria Zoo. "Sandenbergh Mountain", Mr. Weir called it once to me during a private moment, showing his long-held bias toward the City Engineer. GoogleMaps now shows that not much of the BKS&H freeway around the downtown itself was con-structed. But Belle Ombre (see the large rectangle on the west side of Figure 4) did develop! See below for more on this situation.

Sinovich Drive was one of the old 18' wide chip-sealed roads around the City; it ran east-west north of the Magaliesberg, from the National Road to Derdepoort, and was likely one of the "Military Roads" from the days of WW II. This was located in "New Pretoria"; the Townships of Annlyn and Sinoville had already been proclaimed during the time of the PUHB, as well as the extensive area of Montana Agricultural Holdings (and other names) further east, and north to Wonderboom Airport. This was where the house building action was hot at the time. City Council had agreed that Sinovich Drive be widened, and Mr. van Staden had already got his equipment out there to do what City forces had done for many years, at a number of other places – widening these roads to a 48' asphalt width. Now it so happened that Lydia and I had purchased[115] and moved into a brand new house at 221 Orsula Street, Sinoville, in February 1968. I first commuted to downtown Pretoria with Petronella Bus Services, a school bus type of service that picked me up on Sinovich Drive and took me to Church Square in downtown, shaking through the gravel streets of Annlyn and experiencing peak hour traffic on Paul Kruger Street which was four lanes at most through much of its length, every morning and afternoon. So I went to Mr. Weir's office and asked him if it would not be better to construct a four-lane divided road on Sinovich Drive. I pointed out to him (from the Township's legal plan) that the right-of-way was adequate for this, and had actually been envisaged when the area was under PUHB jurisdiction, and that for much of its length through Sinoville, frontage roads already existed for lot access; that twinning would have many traffic safety advantages, that this was most likely the idea when Sinoville was proclaimed, that the intersections of the crossroads were far apart and that very likely, traffic signals would need to be installed in the next few years.[116] I believe I did not convince him during that meeting.

I then said something to him that was likely **my very first professional act of activism**: "Mr. Weir", I said, "I live in that area; I know and experience the traffic situation every day. I would like to ask you for permission to discuss this with Councillor Malherbe". (This person was Councillor for the Wonderboom ward of the City). He did not like that at all. He sat there for a few moments, (with a face like the well-known photo of Winston Churchill), and I already feared the worst. "What have I now done wrong?" went through my mind, and "Am I perhaps going to be fired for this?" But then Mr. Weir looked up and just said: "Let's go out right now, to see the site", and that's what we did, he driving his light blue Peugeot 404, and I with a roll of papers on my lap. Arriving at Sinovich Drive, we stopped where a grader had just started ripping up the existing gravel shoulder. Almost directly, getting out of the car, Mr. Weir noticed the heavy truck traffic and its noise that actually overpowered our speech. I believe that both the noise and the smoke convinced him more than I had. So we walked over to the foreman and

[114] I believe that I was once told that Dr. Dalgleish had a PhD in statistics, quite appropriate for this position.
[115] Corner lot – 9 800 sq. Cape feet, purchase price R 11,000, with a downpayment of R 1,500 from Lydia's parents.
[116] On the westernmost block of Sinovich Drive, a brand new house had been built with direct access to the arterial road, while there was also an access from the rear lot line to a local road. This concrete driveway violated the "red line" on the approved Township Layout Plan, probably due to the transition from PUHB to City jurisdiction.

(very unexpectedly) Mr. Weir told him: "We want you to stop this work right now and to go and do some maintenance grading in the agricultural holdings; tomorrow, we will have some new directions on what to do with this road. I think that we should build a divided road, with a median." The rest of the week, I dropped everything else, rushing to complete some conceptual drawings for a divided roadway, with a 14' wide median[117], and the construction crew then returned and started building what later became Zambezi Drive. About two weeks later, Mr. Weir came into my office and told me with a huge grin on his face: "Councillor Malherbe just phoned me, and I told him that we are twinning the whole length of Sinovich Drive. I also told him why; and he likes the idea very much!" All of this just happened, without any Official Community Plan, Traffic Impact Study or even a City Council decision! Is that possible today?

Soon after the twinning of Sinovich Drive was completed, a section of Lynnwood Drive needed to be widened. In this case, an adequate right-of-way was also available, and Mr. Weir enthusiastically suggested twinning of the old 18' wide asphalt. This was not a straight alignment like Sinovich Drive; the road curved almost all the way. Based on the legal lines, I used spirals for the road design. Fortunately, there were hardly any electrical cables, watermains or sanitary sewers to be relocated. The west limit of this project was at Atterbury Road (west of that point, it was already a four-lane undivided roadway, past the University's Hostels) and the east limit was originally to be located somewhere different than where it ended up: One day, I was asked to go to Mr. Weir's office, where he introduced me to someone from a consulting engineering firm called Deleuw Cather & Associates. This firm was preparing the design of the Pretoria Eastern Bypass (for the National Department of Transport) and this gentleman had come to enquire if the City had any ideas for a proposed "partial interchange" at Lynnwood Drive, east of Lynnwood Glen and Lynnwood Ridge. It was with quite some glee that Mr. Weir told this consultant that "Yes, the City has just started the twinning of Lynnwood Drive up to this proposed interchange, and these are all the design parameters for our design", and "Please contact Jacob if you need any more over the next few months", and "Yes, I will advise Council that we support the concept of this partial interchange." The consultant was obviously very pleased. I later learnt from him that he had initially expected a long and difficult negotiation process about connecting the freeway to the 18' wide asphalt…. As a result, Lynnwood Drive was only twinned by City forces up to where the Freeway Interchange project started.

I was then asked to deal with a formal written request by the National Institute for Road Research (NIRR) of the CSIR that had its campus just northeast of Lynnwood Township. This request was to use a section of Lynnwood Drive, just west of the proposed Pretoria Eastern Bypass, for a series of non-destructive experiments with additives to road tar. This was a section that would become redundant with construction of the interchange (as in the previous paragraph), so Mr. Weir gladly gave permission to this cooperation, asked me to draft a "Notice" to be written for his signature for the Afrikaans and English newspapers (because this was a "partial roads closure") and also asked me to do the liaison and attend the experiment and report to him afterwards. The purpose of the experiment was to determine the optimum PVC admixture percentage in "road tar" for chip sealing projects. (The reason being that "bitumen", being an imported commodity, was much more expensive than local tar from coke ovens, and that it had already been determined that PVC as an additive would prohibit the ultra-violet ray deterioration of tar, if used in a "top layer" of a chip-seal project.) A fairly long section of the south half of the 18' wide roadway was marked off in 1' x 1' squares, and these squares were then individually "surfaced" with tar and rock chips – the former out of glass jars, the latter out of little canvas bags; the application of the tar with brushes, and the application of the aggregate by hand; the rolling by a small vibratory roller – all to resemble a typical chip-seal operation. The tar was from three different sources and qualities, ISCOR Pretoria, ISCOR Newcastle and Wankie (in Rhodesia). The PVC percentages varied from ½% to 1½% if I am not mistaken (with ¼% intervals), there were "control squares" without PVC, and there were also some squares

[117] 10' turning lane and 4' shy distance, somewhat like the concept used at William Nicol Drive in Bryanston, the project that I had designed when at BSB&P a few years earlier. Did I already make use of my earlier experience?

with rubber additive instead of PVC additive. Thinking about how the research was conducted that day, by a group of people (mostly men) with white coats, without a lot of signs and hardly any traffic control (and obviously no hard hats!) amazes me. How easy things were, and how complicated they have since become! And remember that Lynnwood Drive was already heavily trafficked – at that time!

This was a typical "medium term" NIRR research project, and the initial application would be followed up by regular panel visits, during which the "experts" would evaluate the conditions of all these squares, with friction tests and aggregate loss tests and yes, in 1974, this practical research ended up – after earlier reports – as the source of an International Research Report written by Mr. I.L. Jamieson, B.Sc., Chief Research Officer at the NIRR, who in 1976 became my colleague – but that is another story, for now. Its title (and it was co-authored with his supervisor, Dr. C.P. Marais and Head of what was then called the Treated Materials Group): "The development of PVC / tar binder for surface treatments in hot climates." (See ARRB Proceedings, Volume 7, Part 6, 1974.) It was my first exposure to road testing and research. This Final Research Report found that the optimum PVC admixture was 0.75%, with ISCOR #2 Tar.

In 1960, a Mr. C.H. Haddon had been the City Engineer, and Mr. Sandenbergh the City Roads Engineer. When Mr. Sandenbergh was promoted, so was Mr. Weir, who took his former position. One could sometimes feel that they did not really like each other; some of the issues came out during my two years at Munitoria. During Mr. Sandenbergh's time as Roads Engineer, many streets in "old" Pretoria had been built and chip-sealed without curb and gutter or pavements (meaning "sidewalks"). It had been his idea to show that the City cared for the people – not unlike the situation these days to keep roads "black" without caring what goes on below the surface.[118] However, streets built before the "Sandenbergh era" had been constructed with long and heavy norite curbstones from the City's Bon Accord quarry. But over the years, the edges of the "not so very old" streets had been eroded in many places, even in the posh neighbourhoods like Hatfield and Brooklyn. This caused people to e.g. lose their automobiles' tailpipes when entering their properties. The City had an annual program to build pavements for the streets that lacked them, and Mr. Gie sat down regularly with the ward Councillors and the various Ratepayers' Association board members (in both "old" and "new" Pretoria) to determine what to do with the annual allocation of one mile per ward in "new" Pretoria and 1 mile for the whole of "old" Pretoria. Where will City forces build the new pavements next? Of course, invariably, the pavements were built close to these influential peoples' residences. Kerbing (yes, that is the South African English spelling) installations were not handled that way – it was more on an "as required" basis – perhaps based on "complaints", one should say.[119] I handled design and site supervision of curbing of two blocks of Orient Street and another north-south block in Hatfield Township, close to where Lydia's parents lived at that time. These streets had originally been built with a parabolic cross-section, which one can see on old textbooks, and there were huge jacaranda trees on both sides, close to the asphalt edges. Unreinforced concrete slabs, 18" wide, with an upslope toward the properties, were built for the lengths of these street blocks, after which hot-mix asphalt was poured into the areas next to the chip seal, and all existing driveways were then reconstructed "to match". The longitudinal grades of these four 450' street block lengths needed careful consideration. There were only a few driveways along these north-south street blocks, because most of the lots fronted Church Street, Pretorius Street or

Orient Street at Pretorius Street, note kerbing & (pre-existing) catchbasin.

[118] I am referring to "Pavement Preservation" as it is practiced in Arizona, and also in British Columbia.
[119] Much later, I learnt the difference between "proactive" and "reactive" bylaw enforcement policies.

Schoeman Street. When living in a nearby house on Schoeman Street that was later torn down for the large USA Embassy complex, my father-in-law took a photo of the intersection (at left) in October 1979, sending it to us in Canada, with the jacarandas in bloom!

The Belle Ombre area (this was an original farm name) is bordered by Boom Street to the south, Paul Kruger Street to the east, Marabastad to the west and the west-flowing Apies River to the north. East of Paul Kruger Street is the Pretoria Zoo. Circuses, merry-go-rounds and similar businesses occasionally leased parts of this City-owned property – and across the river are Langenhoven High School and Eloff's Cutting, through the Daspoort Range. In early 1969, somebody applied to lease an area on Belle Ombre to build a little arena and an oval track for stock car racing events. City Council approved this application for a certain number of years, and then had the City Surveyor draw up a legal survey plan of the lease area, complete with a formal agreement. One day, during the winter (June or July) of 1969, Mr. Weir asked me to visit the site and see what was happening, because construction had just started there. He gave me prints of the approved development proposal and the legal lease area. I drove there the very next morning, on my way to work, and immediately noticed that something was not right. The clearing for the "arena under construction" was too close to the Apies River, within what I saw as a legally established environmental setback (so that the animals in the Zoo would not drown during a major flood, I had been told; and obviously also to protect cages and other infrastructure in the Zoo); some of the distances on the papers did not match with how I paced them; and I also noticed that one legal pin[120] had actually been removed – I even saw the hole from which it must have been pulled out. Nobody was on site early that morning. So I continued to work and went directly to Mr. Weir's office, reporting what I had seen. Without any hesitation, he picked up the phone and called Mr. Vorster, the City Surveyor, (he was on the 5th floor while we were on the 9th) and the three of us jumped into a pickup truck in the basement garage of the building and drove to the site. We found there that there was a "pin" that Mr. Vorster said he and his crew had not placed, and we also saw the "hole" that I had noticed earlier that morning, where, Mr. Vorster said, he had recently placed a pin. And then the "boss" of the "joint" arrived on the scene. Wow. My ears almost popped while kicking dirt and listening while both the City Roads Engineer and the City Land Surveyor gave this man a verbal lesson (or was it a lashing?) on how never again to disturb a legal pin; that if he ever did, he could and would be sued for doing so; that he would never again be given the opportunity to lease land from the City; and would he please replace the pin directly and properly, in the presence of the City Surveyor, and if he did, that would be the end of it. And yes, would he please rearrange his construction activities as well, and only build according to what City Council had agreed to! We left soon the man dumbfounded, and laughed all the way back to Munitoria.

In the winter of 1969, I did something "abnormal" directly for Mr. Gie, who was to appear in Court shortly, on behalf of the City. There had been a major upset at the City's Concrete Plant, located at the Works Yard: A theft of sand. This plant received sand regularly from Contractors who had annual sand supply contracts with the City, and the stockpile fed the City's concrete mixing plant. Mixed concrete was placed in concrete trucks that were then dispatched to the various City crews. Some other "loose concrete" as well as loose sand (for mortar or pipe bedding) also came from this stockpile. The supervisor at the Works Yard, a Mr. Engelbrecht, had gone on vacation, and a Mr. Baron was acting on his behalf. One day, a truck came through the gate to deliver sand, and Mr. Baron suddenly discovered a whole pile of "pre-completed" tickets for truckloads of sand, in Mr. Engelbrecht's desk drawer; the truck driver had somehow alerted him. So instead of receiving one ticket per truckload, the sand contractor had (sometimes or regularly?) received two or three or more tickets, which had then been used in invoicing the City. For how long had this irregularity (or fraudulent practice) been going on? How much sand had the City already paid for but not received? That became my assignment for the next two weeks. I needed to go through all the previous three years' sand usage records (from the concrete plant and from half-

[120] An 18" length of ½" dia. steel rod was normally used at that time.

pickup truck loads or even wheelbarrow loads[121]) and all the sand delivery records, to establish a fairly accurate "estimate" (for that's all it could be) of the situation. In the end, I believe that the amount (or loss) claimed by the City was about R 365 000. Surprisingly, on his return from vacation, Mr. Engelbrecht confessed, was then fired, charged in Court, found guilty and fined. Mr. Gie presented the City's case in Court. And Mr. Baron was obviously promoted into Mr. Engelbrecht's position. And the sand supply contractor, you might ask? He had already gone bankrupt when the judgment was made, and the owner (for there is always a "real body" behind any business) had probably established another company.

Whenever a new project was to be started, Mr. Weir would advise me (or another employee), and Mr. Bosman would be consulted. He had a big book in which all the Department's budget items were listed. Mr. Bosman would tell us about all the projects for "this year" and those for "next year", and those that ran from the one year into the other. In this way, the underlings like me would somehow become aware of how the process worked (or was supposed to work). On one occasion, Mr. Bosman alerted Mr. Weir that he should not forget that the current budget allowed the Department to buy a new grader. This purchase would be made following a Public Tender Process. Great was my surprise when Mr. Weir asked me to liaise with Mr. Van Staden and with the City's Mechanical Engineer (whose office was at the Workshops) regarding this Tender. Why? Well, Mr. Van Staden (and some of the foremen) were afraid that in the process, one brand of grader would be successful, so that the City would buy it – as the "Lowest Price". They did not want that grader; the City had one already, and the City's Mechanical Engineer knew how many oil leaks it had already sprung, how many days it had been in the shop, and basically, "how crappy this piece of junk really was". The next few weeks, I spent some time with the two "experts" (the mechanical one and the operational one) and a detailed "performance specification" for the grader was developed, one that could not be met by the "unwanted" (American) manufacturer. We went through various brochures of the three (or four) grader manufacturing companies, and found some transmission detail in which Caterpillar excelled – the type that Mr. Van Staden wanted. To prove all this to Mr. Weir, (who was obviously **directly** responsible, **through** Mr. Sandenbergh, **to** Council), a demonstration of grader capabilities was organized, prior to the advertisement date, somewhere on a bare piece of land near the east City boundary. All four available grader models were featured by their representatives, and I also attended. Mr. Weir was satisfied; the tender process continued, and a few months later, the City staff welcomed another Cat. **Devious? Perhaps.** But did you notice, dear reader, that I have been successful to refrain from mentioning the brand name of the unwanted grader?

One day, I received a phone call from Jessie Verster, a former classmate, who had become Town Engineer for the Town of Potgietersrus in Northern Transvaal. He asked me to send him, if available and possible, construction prints of the kilns at the well-known Kirkness Brickworks (in Pretoria, near Groenkloof). He said that there was a proposal to build brickworks in Potgietersrus, and he would like to check if their proposal would meet industry standards and normal requirements, e.g. those that Kirkness had met more than 50 years ago. So I went down to the Building Department on the 5th floor and asked if they had the building permits drawings (and the answer was "Yes") and would it be allowed, as a courtesy between municipalities, to send them some photocopies. That was also considered "OK", and I then photocopied quite a number of very beautiful and detailed construction drawings (white lines and letters on a pink linen background, from around 1904) of the kilns, and mailed them all to Jessie. So it was all "above board" as far as I knew. A few years later, I learnt that due to some irregularity about approving building permits (which was the Town Engineer's responsibility), Jessie had lost his job with the Town, and (which was worse) that he had also lost his PrEng status with the South African Council of Professional Engineers. I never heard of him again, and presume that he may have gotten another kind of job. And I sometimes wonder if this situation might somehow have been related to "brickworks". Jessie may well have become the Town Clerk of another municipality, salvaging his experience. I later became aware that

[121] One wheelbarrow is supposed to be 4 cubic feet. But what about the moisture rate, bulking factor and the like?

the Town Clerk of Reitz OFS had been a civil engineer, but he had done this by choice. These days, it is clear that even a valid request by a Town Engineer to a colleague working for another municipality would not be as easily honoured, for quite a number of (privacy and legal) reasons. More hoops would need to be jumped through; more "checks and balances". Times have changed a lot, also in this respect.

Before this happened, I had already built up a good working relationship with those who worked in the City's Building Department. Ellis Furniture was in a four storey concrete building on the west side of Andries Street, with the ground floor and the basement full of furniture, and with offices upstairs. The basement encroached into the right-of-way (we called it a "road reserve"), and there were cast iron frames with little glass panes within the concrete pavement (meaning "sidewalk"). Some glass panes had broken and water had leaked into the basement. A City crew was supposed to come and do something about it. At the Building Department, I looked at the 1911 building permit for this edifice, and the drawings. This way of providing daylight into the basement was fairly common a century ago; I have seen these "sidewalk glass panes" in other cities like Vancouver, B.C. since, at the Hudson's Bay store on West Hastings Street. There must have been an agreement of some kind between the property owner and the municipality. How the problem was solved in Pretoria? Well, these glass panes and their cast iron frames were no longer available in 1969, and the City Roads Department crew just poured a concrete slab. What else could be done? I wonder how many of these skylights are still in operation, all over the world.

I said before that things were changing in those days, with more private land development. I was asked to review engineering drawings for the development of these projects. One of these was Murrayfield Ext. 1 Township. Murrayfield Township was an existing up-scale neighbourhood in "new" Pretoria, named after the rugby field in England where the South African Springbok Rugby Team had beaten the English Lions with a score of 44 - 0 (or something like that) in 1949. Since then, the term "murrayfielding someone" meant giving him a real licking, and not only in sport. Directly south of Murrayfield Township was the right-of-way for the proposed National Road to Witbank, on which design was already proceeding at that time. Murrayfield Ext. 1, directly south of this proposed freeway, was one of the City's first private "turn-key" developments. The "new method " way of approval of any Township meant that all the requirements for "servicing" had to be written into the Proclamation in the Provincial Gazette. Below follows a 5½ page sample of what was required, and the Developer ad werll as thre Municipality had to conform to all the Conditions that the Province required to be met. Fortunately, you only need to read half of te text.

Administrator's Notice 841 21 June, 1978

DECLARATION OF APPROVED TOWNSHIP.

In terms of section 69 of the Town-planning and Townships Ordinance, 1965 (Ordinance 25 of 1965), the Administrator hereby declares Phalaborwa Extension 8 Township to be an approved township subject to the conditions set out in the Schedule hereto.

PB. 4-2-2-4939

SCHEDULE.

CONDITIONS UNDER WHICH THE APPLICATION MADE BY THE TOWN COUNCIL OF PHALABORWA UNDER THE PROVISIONS OF THE TOWN-PLANNING AND TOWNSHIPS ORDINANCE, 1965, FOR PERMISSION TO ESTABLISH A TOWNSHIP ON PORTION 26 OF THE FARM LAASTE 24-L.U., PROVINCE OF TRANSVAAL, HAS BEEN GRANTED.

Administrateurskennisgewing 841 21 Junie 1978

VERKLARING TOT GOEDGEKEURDE DORP.

Ingevolge artikel 69 van die Ordonnansie op Dorpsbeplanning en Dorpe, 1965 (Ordonnansie 5 van 1965), verklaar die Administrateur hierby die dorp Phalaborwa Uitbreiding 8 tot 'n goedgekeurde dorp onderworpe aan die voorwaardes uiteengesit in die bygaande Bylae.

PB. 4-2-2-4939

BYLAE.

VOORWAARDES WAAROP DIE AANSOEK GEDOEN DEUR STADSRAAD VAN PHALABORWA INGEVOLGE DIE BEPALINGS VAN DIE ORDONNANSIE OP DORPSBEPLANNING EN DORPE, 1965, OM TOESTEMMING OM 'N DORP TE STIG OP GEDEELTE 26 VAN DIE PLAAS LAASTE 24-L.U., PROVINSIE TRANSVAAL, TOEGESTAAN IS.

Typical start of an Administrator's Notice of "Proclaiming" a Township. (not my project)

1. CONDITIONS OF ESTABLISHMENT.

(1) *Name.*

The name of the township shall be **Phalaborwa Extension 8.**

(2) *Design.*

The township shall consist of erven and streets as indicated on General Plan S.G. A.6176/77.

(3) *Endowment.*

Payable to the Transvaal Education Department:

The township owner shall in terms of the provisions of section 63(1)(a) of the Town-planning and Townships Ordinance, 1965, pay to the Transvaal Education Department, for educational purposes, a lump sum endowment on the land value of special residential erven in the township, the extent of which shall be determined by multiplying 48,08 m² by the number of special residential erven in the township.

The value of the land shall be determined in terms of the provisions of section 74(3) and such endowment shall be payable in terms of the provisions of section 75 of the said Ordinance.

(4) *Disposal of Existing Conditions of Title.*

All erven shall be made subject to existing conditions and servitudes, if any, including the reservation of rights to minerals.

(5) *Land for Municipal Purposes.*

The township owner shall at its own expense have the following erven reserved for municipal purposes:

(i) Parks: Erven 2882 to 2889.

(ii) General: Erven 2350, 2386 and 2890 to 2895.

(6) *Access.*

Ingress to and egress from the township to the future circular road shall only be allowed at the street junctions between Erven 2199 and 2368, 2261 and 2477 and between Erven 2531 and 2696 with such circular road.

(7) *Enforcement of Conditions.*

The township owner shall observe the conditions of establishment and shall take the necessary steps to secure the enforcement of the conditions of title and any other conditions imposed in terms of section 62 of Ordinance 25 of 1965: Provided that the Administrator shall have the power to relieve the township owner of all or any of the obligations and to vest such obligations in any other person or corporate body.

2. CONDITIONS OF TITLE.

CONDITIONS IMPOSED BY THE ADMINISTRATOR IN TERMS OF THE PROVISIONS OF ORDINANCE 25 OF 1965.

The erven mentioned hereunder shall be subject to the conditions as indicated imposed by the Administrator in terms of Ordinance 25 of 1965.

1. STIGTINGSVOORWAARDES.

(1) *Naam.*

Die naam van die dorp is Phalaborwa Uitbreiding 8.

(2) *Ontwerp.*

Die dorp bestaan uit erwe en strate soos aangedui op Algemene Plan L.G. A.6176/77.

(3) *Begiftiging.*

Betaalbaar aan die Transvaalse Onderwysdepartement:

Die dorpseienaar, moet kragtens die bepalings van artikel 63(1)(a) van die Ordonnansie op Dorpsbeplanning en Dorpe, 1965 aan die Transvaalse Onderwysdepartement as begiftiging vir onderwysdoeleindes 'n globale bedrag op die grondwaarde van spesiale woonerwe in die dorp betaal, waarvan die grootte bepaal word deur 48,08 m² te vermenigvuldig met die getal spesiale woonerwe in die dorp.

Die waarde van die grond word bepaal kragtens die bepalings van artikel 74(3) en sodanige begiftiging is betaalbaar kragtens die bepalings van artikel 75 van genoemde Ordonnansie.

(4) *Beskikking oor Bestaande Titelvoorwaardes.*

Alle erwe moet onderworpe gemaak word aan bestaande voorwaardes en serwitute, as daar is, met inbegrip van die voorbehoud van die regte op minerale.

(5) *Grond vir Munisipale Doeleindes.*

Die dorpseienaar moet op eie koste die volgende erwe vir munisipale doeleindes voorbehou:

(i) Parke: Erwe 2882 tot 2889.

(ii) Algemeen: Erwe 2350, 2386 en 2890 tot 2895.

(6) *Toegang.*

Toegang tot en uitgang uit die dorp tot die toekomstige ringpad sal slegs toegelaat word by die straataansluitings tussen Erwe 2199 en 2368, 2261 en 2477 en tussen Erwe 2531 en 2696 met sodanige ringpad.

(7) *Nakoming van Voorwaardes.*

Die dorpseienaar moet die stigtingsvoorwaardes nakom en die nodige stappe doen om te sorg dat die titelvoorwaardes en enige ander voorwaardes opgelê kragtens artikel 62 van Ordonnansie 25 van 1965, nagekom word: Met dien verstande dat die Administrateur die bevoegdheid besit om die dorpseienaar van almal of enigeen van die verpligtings te onthef en om sodanige verpligtings by enige ander persoon of liggaam met regspersoonlikheid te laat berus.

2. TITELVOORWAARDES.

VOORWAARDES OPGELÊ DEUR DIE ADMINISTRATEUR KRAGTENS DIE BEPALINGS VAN ORDONNANSIE 25 VAN 1965.

Die erwe hieronder genoem is onderworpe aan die voorwaardes soos aangedui opgelê deur die Administrateur ingevolge Ordonnansie 25 van 1965.

(1) *All Erven.*

(a) Neither the owner nor any other person shall have the right to make or permit to be made upon the erf for any purposes whatsoever any bricks, tiles or earthenware pipes or other articles of a like nature.

(b) Neither the owner nor any other person shall have the right, save and except to prepare the erf for building purposes, to excavate therefrom any material or to continue an existing use without the written consent of the local authority.

(c) Except with the consent of the local authority, no animal as defined in the Local Authorities' Pounds Regulations, published under Administrator's Notice 2 of 1929, shall be kept or stabled on the erf.

(d) Except with the written consent of the local authority, no wood and/or iron buildings or buildings of unburnt clay-brick shall be erected on the erf.

(e) Except with the written approval of the local authority and subject to such conditions as the local authority may impose, neither the owner nor any occupier of the erf shall sink any wells or boreholes thereon or abstract any subterranean water therefrom.

(f) Where, in the opinion of the local authority, it is impracticable for stormwater to be drained from higher lying erven direct to a public street, the owner of the erf shall be obliged to accept and/or permit the passage over the erf of such stormwater: Provided that the owners of any higher lying erven, the stormwater from which is discharged over any lower lying erf, shall be liable to pay a proportionate share of the cost of any pipeline or drain which the owner of such lower lying erf may find necessary to lay or construct for the purpose of conducting the water so discharged over the erf.

(g) Upon the submission to the Registrar of Deed of a certificate by the local authority to the effect that the township has been included in an approved Town-planning Scheme, and that the scheme contains conditions corresponding to the title conditions contained herein, such title conditions shall lapse.

(2) *Business Erf.*

In addition to the conditions set out in subclause (1) hereof, Erf 2275 shall be subject to the following conditions:

(a) The erf shall be used solely for the purpose of erecting thereon shops, offices and professional suites: Provided that with the consent of the local authority the erf may also be used for a place of instruction, social hall, place of amusement, dry cleaner, fish frier, fishmonger, launderette, bakery, or a place of public worship.

(b) The height of the buildings shall not exceed two storeys.

(c) The erf shall not be used for residential purposes.

(1) *Alle Erwe.*

(a) Nóg die eienaar, nóg enigiemand anders, besit die reg om vir enige doel hoegenaamd, tenís of erdepype of ander artikels van 'n soortgelyke aard op die erf te vervaardig of te laat vervaardig.

(b) Nóg die eienaar, nóg enigiemand anders besit die reg om, behalwe om die erf vir boudoeleindes in gereedheid te bring, enige materiaal daarop uit te grawe of enige bestaande gebruik voort te sit sonder die skriftelike toestemming van die plaaslike bestuur.

(c) Behalwe met toestemming van die plaaslike bestuur mag geen dier, soos omskryf in die Skutregulasies van Plaaslike Besture, soos afgekondig by Administrateurskennisgewing 2 van 1929, op die erf aangehou of gestal word nie.

(d) Behalwe met die skriftelike toestemming van die plaaslike bestuur mag geen geboue van hout en/of sink of geboue van rousteene op die erf opgerig word nie.

(e) Behalwe met die skriftelike toestemming van die plaaslike bestuur en onderworpe aan sodanige voorwaardes as wat die plaaslike bestuur mag oplê, mag nóg die eienaar, nóg enige bewoner van die erf putte of boorgate op die erf sink of enige ondergrondse water daaruit put nie.

(f) Waar dit volgens die mening van die plaaslike bestuur, ondoenlik is om stormwater van erwe met 'n hoër ligging regstreeks na 'n openbare straat af te voer, is die eienaar van die erf verplig om te aanvaar dat sodanige stormwater op sy erf vloei en/of toe te laat dat dit daarvoor loop: Met dien verstande dat die eienaars van erwe met 'n hoër ligging, vanwaar die stormwater oor 'n erf met 'n laer ligging loop, aanspreeklik is om 'n eweredige aandeel van die koste te betaal van enige pyplyn of afleivoor wat die eienaar van sodanige erf met 'n laer ligging nodig vind om aan te lê of te bou om die water wat aldus oor die erf loop, af te voer.

(g) By the indiening van 'n sertifikaat by die Registrateur van Aktes deur die plaaslike bestuur te dien effekte dat die dorp in 'n goedgekeurde dorpsbeplanningskema opgeneem is en dat die skema voorwaardes bevat wat in ooreenstemming is met die titelvoorwaardes hierin vervat, moet sodanige titelvoorwaardes verval.

(2) *Besigheidserf.*

Benewens die voorwaardes uiteengesit in subklousule (1) hiervan is Erf 2275 aan die volgende voorwaardes onderworpe:

(a) Die erf moet slegs gebruik word om daarop winkels, kantore en professionele kamers op te rig: Met dien verstande dat, met die toestemming van die plaaslike bestuur, die erf ook gebruik kan word vir die doeleindes van 'n onderrigplek, gesellighedsaal, vermaaklikheidsplek, droogskoonmaker, vishakker, vishandelaar, wassery, bakkery, of 'n plek vir openbare godsdiensoefening.

(b) Die hoogte van die geboue mag nie twee verdiepings oorskry nie.

(c) Die erf mag nie vir woondoeleindes gebruik word nie.

(d) Effective and paved parking shall be provided on the erf to the satisfaction of the local authority in the ratio of six (6) car spaces to 100 m² of gross leasable shop floor area and two (2) car spaces to 100 m² of gross office floor area.

(e) Provision shall be made on the erf for the loading and off-loading of vehicles to the satisfaction of the local authority.

(f) The siting of all buildings and ingress to and egress from the erf to a public street system shall be to the satisfaction of the local authority.

(g) A screen wall, two metres high, shall be erected to the satisfaction of the local authority along any boundaries of the erf. The extent, materials, design, position and maintenance of the wall shall be to the satisfaction of the local authority.

(h) The business premises shall be erected simultaneously with or before the erection of the outbuildings.

(i) The registered owner shall be responsible for the maintenance of the whole development on the erf. If the local authority is of the opinion that the premises or any part of the development is not kept in a satisfactory state of maintenance, then the local authority shall be entitled to undertake such maintenance at the registered owner's cost.

(3) *Special Purpose Erven.*

In addition to the conditions set out in subclause (1) hereof, the undermentioned erven shall be subject to the following conditions:

(a) Erven 2477 and 2803:

(i) The erf shall be used solely for religious purposes and for purposes incidental thereto: Provided that parking in the ratio of one parking space to ten seats, together with the necessary manoeuvring space, shall be provided on the erf to the satisfaction of the local authority.

(ii) Sewerage and stormwater drainage pipes shall be of durable material and fitted with water tight flexible gaskets at joints to the satisfaction of the local authority.

(iii) The owner of the erf shall take the necessary steps to ensure that downpipes on buildings will discharge water away from the foundations of buildings to the satisfaction of the local authority and that there will be no stagnant water pools.

(iv) Where waterpipes penetrate buildings ample provision shall be made by bending the pipes in order to absorb movement.

(v) No trees or shrubs shall be planted closer than 10 m from any building.

(b) Erven 2266 and 2802:

(i) The erf shall be used solely for the purpose of a crèche and for purposes incidental thereto, subject to such requirements as may be determined by the local authority.

(ii) Sewerage and stormwater drainage pipes shall be of durable material and fitted with water

(d) Doeltreffende en geplaveide parkering moet op die erf tot bevrediging van die plaaslike bestuur verskaf word in die verhouding 6 (ses) parkeerplekke tot 100 m² bruto verhuurbare winkelvloerruimte en 2 (twee) parkeerplekke tot 100 m² bruto kantoorvloerruimte.

(e) Voorsiening moet op die erf gemaak word vir die op- en aflaai van voertuie tot bevrediging van die plaaslike bestuur.

(f) Die plasing van alle geboue en in- en uitgange tot 'n openbare straatstelsel moet tot bevrediging van die plaaslike bestuur wees.

(g) 'n Skermmuur, twee meter hoog, moet langs enige grens van die erf tot bevrediging van die plaaslike bestuur opgerig word. Die omvang, ontwerp, posisie en instandhouding van die muur moet tot bevrediging van die plaaslike bestuur wees.

(h) Die besigheidsgeboue moet gelyktydig met, of voor, die buitegeboue opgerig word.

(i) Die geregistreerde eienaar is verantwoordelik vir die instandhouding van die algehele ontwikkeling op die erf. Indien die plaaslike bestuur meen dat die perseel of enige gedeelte van die ontwikkeling nie bevredigend instand gehou word nie, is die plaaslike bestuur geregtig om sodanige instandhouding op koste van die geregistreerde eienaar te onderneem.

(3) *Erwe vir Spesiale Doeleindes.*

Benewens die voorwaardes uiteengesit in subklousule (1) hiervan, is ondergenoemde erwe aan die volgende voorwaardes onderworpe: —

(a) Erwe 2477 en 2803:

(i) Die erf moet uitsluitlik vir godsdiensdoeleindes gebruik word en vir doeleindes in verband daarmee: Met dien verstande dat parkering tot bevrediging van die plaaslike bestuur op die erf verskaf moet word in die verhouding van een parkeerruimte tot tien sitplekke, tesame met die nodige beweegruimte.

(ii) Riool- en stormwaterpype moet van duursame materiaal wees en moet voorsien word van waterdigte buigbare seëllasse, tot bevrediging van die plaaslike bestuur.

(iii) Die eienaar van die erf moet die nodige reëlings tref tot bevrediging van die plaaslike bestuur om te verseker dat afvalpype by alle geboue water weg van die fondamente afvoer en dat water nie in poele bly staan nie.

(iv) Waar waterpype gebou binnegaan moet ruim voorsiening gemaak word deur pype te buig sodat beweging geabsorbeer kan word.

(v) Geen bome of struike mag nader as 10 m van enige gebou geplant word nie.

(b) Erwe 2266 en 2802:

(i) Die erf moet slegs gebruik word vir die doeleindes van 'n bewaarskool en vir doeleindes in verband daarmee, onderworpe aan sodanige vereistes as wat deur die plaaslike bestuur bepaal mag word.

(ii) Riool- en stormwaterpype moet van duursame materiaal wees en moet voorsien word van

tight flexible gaskets at joints to the satisfaction of the local authority.

(iii) The owner of the erf shall take the necessary steps to ensure that downpipes on all buildings will discharge water away from the foundations to the satisfaction of the local authority and that there will be no stagnant water pools.

(iv) Where waterpipes penetrate buildings ample provision shall be made by bending the pipes in order to absorb movement.

(v) No trees or shrubs shall be planted closer than 10 m from any building.

(4) *Special Residential Erven*

The erven, with the exception of those referred to in Clause 1(5) and Clauses 2(2) and 2(3) shall be subject to the following conditions:

(a) The erf shall be used solely for the erection of a dwelling-house together with such outbuildings, as are ordinarily required to be used in connection therewith.

(b) The main building, which shall be a completed building and not one partly erected and intended for completion at a later date, shall be erected simultaneously with or before the erection of the outbuildings.

(c) Buildings, including outbuildings, hereafter erected on the erf shall be located not less than 5 m from the boundary thereof abutting on a Street: Provided that the local authority shall have the right to reduce the building line on one of the street frontages of corner erven or where, in its opinion compliance with the building line restriction would on account of the topographical features of the erf interfere with the development of the erf.

(d) If the erf is fenced, or otherwise enclosed, the fencing or other enclosing device shall be erected and maintained to the satisfaction of the local authority.

(5) *Erven subject to Special Conditions.*

In addition to the conditions set out above, Erven 2211 to 2213, 2222 to 2223, 2231 to 2235, 2254, 2264, 2265, 2287, 2289, 2290, 2309, 2310, 2312, 2313, 2332, 2337, 2338, 2350, 2353, 2354, 2373, 2380, 2386, 2478 to 2480, 2505, 2509, 2510, 2519 to 2521, 2523, 2524, 2541, 2636, 2650 to 2652, 2654 to 2656, 2669 to 2672, 2688 to 2692, 2748, 2754, 2755, 2761, 2762, 2768, 2781, 2782, 2787, 2788, 2790, 2791, 2796, 2797, 2806, 2808, 2812, 2813, 2838, 2839, 2840 to 2842, 2859, 2860 to 2862, 2870 to 2872, 2883, 2884, 2887, 2888 and 2895 shall be subject to the following conditions:

(a) Buildings, including outbuildings thereafter erected on the erf, shall be erected on the granite portions of the erf, or where the land appears to be clayish, foundations of buildings shall be made wider as is usually required, and shall be to the satisfaction of the local authority.

(b) Sewerage and stormwater drainage pipes shall be of durable material and fitted with water-tight flexible gaskets at joints to the satisfaction of the local authority.

(c) The owner of the erf shall take the necessary steps to ensure that downpipes on buildings will discharge water away from the foundations to the satisfaction of the local authority and that there will be no stagnant water pools.

(d) Where waterpipes penetrate buildings ample provision shall be made by bending the pipes in order to absorb movement.

(e) No trees or shrubs shall be planted closer than 10 m from any building.

waterdigte buigbare sellasse, tot bevrediging van die plaaslike bestuur.

(iii) Die eienaar van die erf moet die nodige reëlings tref tot bevrediging van die plaaslike bestuur om te verseker dat afleipype by alle geboue water weg van die fondamente afvoer en dat water nie in poele bly staan nie.

(iv) Waar waterpype geboue binnegaan moet ruim voorsiening gemaak word deur pype te buig sodat beweging geabsorbeer kan word.

(v) Geen bome of struike mag nader as 10 m van enige gebou geplant word nie.

(4) *Spesiale Woonerwe.*

Die erwe met die uitsondering van die wat in Klousule 1(5) en Klousule 2(2) en 2(3) genoem word is onderworpe aan die volgende voorwaardes:

(a) Die erf moet slegs gebruik word om daarop 'n woonhuis met sodanige buitegeboue as wat gewoonlik in verband daarmee nodig is, op te rig.

(b) Die hoofgebou, wat 'n voltooide gebou moet wees en nie een wat gedeeltelik opgerig is en eers later voltooi sal word nie, moet gelyktydig met, of voor, die buitegeboue opgerig word.

(c) Geboue, met inbegrip van buitegeboue wat hierna op die erf opgerig word, moet minstens 5 m van die straatgrens daarvan gelê wees: Met dien verstande dat die plaaslike bestuur die reg het om die boulyn langs een van die straatgrense van hoekerwe te verminder of waar dit na sy mening, as gevolg van die topografiese eienskappe van die erf, die ontwikkeling van die erf mag benadeel.

(d) Indien die erf omhein of op 'n ander wyse toegemaak word, moet die heining of ander omheiningsmateriaal tot bevrediging van die plaaslike bestuur opgerig en instand gehou word.

(5) *Erwe onderworpe aan Spesiale Voorwaardes.*

Benewens die betrokke voorwaardes hierbo uiteengesit, is Erwe 2211 tot 2213, 2222 tot 2223, 2231 tot 2235, 2254, 2264, 2265, 2287, 2289, 2290, 2309, 2310, 2312, 2313, 2332, 2337, 2338, 2350, 2353, 2354, 2373, 2380, 2386, 2478 tot 2480, 2505, 2509, 2510, 2519 tot 2521, 2523, 2524, 2541, 2636, 2650 tot 2652, 2654 tot 2656, 2669 tot 2672, 2688 tot 2692, 2748, 2754, 2755, 2761, 2762, 2768, 2781, 2782, 2787, 2788, 2790, 2791, 2796, 2797, 2806, 2808, 2812, 2813, 2838, 2839, 2840 tot 2842, 2859, 2860 tot 2862, 2870 tot 2872, 2883, 2884, 2887, 2888 en 2895 aan die volgende voorwaardes onderworpe:—

(a) Gebou, met inbegrip van buitegeboue wat hierna op die erf opgerig word, moet of op die granietdele van die erf opgerig word, of waar die grond kleierig voorkom, moet fondamente van geboue breër as gewoonlik gemaak word en moet dit tot bevrediging van die plaaslike bestuur wees.

(b) Riool- en stormwaterpype moet van duursame materiaal wees en moet voorsien word van waterdigte buigbare sellasse, tot bevrediging van die plaaslike bestuur.

(c) Die eienaar van die erf moet die nodige reëlings tref tot bevrediging van die plaaslike bestuur om

charge water away from the foundations to the satisfaction of the local authority and that there will be no stagnant water pools.

(d) Where waterpipes penetrate buildings ample provision shall be made by bending the pipes in order to absorb movement.

(e) No trees or shrubs shall be planted closer than 10 m from any building.

(6) Servitude for Municipal Purposes.

In addition to the conditions set out above, the undermentioned erven shall be subject to the following conditions:

(a) All erven with the exception of those mentioned in Clause 1(5):

(i) The erf is subject to a servitude, 2 m wide, in favour of the local authority, for sewerage and other municipal purposes, along any two boundaries other than a street boundary as determined by the local authority.

(ii) No building or other structure shall be erected within the aforesaid servitude area and no large-rooted trees shall be planted within the area of such servitude or within 2 m thereof.

(iii) The local authority shall be entitled to deposit temporarily on the land adjoining the aforesaid servitude such material as may be excavated by it during the course of the construction, maintenance or removal of such sewerage mains and other works as it, in its discretion may deem necessary and shall further be entitled to reasonable access to the said land for the aforesaid purpose subject to any damage done during the process of the construction, maintenance or removal of such sewerage mains and other works being made good by the local authority.

(b) Erven 2617, 2624, 2700 and 2705:

The erf is subject to a servitude for municipal purposes in favour of the local authority, as indicated on the general plan.

te verseker dat afleipype by alle geboue water weg van die fondamente afvoer en dat water nie in poele bly staan nie.

(d) Waar waterpype gebou binnegaan moet ruim voorsiening gemaak word deur pype te buig sodat beweging geabsorbeer kan word.

(e) Geen bome of struike mag nader as 10 m van enige gebou geplant word nie.

(6) Serwitute vir Munisipale Doeleindes.

Benewens die voorwaardes hierbo uiteengesit is die ondergenoemde erwe onderworpe aan die volgende voorwaardes.

(a) Alle erwe met uitsondering van die genoem in Klousule 1(5):

(i) Die erf is onderworpe aan 'n serwituut 2 m breed, vir riolerings- en ander munisipale doeleindes, ten gunste van die plaaslike bestuur, langs enige twee grense, uitgesonderd 'n straatgrens, soos deur die plaaslike bestuur bepaal.

(ii) Geen gebou of ander struktuur mag binne die voornoemde serwituutgebied opgerig word nie en geen grootwortelbome mag binne die gebied van sodanige serwituut of binne 'n afstand van 2 m daarvan geplant word nie.

(iii) Die plaaslike bestuur is geregtig om enige materiaal wat deur hom uitgegrawe word tydens die aanleg, onderhoud of verwydering van sodanige rioolhoofpypleidings en ander werke wat hy volgens goeddunke noodsaaklik ag, tydelik te plaas op die grond wat aan die voornoemde serwituut grens en voorts is die plaaslike bestuur geregtig tot redelike toegang tot genoemde grond vir die voornoemde doel; onderworpe daaraan dat die plaaslike bestuur enige skade vergoed wat gedurende die aanleg, onderhoud of verwydering van sodanige rioolhoofpypleidings en ander werke veroorsaak word.

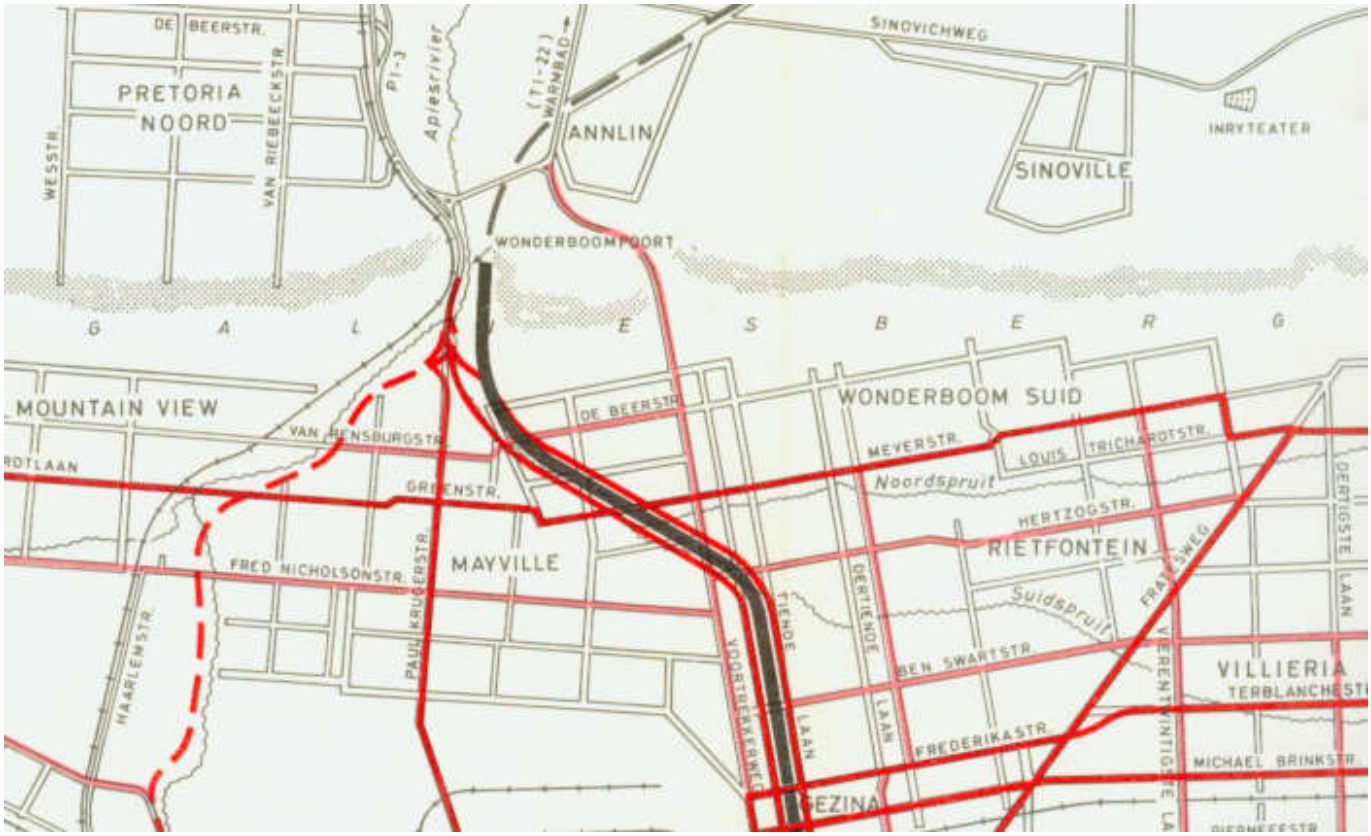
(b) Erwe 2617, 2624, 2700 en 2705:

Die erf is onderworpe aan 'n serwituut vir munisipale doeleindes ten gunste van die plaaslike bestuur, soos op die algemene plan aangedui.

Typical continuation and conclusion of an Administrator's Notice of Proclaiming a Township.

A former co-student, Coen van Beek, who had preceded me at the University of Pretoria by about two years, worked for the firm Haacke, Sher and Aab, consulting engineers for this project, and he brought me the plan set for all the municipal services – of which I only had to review the roads and storm drainage systems. This was a fancy residential development site, with beautiful lots of nice huge existing trees that could remain with the proper location of houses. I reviewed these drawings and remember that there was one uphill cul-de-sac along its south boundary. This had a grade of 19% and hardly any "levelling out" at the top. The assumption could be made that for the two lots at the top end of this cul-de-sac, excavations would be needed for their underground garages. I believe that 19% was in fact the maximum allowable grade, but only for a certain length. The first (west) phase of Murrayfield Ext. 1 would be served by a "Huisman" package sewage treatment plant, because the City's Moreleta Spruit Main Sewer would not be completed in time. Just before we left Pretoria, we purchased a lot in this subdivision for R 7,900,

intending to build a house there on our eventual return. When that did not happen as soon as we had expected, we just sold the lot for R 11,000 a few years later. In 1991, when visiting South Africa, Lydia's brother Chris and his wife lived in Murrayfield Ext. 1, and we once went for a walk looking at this property, on which a beautiful house had been built by that time.



This map (from the 1968 BKS&H Transportation Study) shows a large section of north suburban Pretoria; several of my design and construction projects can be identified – as well as Sinoville, where we lived.

Many years later, in Canada, I discovered that Alberta, Yukon and British Columbia, (and the other provinces and territories) have their own land development and land registratrion processes, and while working in Arizona, USA, I noted processes (with incredably much paperwork), very different from what I had already become acquainted with when operating as Grassroots Consulting Services (1992 – 2002). British Columbia actually boasts that its (provincial) land registry system is second to none in the world for clarity, while subdivision approval, based on Official Community Plans, Zoning and Development Permits, is (almost) entirely a municipal prosess, seldom requiring some Provincial Government approval.

Prior to purchasing this vacant lot from the "Developer", I had already made a formal (and personal) application to the City, to purchase a triangular piece of land from the City. This was a completely undeveloped "Park", which was in fact an eyesore, due to illegal dumping. At the same time, I applied to purchase the right-of-way of some unconstructed road beside this triangular park. In my application, I mentioned that my purpose was to consolidate these areas into a single feasible building parcel, for my own use as residence. Was I trying to play "Developer"? Perhaps. Lydia liked the idea. But the City Planning Department did not seem to take my application serious. Why? Well, I never knew. But the funny thing is that the application was for a piece of "Why Street" (plus the triangular park) in Menlo Park Township, just half a block south of Lynwood Drive, and directly opposite the Tukkies mens' hostels. From GoogleMaps, it was at Brooks Street and 2nd Street – close to the very shortest street in the

City, by name and length: "**Ox Street**". Someone, somehow, later got that application revived, and a new house was then built. "Too much traffic noise, definitely", Lydia or I would say today.

My administrative duties were mostly "project related" but could sometimes deal with complaints from the public, in which case Mr. Weir just gave me the letter (or small note from Mr. Ueckermann) with a request to investigate. All formal letters initially needed to be written in pencil, in a carbon paper book, so that the gentlemanly Mr. Gie could check them for proper "legalese". He was a very calm and precise man, and it was sometimes only my third draft that he approved and forwarded to Mr. du Toit, the male typist (or is it "typer"?) All letters obviously went out on City letterhead and under Mr. Weir's signature. How that has changed over the past five decades!!! We had no e-mail. It was a more "formal" society.

Things were also changing with the use of consulting firms, by municipalities, instead of in-house design. I knew that from discussions with my father-in-law and the regular advertisements in 1964 (in "The Civil Engineer in South Africa") for a junior engineer for the Town of Boksburg, assisting a Mr. W.C.D. Smith who was the Town Engineer. This municipality offered an inadequate salary, and the position remained vacant for a long time, because nobody applied. An article in the magazine (April 1969) about Mr. Smith stated that he had "since the early 1950s" advocated the use of consulting firms for design work, and construction to be carried out by Contract.[122] One design project that the City of Pretoria had already awarded to a firm called Mackintosh, Bergh & Sturgess shortly before I became a City employee, was for the widening of Paul Kruger Street through Eloff's Cutting, between the Pretoria Zoo (east side) and Langenhoven High School (west side) south of the cutting, and existing residential lots (both sides) north of the cutting, in Capitol Park Township. This four-lane roadway was to be widened to six lanes, on the inside of a horizontal curve. The overhead wiring system for electric buses had already been abandoned at that time, and there was a substantial bank of telephone wires in the east side sidewalk, which lead from the downtown to Wonderboom Airport for international usage. The design showed pre-split rock blasting on the west side only, with a proposed slope of 9 vertical: 1 horizontal. This was supposedly competent quartzite rock of the Daspoort Range, Magaliesberg Series. I first met Mr. Adrian Bergh and Mr. Bert Jager of MB&S just prior to the pre-construction meeting for the blasting and rock removal contract, and was asked by Mr. Weir to be the City's "contact person" for this already awarded high-profile project, seeing the arterial traffic situation. This meant participating in that meeting; meeting with the Consultant and the Contractor (Beztra) once per week on site for the duration of the work, handling payment certificates and also supervising the city crew that would come and build the road and sidewalks after completion of the blasting and rock removal contract. Blasting was to occur in two stages. In Stage 1, the whole west "face" was to be drilled along the 9:1 slope, with holes close together, and the rock would at that moment be sheared with a light charge along the line of the holes. In Stage 2, certain blocks of rock (on the road side of the split) would be drilled, and these would be blasted to smaller pieces, with blasting mats covering the surface, so as to minimize the time that Paul Kruger Street could need to be closed. After each of these blasts, the road was to be cleared as soon as possible, and rock removal would then occur with bulldozers adjacent and parallel to the roadway, behind a temporary timber barrier. Work was to start from the south, and rock was to be hauled south to a designated site, to expand sports fields of Langenhoven High School (opposite the Zoo). I remember driving by the site on the bus from Sinoville.

[122] My in-laws knew about Mr. Smith and his wife for many years. My father-in-law had been Town Engineer of the Town of Brakpan and later City Engineer of the City of Germiston, both municipalities bordering on Boksburg. They often met at SAIMunE conferences. In 1981, my in-laws and the Smiths met each other in Banff, Alberta, completely unexpectedly: The van Tonders were visiting us in Calgary, the Smiths were on an international trip with a bus tour to Banff from Vancouver. The magazine featuring the "Personalia" of Mr, Smith (April 1969) also showed the Institution's receipt of my application to become an "Associated Member" – transfer from "Graduate". The low salaries offered by Boksburg were likely typical of municipal councils' ignorance, and likely also one of reasons why my father-in-law retired at the end of 1965. But by the end of 1967, salaries had improved much.

I think it was on a Saturday (in May or June?) that I attended one of the Stage 2 “big blasts”, from a safe site within the confines of the Pretoria Zoo. The first photo shows the big blast itself, and the second photo shows to what depth the rock had already been blasted that day. After the “all clear” whistle had been sounded, I (and others, perhaps Mr. Bert Jager) walked north along Paul Kruger Street (which had been completely closed to traffic for a few hours) to see the result of the blast. Note the absolute absence of hard hats, safety equipment, traffic barriers, yellow ribbons and the like, very unlike a project in 2018!

One big blast one the west side of Eloff’s Cutting.

After the blast, the 9:1 pre-split slope is very clear.

This is the south end of the Eloff’s Cutting site.

Nearing the blast site, showing a temporary barrier.

Walking over the rubble to the Capital Park side.

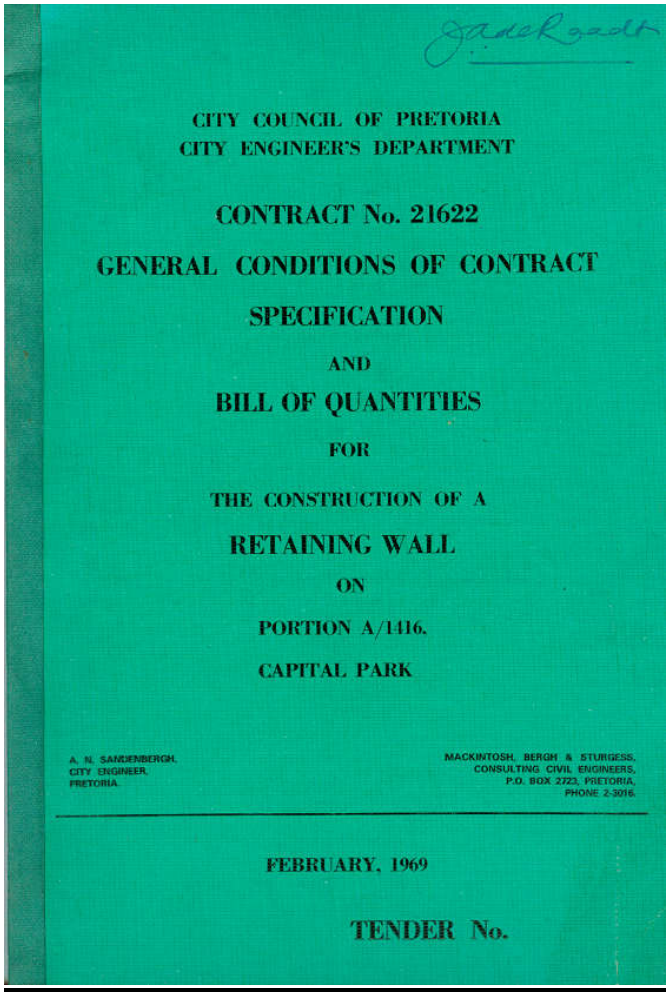
Removing the rubble & showing the 9:1 rock face.

This construction project was done very efficiently and there was no property damage to the cable bank, the residential properties nor the Zoo, where a cableway with a series of Cor-Ten steel towers was under construction at that time by a Swiss contractor. The project also included the construction (by a separate contract) of a substantial reinforced concrete retaining wall on the northwest side, which in fact closed off the intersection of Venter Street to the west. This retaining wall went north to the intersection of Malherbe Street – a cute way of "access control", a desired feature along any arterial road. Through Eloff's Cutting itself, City forces later built an additional wall beside the west sidewalk, in order to keep potential falling rock from ricocheting onto the roadway. Due to this "afterthought", the lane widths were all revised from 12' to 11', so that the total road width became 66'. The east sidewalk was also rebuilt but no rock was cut on that side. The wall was separately tendered, being on Portion A/1416, Capital Park, with a green document cover and **Contract No. 21622**. My only hand in that was some review of the design, as well as the tendering process and administrative duties.

In 1969, during one of the last site visits to the Eloff's Cutting retaining wall project, Mr. Adrian Bergh mentioned to me that the Bloemfontein office of the firm, managed by his partner, Mr. Frank Sturgess, was looking for a Resident Engineer for a road and bridge construction project between Sasolburg and Koppies in the northern Orange Free State. This work would start in January 1970. I was told that this was an urgent project, and needed somebody with at least four, preferably five years of experience, as well as eligibility for registration as PrEng. (The South African Council of Professional Engineers was just getting started, and the legislation had been passed by Parliament.) A change of work environment, back to highways, whetted my interest, seeing that I had at that time already completed two years of highway design, and had become responsible for road construction by City crews, which seemed to me somewhat boring as there was no real design involved. I needed true construction experience, I thought. The prospect of having free housing for the duration of the more than two year project and the use of a work pick-up truck, was appealing. Moreover, the project was not as far away from Pretoria as Chrissiesmeer, it was just over the border, into the Orange Free State. Our daughter Plonia had been born as a "preemie" and my mother had passed away in Potchefstroom during September. Living at Sasolburg would bring us closer to my father than our home on the north side of Pretoria allowed us to be. After discussing this opportunity with Lydia, a meeting was therefore arranged with MB&S in their offices in the City House Arcade, where I met Mr. Sturgess. Another advantage of accepting this offer of employment was that in Sasolburg I could likely enroll for after-hours MBA studies at the Vanderbijlpark campus of the PU for CHE, which courses had started a year or so earlier. The salary offered to me for 1970 was R 4,800 per year + free housing, while at the City of Pretoria my 1970 salary would have been about R 4,100 per year. Lydia was in favour of this change, and her parents as well. I accepted the offer and then gave the normal one-month notice to the City. During December 1969, we placed a classified advertisement for our house in the newspapers, and received a R 14,500 offer (from a teacher, his wife and his mother-in-law) within a few days. We had purchased that same house for R 11,000 less than two years earlier. In early December, we went on vacation to Amanzimtoti, Natal, with our two young children and a maid, meeting Pierre Cronjé, a former classmate, who was the Town Engineer, and making a day trip to Oribi Gorge as mentioned above. On the return trip, we drove through the town of Sasolburg and saw the house that the Contractor had already leased for our use during the duration of the project, more than two calendar years. We sold the 1956 Peugeot Station Wagon and arranged for Transvaal Cartage to pick up our furniture and deliver it at 19 Collins Crescent, Sasolburg. A house in Sasolburg had also been leased for my assistant, a soils technologist, and his family. We were invited to, and attended, the MB&S Christmas Party at 51 Glyn Street, Colbyn, the Berghs' residence.

I now recall one specific detail about my student days. During 1961 and 1962, my first and second study years, we had courses in Physics and in Applied Mathematics, with 3-hour long laboratory work in the afternoons. Physics was taught entirely in **metrc units**, but Applied Mathematics was taught in **imperial units**. Why? Was it because professor H. Verleger had written the Handbook "Fisika 1" and "Fisika 2"

plus the Guidelines for the laboratory work, while in Applied Mathemaics we uses foolscap size roneoed notes that were perhaps a few years old already? Physics 1 was the course with the highest attendance at UP in 1961 – all architectural, quantity surveying, medical, dental, veterinary and engineeering student had to take it, as well "pure" B.Sc. students (like those who were to become teachers). Prof. Verleger (of German origin and ecucation) one mentioned from the stage of the A.E. du Toit Auditorium that the number of Physics 1 students in 1961 was **more than 2 000** – the highest of all courses taught that year at UP. But Jaap Zuidam made me remember (in August 2018) that many students did not need to write the exams. If your mark for class work through the year was high enough, you just "**promoted**" the course. That is perhaps why so many engineeering student had a problem during the second year, when the type of lecturer was different and the work load so extreme – with only three "free" class period per week, and with only one "free" afternoon per two week cycle. I guess that today's students have things much easier.



CITY COUNCIL OF PRETORIA
CITY ENGINEER'S DEPARTMENT

CONTRACT No. 21622

GENERAL CONDITIONS OF CONTRACT

SPECIFICATION

AND

BILL OF QUANTITIES

FOR

THE CONSTRUCTION OF A

RETAINING WALL

ON

PORTION A/1416,

CAPITAL PARK

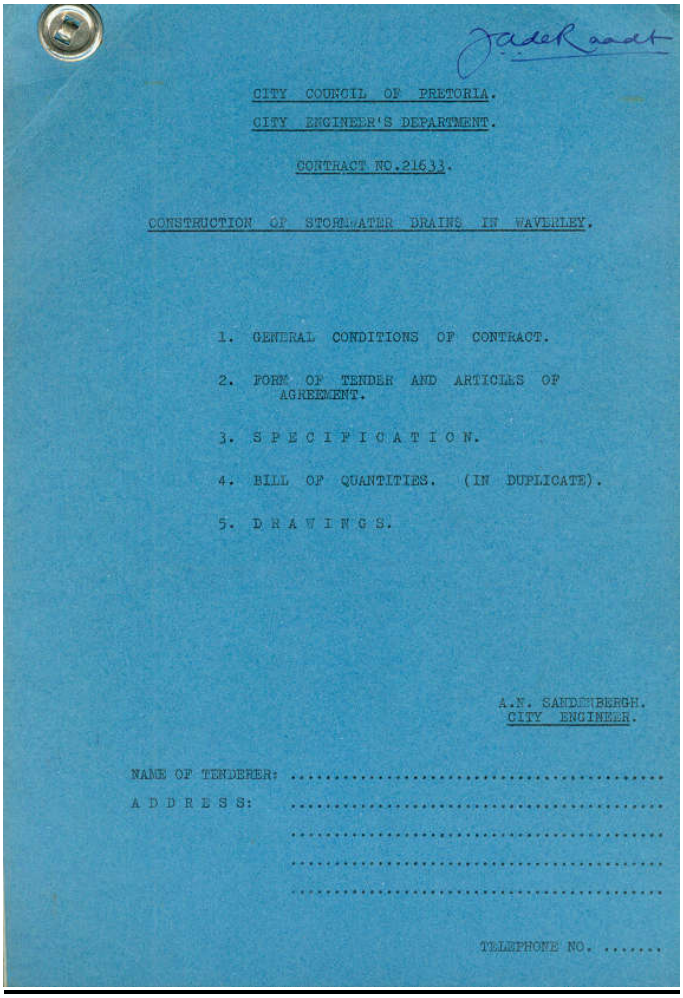
A. N. SANDENBERGH,
CITY ENGINEER,
PRETORIA

MACKINTOSH, BERGH & STURGESS,
CONSULTING CIVIL ENGINEERS,
P.O. BOX 2723, PRETORIA,
PHONE 2-3016.

FEBRUARY, 1969

TENDER No.

MB&S project, tenders closed 1969-02-28, for concrete retaining wall[123] next to Eloff's cutting, Paul Kruger Street, Pretoria.



CITY COUNCIL OF PRETORIA.
CITY ENGINEER'S DEPARTMENT.

CONTRACT NO.21633.

CONSTRUCTION OF STORMWATER DRAINS IN WAVERLEY.

1. GENERAL CONDITIONS OF CONTRACT.
2. FORM OF TENDER AND ARTICLES OF AGREEMENT.
3. S P E C I F I C A T I O N.
4. BILL OF QUANTITIES. (IN DUPLICATE).
5. D R A W I N G S.

A.N. SANDENBERGH.
CITY ENGINEER.

NAME OF TENDERER: .....
A D D R E S S: .....
.....
.....
.....
TELEPHONE NO. .....

Typical City of Pretoria tender document, used for various stormsewer installation projects within the City of Pretoria.[124]

[123] The blasting contract had preceded this contract. The quantities were: 1,000 cub. yd. excavation, 1,350 cub. yd, approved backfill, 948 cub. yd. concrete, 1,831 sq. yd. shuttering, 789 centals mild steel reinforcement, 1,020 sq. yd. steel mesh, 656 lin. ft. handrails and 16 bolts for electric streetlights.

[124] This Waverley contract was for 1 980 ft. of 36" Class A pipe, 40 ft. of 36" Class C pipe, 1 760 ft. of 27" Class A pipe and 40 ft. of 27" Class C pipe. Class C pipe for road crossings (Class 1 bedding and encasing); Class A pipe for boulevards (Class 2 bedding). The Tender Document did not show the actual location of the work, but the drawings (plan ands profile) did.

Mackintosh, Bergh and Sturgess 735 City Centre, 272 Pretorius Street, Pretoria (P.O. Box 2723) ⊿ A. O. Bergh, PrEng, BSc(Eng), MSAICE ⊿ F. Sturgess, PrEng, BSc(Eng), MSAICE	From the same magazine as before – with the firm name, and only two partners in December 1970. Mr. C.S. Mackintoch had already retired by that time. I guess that Mr. Jack Fasken (in the Pretoria office) became a partner shortly after this date, and also Mr. John Woodcock (in the Bloemfontein office.)

In retrospect (2019), I enjoyed my work for the City of Pretoria Roads Department. I might well have remained there for more than two years, which might likely have resulted in a promotion of some kind, some time, and pay raises more then the originally advertised ones. It was an inflationary period. I would perhaps have become a good bureaucrat, like those working for the City a mere 3½ years later…….

But I am jumping ahead with the story. I did not remain in the public sector; I went back to the private sector, at first almost by myself, in a little asbestos-cement office at Dover, OFS, (population < 20 if counted). Isolation from coalleagues and from all kinds of other benefits? Yes, but gratifying in itself, for a while.

Chapter 3 – Resident Engineer, Orange Free State – Mackintosh, Bergh & Sturgess.

On arrival at Sasolburg with the moving truck, on a scorching hot day, Friday 2 January 1970, Mr. Sturgess and his son Mike arrived from Bloemfontein. Mike had brought one of the two pick-up trucks for the project, a brand new Mazda 1300, and Mr. Sturgess' Jaguar contained a huge pile of all kinds of project related paperwork. While the moving truck was being unloaded into the empty house, directed by Lydia and her sister Adri and brother-in-law Leon (from nearby Vereeniging), with five young children exploring the backyard, Mr. Sturgess and I stood at the counter between the kitchen and the dining room to discuss all this important stuff, and he presented me with my first "marching orders". I was to meet Louis van Wyk the next Monday morning at his newly occupied home address, and we would drive down to Dover Station together, where the Contractor was already mobilizing and was constructing a pre-fab site office and site soils laboratory. A "Compensation Meeting" was to be held soon at the Friesland Hotel at Koppies, and I needed to fully prepare for it, and attend. What did I know about the OFS?

Not much. In 1962/1963, I had completed eight weeks of compulsory vacation work at the Bethlehem District Roads Engineer's Office, at a salary of R 840 per annum, (and yes, I really worked on Saturdays). I had witnessed construction of (**a**) the eastern half of the Reitz-Petrus Steyn road, linking Bethlehem with Vereeniging as a two-lane north-south Provincial Road, (**b**) part of the National Road north of Harrismith, (**c**) a road over rail overpass near Frankfort and (**d**) a road over road and rail overpass on the Heilbron Southern Bypass. That construction had all been done by provincial workers and their equipment. I had to write a weekly report on my work activities, in English, the "second language", in the third person singular, and this had to be on my supervisor's desk every Monday morning. Later in 1963, during a course called Seminar 3S, I also had to address "what I had learnt" to my fellow students.

But in 1953, I had also attended Standard 3A at Sentrale Volkskool in Kroonstad, learning a lot of OFS history and geography; the province was not new to me. I have fond memories of visiting a school buddy's parents' farm Oshoek, half-way between Lindley and Kroonstad, where he lived "out-of-town".

And Bethlehem is where I had had uncles and aunts and cousins on arrival, straight from the Netherlands, by train from Cape Town in August 1952. They had all left the OFS by 1970. O yes, I remember it well.

The next page contains the Title Page of my "Report on Holiday Work" on which I received a mark of 14 out of 20. The page after that shows the first of seventeen pages of the report. **Please note how poor my technical English was in those days!**

To this report, I added many pages of work-related "samples" of soils test and survey calculations, plus photos taken with a camera I had bought in Bethlehem, as my former camera had been lost or stolen during 1962. I had actually been "transferred" from Bloemfontein to Bethlehem, before even starting. In my report is the letter signed by Mr. K. J. Harpur, dated 1962-11-07, stating that I had to report in Bethlehem for work on Monday 26 November. Having no vehicle, this was almost impossible, until my father (the amanuensis at the Theological School) discovered that after a few days' of meetings, Rev. Johannes Postma from Nylstroom was to travel from Potchefstroom to a junior colleague, Rev. Wouter de Vos, in Bethlehem, that day. I obtained a ride from him, and stayed over in the Bethlehem parsonage that Monday night, walking to the DRE's office the next morning, **my 20th birthday**. Later that day, I rented a room at a boarding house at 1 Kolbe Street, where a brand new colleague, Mr. Marx, a technician, lived.

(But it was not all "work": I was able to apply for "unpaid leave" for Monday 1962-12-24, (Christmas Eve day) and hitch-hiked to Ladybrand after work on the previous Friday, visiting my oom Andries and tante Bep Domburg and five cousins for Christmas. I even helped out in their butchery that Saturday.)

14/20

REPORT ON HOLIDAY WORK

DONE AT D.R.E.'s OFFICE

BETHLEHEM.

From 27/11/1962 to 22/1/1963.

(Eight weeks)

Compiled by : Jacob A. de Raadt.

I. INTRODUCTION.

The University arranged for holiday work for the student, which should start at Dec.,3rd at Bloemfontein,at the office of the Chief Engineer of the O.F.S. Roads Branch, but in a private letter this was changed, and thus the student started his holiday work on Nov.,20th at Bethlehem, at the office of the D.R.E.

The Road Camp at Bethlehem actually consists of two sections, namely the District Road Engineer's Section, and the Mechanical Workshop. The management of each section is in the hand of an Engineer Grade I, respectively Mr. Steer and Mr. Durand, both with corresponding engineering degrees. Although the two sections are apart, there has always been the best of spirits between the two sections, and cooperation is splendid.

The student had to work in the Road Engineer's Section. In this section there is one more engineer,Mr. Van Niekerk,a graduated civil engineer. There also are two land surveyors,and two surveyors-to-be. In addition to this,there is a well-supplie soil mechanics laboratory,under supervision of Mr. Herbst. In th laboratory the work is done by Mr. Prinsloo,Mr.Terblanche and Mrs.Bouillon. In the same building the Roads Inspector and his clerk have their offices. The building is a 16-roomed brick 2-storey building just outside the Bethlehem township on the Harri smith road,and has been erected in 1955. At the moment it perfectly suits its purpose, as everybody has a room.In the laboratory 4 Bantu find their work.

In the O.F.S. there are 3 Road Engineer's Districts, at Bloemfontein, Kroonstad and Bethlehem. The district of Bethlehem consists of the Magistrate's districts of Harrismith, Vrede, Reit Frankfort, Bethlehem, Lindley, Fouriesburg, Ficksburg,and Clocolan. This is not the exact boundary, but only roughly. The area is subdivided into road districts, to facilitate administration and works. The road districts may be smaller than the magistrate districts, e.g. Warden is no m.d. but an important road district There is an important office and a large camp, because the town is situated along a National Road.

At the moment (Dec. 1962) roads are being constructed at three spots in the Bethlehem area. A National Road is being buil between Harrismith and Warden,and the aim is to finish this road up to the ± 6 miles existing tar road north of Harrismith. The road is built from Warden onwards. Before Christmas this is to b finished, to carry the traffic during the holidays, as this road is ± 30 miles shorter between Johannesburg and Durban, as compared with the Volksrust road.Another fact is that it is easier to the engine, as Villiers-Harrismith is one straight. The road wil reach the Harrismith-Van Reenens pas road just east of the town.

Another road under construction is a special road linking Frankfort with the above-mentioned National Road at a farm Flatrand, between Cornelia and Warden. The third road being built is the provincial road Reitz-Petrus Steyn.

Not at all the least important aspect of the works is the maintenance. This is being done by special units. If necessary, roads are repaired, but usually the roads are completely reseale The many secondary (=gravel)roads and tersian roads are cared fo by the various construction superintendents, in accordance with reports from the road inspectors.

An interesting aspect is the change in policy with the change of chief engineer. In Mr. Van Belkum's days, when he was chief engineer, the idea was to make short strips of tar radiat-

Bethlehem District Engineer's Office, OFS Provincial Roads Department, January 1963.

I will now attempt to present the highway construction project's history prior to and during the design stage, as I was able to discover in early 1970 (and had known since 1963, see the above). Originally, when Mr. van Belkum had been the Chief Engineer, provincial road construction in the Orange Free State started out as short sections from the various Magisterial District Centres (= the major towns). But in the 1950's already, (under Mr. de Villiers or Mr. Harpur?) a proper construction and maintenance program was set up under three District Engineer's Offices – Bethlehem, Kroonstad and Bloemfontein, for a network of Provincial Roads. (With the development of gold mines around Welkom, there might also have been a fourth District.)

The Koppies Settlement had started as an irrigation project town in the Heilbron Magisterial District. Irrigation had been possible since completion of the Koppies Dam on the Renoster River in 1912. This project had been started by the government of the Orange River Colony in 1909, prior to Unification. General Christiaan de Wet, of Second War of Independence (1899-1902) fame, had lived there, also when he was arrested and convicted as a rebel in the aftermath of the failed 1914 Rebellion, opposing South Africa's participation in World War I. Many of his descendants and other relatives still lived in the area. Koppies did not have a paved road access, being somewhat "in the middle of nowhere", though it was located on the main railway line between Kroonstad and Vereeniging. Poor materials (black clay) existed in the area, and it was only in about 1965 that a seven miles long road had been built between directly north of Koppies and Greenlands Station, called P 30/1, including a railway overpass at the latter location. This road consisted of a 20' wide chip-seal road with 6' shoulders[125] within an asymmetrical 100' wide right-of-way (meaning 60 Cape foot right and 40 Cape foot left of centre line), along which farmers would drive their cattle and sheep to stock auctions at Koppies. In 1968, a railway overpass was built just north of Koppies Station, and although the main streets in downtown Koppies were also paved, there was a "missing link" of blacktop north-west of town (and also south of town, via Heuningspruit Station to Kroonstad). The new project actually started at the bottom of the Koppies railway overpass, on Link Road A102. I notice on GoogleMaps that the south part of the project (i.e. a skew intersection with a gravel "secondary road") no longer exists, as it has been relocated toward the east to a new asphalt road.

In checking some old South African AA road maps, it struck me that the northeast Orange Free State is actually very much "rolling terrain" according to terminology used by the FWHA in the United States. What I mean is that there are many fairly shallow river valleys, (in which the towns and most roads are located), and fairly high hills in between. But to the west of Heilbron, everything flattens out, without substantial ridges, and a much higher percentage of plowed lands than further east. In general, elevations decrease from east to west, and all the rivers flow in a northwesterly direction. Sample elevations follow:

Koppies: 1 421m Lissagally: 1 499m Coalbrook: 1 503m Heilbron: 1 573m Parys: 1 416m

Sasolburg, a very real company "New Town", headquarters of SASOL, the South African Coal and Oil Corporation and its booming "gasoline from coal" plant, as well as a centre with a variety of spin-off

[125] This roadway standard was surely already "outdated" five years later, particularly in a maize growing area. But I remember the Potchefstroom-Parys road, which in 1956 had an 18 ft. wide chip sealed surface without paint lines. I have the 8mm movie on which my father and I change a tire (tyre?) on our 1940 Studebaker Champion. My mother operated the Eumig cine camera, a present from her father. In 1965, I used that camera for my thesis at UP.

petro-chemical industries by other companies like African Explosives and Chemical Industries (AE&CI), and even an "under construction" NATREF oil refinery (jointly owned by SASOL and the National Iranian Oil Company - NIOC), had mushroomed since the early 1950's and was linked by paved Provincial Roads to Vanderbijlpark (Transvaal) where the second ISCOR steel plant existed, to Parys in the west, and to Vereeniging (Transvaal). Just east of Coalbrook Station was a triangular shaped "Road Camp" area, around which three roads met – those from Vereeniging, Heilbron and Sasolburg. GoogleMaps shows that Regional Road R82 bisects this former road camp; the eastern part still used for that purpose.

It must have been in the early 1960's already that farmers at Koppies complained and then decided that they were not going to renew their vehicle licenses because they "actually had no roads to drive on". One of the leaders of this group was related to Koppies' MPC (Member of the Provincial Council[126]), who was also the province's MEC (Member of the Executive Committee) for Roads[127]. I understood that some of the leaders of the dissatisfied group of people had been charged, convicted and fined, and then refused to pay their fines, so that they were actually put in jail for a short while. This strange situation became a political embarrassment to the elected officials in Bloemfontein[128], and at some date that I do now know, the MEC (or was it the Administrator?[129]) made a formal announcement that the short "missing link" west of Koppies, as well as the extension of the road north of Greenlands Station, all the way to the Coalbrook Station area, would be built soon, in fact: "**The Contractor will be on site within six months**".

I do not know exactly what the Bloemfontein office of MB&S's involvement was in the design prior to this provincial government announcement. Frank Sturgess (born in 1920 at Clocolan) had been an OFS roads engineer who had (like many others) left the public sector and had joined two former Transvaal roads engineers (C.S. Mackintosh and A.O. Bergh) in the early sixties, with Frank Sturgess in charge of the Bloemfontein office. I knew that the Koppies railway overpass had been an MB&S project, because Louis van Wyk and an older Clerk-of-Works, a Mr. Monty Pistorius – whom I later met in Bloemfontein – had supervised that project for a Contractor that had shortly afterwards gone bankrupt. Perhaps the "missing link" had been a small MB&S design project (length 14 000 feet (140 chains), and the additional length of 155 000 feet (1 550 chains) north of Greenlands Station was somehow added to the project, with a request: "Have this design completed and advertised a.s.a.p., together with the "missing link"." These things sometimes happen due to political interference into the bureaucratic process. But thinking about it after more than forty-five years, the section north of Greenlands was not really a "completed design" at all. It needed a lot of refinement and even redesign – which became my on-site responsibility.

For example: The horizontal point of intersection for the 11 mile long tangent north of Greenlands and the stretch coming off the Greenlands railway overpass had been located at night, by some stellar interpolation (based on the 1:50 000 maps mentioned earlier). Cross drainage culvert locations were shown on the drawings as approximate (with the words "5 culverts per mile"). The locations and design details of crossroads did not exist on the drawings at all – not as I had designed some of them during my time with BSB&P (according to Transvaal requirements) a few years earlier. Very soon after my arrival, I discovered that the amount of slab reinforcing steel on one structure (Lissagally Road over Road and Rail Bridge) was shown as only 50% of the actual quantity. There were many things that I needed to redesign as construction of P 30/1 proceeded from south to north. And there was also the likelihood of "extra work" based on a number of (political) decisions that had yet to be made (see below) covered under

[126] Comparable to a Member of the Legislative Assembly (MLA) in a Canadian provincial or territorial context.
[127] Comparable to the "Minister of Highways and/or Transportation" in a Canadian provincial or territorial context. This was likely Mr. A.C. van Wyk, (who had addressed the SAICE's Highway and Traffic Division's Conference at Allemanskraal in March 1967.) Mr. Fred Wentzel (from Frankfort) had previously held that position.
[128] Most likely: The National Party was virtually the only political party in the Orange Free State at the time.
[129] Not quite comparable (but close to) the position of "Lieutenant Governor" in a Canadian provincial context.

"contingencies". A recipe for disaster, or a challenge to be met head on? Lastly, Contract No. 1/1968 was one of the last OFS road construction designed in imperial units. All future contracts would be designed and built in metric (SI) units. Metrication had started in South Africa with a vengeance.

Now why on earth would I ever need or want to get involved with one of the last[130] projects designed with feet and inches, gallons, degrees Fahrenheit and cubic yards?[131] Metrication had been a "top-down" decision by the South African "government" in 1968/1969.[132] This project still had all drawings and pay items in the older system, while I also became responsible (from mid-1970) for the supervision of site surveying of an adjacent road project (the east-west link near Coalbrook and the reconstruction of the road to Heilbron) that was to be surveyed, designed and tendered in nothing but metric units. Under my **de facto** though not **de jure** supervision was another soils technician, Mr. Basie Lombard,[133] who was locating "borrow pits" the along this proposed project, called P 9/1**.** The road between the Coalbrook triangle and Heilbron had originally been built around 1954 and was in really poor shape. Fanus Rautenbach, the radio host of "Flink uit die Vere", a morning program on the Afrikaans service of the South African Broadcasting Corporation (SAUK / SABC) had made numerous on-air jokes about the numbers of potholes along this road. I later heard details from a long-term employee of ESCOM (the nationwide Electricity Supply Commission), Mr. Gilfillan PrEng, supervising electrical engineer of the Taaibos and Highveld generating stations, and also from the Heilbron Roads Superintendent. Supposedly, its construction materials had been poor and site supervision had also been pitiable, as he quipped: "with more whiskey than lime in the base course". But reconstruction of P 9/1 also intended to upgrade the road – with wider shoulders and more structural layers.[134] No wonder, traffic had increased and desin and construction standards had been raised.

The P 30/1 project (currently called Regional Road R82) contained four major structures: two river bridges and two railway overpasses. There were also about a dozen reinforced concrete box culverts (mostly 6' or 8' high), sized for stormwater flows, although it was obvious and generally accepted by the public) that they would also be used as underpasses, not colloquially called "cattle creeps" for nothing. One particular double barrel box culvert happened to be located in a meadow near a very skew farm boun-

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[130] Jaap Zuidam supervised construction of "Clarens-Golden Gate", which was also in imperial units. He had to take over, (according to Mr. Grodsky), from a Greek immigrant engineer (Ioannides?) who was removed from the project by the consulting firm Jeffares and Green. Jaap and Magda lived in Bethlehem during their contract period.

[131] In Arizona, a State that had originally adopted metrication in the 1990's (following the lead of the FHWA) and was then forced to return to the former system, it is called "US Customary Units". No longer imperial units, eh? Strange, because in British Columbia, Canada, 2017 property assessments still show "acres" and "square feet"…… **But the real answer to the question "Why?" is that in His infinite wisdom, God prepared me for later work.**

[132] My proposed 1970 chip-seal resurfacing project in Pretoria was drafted with metric units in mind, and there were all kinds of published guidelines about the changeover. A classic example of the government's determination was the rejection of the importation of a crateful of US-made dual-measure micrometers at Cape Town Harbour. "This is a metric country – we do not allow these instruments", was said, and the crate was simply put back on the ship.

[133] He was a taciturn bachelor from the MB&S soils laboratory in Pretoria, which handled work in both provinces.

[134] The location of P 9/1 consisted of three long tangents, with individual lengths of 6, 7 and 8 miles long. These were connected by small "horizontal kinks" on top of ridge where vertical crests existed. On the tangents, vertical alignment went up and down and up and down, so that one could see where the next directional change would be. This design feature was a typical OFS highway characteristic at the time. The conceptual design of these highways had been done by their Mr. P.A. de Villiers, who had (I think) had some US training (in the late 1940's?) and later went to National Transport. In Transvaal, a more curvilinear approach of highway alignment – so that the road would follow the "lay of the land" wherever possible – had been in vogue since highway design started, which was "after the railway came". One example would be the Potchefstroom-Parys road that I knew quite well. This is also very different from road layout according to the historical perspective in Canada's prairie provinces (with nothing but square farms), but not unlike what (in my view) happened in the rural parts of British Columbia.

dary. The obvious solution[135] for which I had to make on-site detailed decisions, after the "Compensation Meeting" had already agreed to this, was to locate the structure in such a place that both farmers could use it – and fence adjustments on both ends (with some neighbourly give and take) ensured that this could and would happen. Another farmer, the first one directly north of the "start of project" at the overpass near Greenlands Station, wanted a higher internal clearance in an already designed 10' wide concrete box culvert, so that he could use it for his agricultural equipment. He was also accommodated, and I modified the lengths of the reinforcing bars, without even changing any of the formwork or concrete details. Fortunately, I could do that because cover was adequate; I did not need to change grade at that location.

The one-span **Goedverblyf River Bridge No. 1412** (near the north end of the "missing link" section at Koppies) was of the same typical design as the four-span **Kromelmboog** (or Kromellenboog) **Spruit Bridge No. 1408** directly east of Dover Station – 40' long spans on solid abutments with wing walls and wall piers, and on top with concrete railings to which W-beam guardrails were fastened. The small river bridge crossed the centre line at right angles, and the larger one had a 20 or 25 degree (I think) skew. It was considered feasible to build both these bridges in the dry season, which is winter in the OFS. The Goedverblyf River one one box culvert were built in the summer-fall of 1970 (meaning February-May), some box culverts north of Greenlands would follow, so that the Kromelmboog Spruit bridge opposite near Dover would be built in the dry season, (and yes, temperatures became important, because pouring concrete at low temperatures was not allowed, in terms of the Specifications). All the other box culverts, as well as both railway overpass structures, were further north. The **Lissagally Road over Road and Rail Bridge No. 1409** was a 5-span bridge, including "jack spans". It was southeast of Wolwehoek Station (over the Wolwehoek-Heilbron railway line, with one northbound and one southbound train per day), and it also crossed the gravel road parallel to and north of the track. The other one, **Amelia Road over Rail Bridge No. 1410**[136] (and I remember the boundary of a farm called Leitrim or Antrim ran directly north of this structure) was a 3-span bridge, including jack spans, east of a "pan" or dry lake one of these farms, called Molensteenpan (or Meulsteenpan). This bridge was almost directly east of Coalbrook Station, over the railway line linking the SAR main line with Clydesdale Collieries[137] and both Taaibos and Highveld Power Stations, with perhaps one very short coal train per week. These four bridges needed their bridge numbers and the year of construction shown on the headwall, but (unlike my much later experience in Arizona) none of the box culverts had a structure number or the construction year shown.[138] Both railway overpasses, approved by the SAR, were to be fitted with galvanized hardware in the concrete deck, for future train electrification! The Lissagally[139] structure was in fact designed for future "double tracking" of the line! The north project limit for D&M's contract was at a point in the middle of nowhere, (meaning in the middle of a maize field) on the farm Leitrim (or Antrim), strangely shown as "chainage 50+00", an indication that future construction work would follow toward the triangular Road Maintenance camp.

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[135] This idea was actually developed by the farmers, during the Compensation Meeting – see below, and "Part 2".

[136] On GoogleMaps, I notice that this railway line has been abandoned, although the bridge structure still exists. A long concrete box culvert has been constructed through the middle span. Furthermore, **a T-intersection** with R 549 (the road to Deneysville, not even in anybody's mind 50 years ago) has been built right **on top of the bridge**, so that (very oddly) the west headwall remains (showing 1971 as its construction year) and the other one is ….. gone!

[137] A massive underground mining accident had occurred at Clydesdale Collieries on 21 January 1961. I remember being glued to the radio for after midnight broadcasts about rescue operations, a week or so before I left my parental home for studies in Pretoria. 435 workers were buried alive when the mine collapsed. The mine was close to the end of its viable lifespan, had formerly served the open market by way of this railway line, and served ESCOM's Taaibos and Highveld generating stations. Built in the early 1950's, these facilities were outdated already in 1970 and only served as back-up to ESCOM's countrywide power generating system. Their (clean) cooling water came straight from Vaal Dam by very long concrete pipelines that crossed P 9/1, the Heilbron Road.

[138] In the United States, box culverts are considered "structures", and need regular Bridge Inspection Reports.

[139] It was common to name bridges after the farm on which the structure was built, unless the stream had a name.

The construction contract, in the amount of **R 2,113,105-35** had already been awarded to a Pretoria based firm called D&M Padaanleg (Edms.) Bpk.[140]. This firm had been started by two ex-TPA employees about ten years earlier; this was their very first road construction project in the OFS. The company had recently been taken over by Volkskas Bank, perhaps due to financial over-extension by the original owners due to "too much workload" or even "intended retirement". A number of other construction companies were being taken over by financial groups in those days, and this sometimes caused friction with provincial engineers.[141] Mr. Koos van Wyk was D&M's foreman and Mr. Ulrich Wessmann PrEng was the Contractor's engineer responsible for the project, visiting from Pretoria at least once per month for a few days. He was occasionally accompanied by Bill Swemmer PrEng, and once or twice by Mr. Dante Marais, one of the two founders of the firm. I understood that D&M stood for "**D**e Wet & **M**arais".

The Sub-Contractor for the structural works (bridges, concrete box culverts and pipe culvert headwalls) was a Pretoria based firm Berghout & Rouvoet[142] (Edms.) Bpk. Their long-time employee Herman Heikens was foreman for their part of the project. There were additional Sub-Contractors for other parts of the work, like fencing, trucking and hauling of materials, as well as chip-sealing, which was on an "as required, when required" basis. Supervising the project on behalf of the OFS Roads Department was Mr. Grodsky, an engineer of Polish extraction, who regularly visited the site with Mr. Frank Sturgess for a single day, out of Bloemfontein; I never met anybody from the Kroonstad District Road Engineer's office.

During the first week of January, Louis and I established ourselves into our brand new asbestos cement[143] pre-fab offices at Dover Station, with the piles of paper that Mr. Sturgess had brought, and with my Remington 12 typewriter that I had bought during my student days for R 3. Louis was used to a field office, I was not. My office was 12' x 12' and Louis' office was 12' x 12' attached to a 24' x 12' soils laboratory. I was given a young and fairly bright personal assistant named **Josef Molefi**, while two of Louis' three assistants had previous soils testing experience (from the Koppies project). The salaries of these four black labourers were to be paid by D&M. My pick-up was a brand new Mazda 1300 and Louis' pick-up was a brand new Mazda 1500, both light blue with Bloemfontein licence plates and no logos or decals on the doors[144]. We were requested to drive to work together when possible, and we did this for the first half-a-year or so. I normally picked up Louis at his home, as this was closer to Coalbrook Station where we left the asphalt and took the rough gravel road parallel to the railway line, through the Wolwehoek Station site and then passing the Ywer siding and crossing over from the west side of the tracks, back to the east side about a mile or so north of Dover Station. However, as the work progressed, driving together became less feasible; each of us had things to do "on the way to work" or "on the way home".

The alignment of P 30/1 was completely inaccessible from other roads at the time; it was located east of the original north-south railway line through the Republic of the Orange Free State. This had been the

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[140] Mr. Dante Marais had been a TPA Roads Department engineer, and Mr. (NN?) de Wet (whom I never met) had been a TPA roads foreman. The term "(Pty.) Ltd." is the English equivalent of "(Edms.) Bpk."

[141] The story went that one civil engineering contracting business had been taken over, and very soon became the "low tenderer" for a substantial project, because the new Owner (a bank) had insisted on that process (= that the tender be "low-balled"). During the pre-construction meeting, quite unexpectedly, the Contractor already came up with a long list of "variation orders", "change orders" and "extra work orders". The provincial engineer (and I do not know from which province) was almost bowled over; because such a thing had never happened before.

[142] Both principals were Dutch immigrants, and so was Herman Heikens. Mr. Adriaan Rouvoet was a Dutch trained HTS'er (eligible for PrEng status), and he was responsible to D&M for their sub-contracted part of the project.

[143] These buildings, used extensively for school class rooms, were called "temples"(!). Two firms provided asbestos-cement products in South Africa at that time. Everite (with Italian technology) had factories in Transvaal and near Cape Town, the other firm was based in Natal, and was smaller. I only read about them (guess where?).

[144] Consulting engineering firms were not allowed to advertise themselves at all, not even by large print headings in the Telephone Directory or the Yellow Pages. Mr. Bergh later told me that these were FIDIC rules. But today???

political football in the 1890's, causing the "tariff war" between the (Cape Colony owned) railway company and the South African Republic (ZAR, meaning Transvaal). During the double tracking project of the line, including electrification, in the early 1960's, a minor horizontal realignment (shortening) had been built near Ywer Siding, halfway between Dover and Wolwehoek.[145] But there was no real way to adjust to impossibilities; this was still an area without any roads. I do not recall if our "office complex" had electricity or not, but think we did not. The lab used propane.

While settling in at 19 Collins Crescent[146] and at Dover Station (during working hours), my first priority was supervision of the work near Koppies; the Contract stipulated that work should start there first, and that work then proceed north, starting at the north end of the Greenlands Overpass. Fencing of the road reserve had just started, with fence poles from recycled and tar-dipped 60 lbs/yd. railway tracks (a common article in South Africa, not seen in North America) at specific locations (for cross-fences and gates).[147] The 5-strand barbed wire fences were at 50' Cape foot left and 50' Cape foot of the centre line of the road. B&R had just started abutment excavation for footings of the Goedverblyf River Bridge on the "missing link" north of Koppies, on the day that I first drove to Koppies. In fact, their foreman Herman Heikens had just has some (minor) job related accident (the details of which I do not recall) when I arrived, and I therefore remained with him until he was taken to the (small) Koppies Hospital for a check-up. Thys Uys, a recently hired local carpenter, took him to hospital, by pick-up truck of course, who had heard about ambulances in Koppies? Before leaving, Herman asked me to tell his wife Thelma, (on my way back), that he would likely be home "late". He directed me to where they has just moved in – the former Greenlands Station School House. That day, I first met Herman and then Thelma (who had been a nurse, but I tried not to scare her with the news). Our families (and children) became very good house friends in the years after this construction project was completed. I saw Herman later on a very difficult and complicated railway realignment bridge project in Muckleneuk, Pretoria; we visited them when he was building a major bridge near Gqweta in Eastern Transvaal, on the road to the Hoedspruit Air Force base, and after that project had been completed, I drew the building permit plan (a pastime I engaged in occasionally) for their house at Rynoue Agricultural Holdings, northeast of Derdepoort.

I had approximately two weeks to review the set of Construction Drawings for the Contract prior to the Compensation Meeting. I also reviewed a set of (Bloemfontein-prepared) "Compensation Diagrams", one for each of the individual parcels of land that would be affected by P 30/1, showing a road reserve that mostly ran right through the maize fields or pasture, or (in a few cases) next to the property line. In general, parcels of land would be "bisected". Why "road reserve" and not "right-of-way", the term used in North America? Well, under OFS laws and regulations, the Provincial Administration only obtained the "right in perpetuity" to build a highway across the farm, while the land ownership itself, as registered in the office of the Surveyor General in Bloemfontein (the provincial capital) remained intact. The farmer therefore still "owned" the complete farm, although the fenced highway crossed it. This meant: No legal drawings or right-of-way surveys to be prepared. The road was proclaimed to be built, by way of a Notice in the Provincial Gazette, and plainly stated to be located "where described on drawings in the Engineering Office of the Provincial Roads Administration." Plain and simple. In January 1970, that proclamation of P 30/1 and Link Road A102 had already occurred. It probably occurred just after the field survey had been completed and approved by the Roads Department in Bloemfontein.[148] The

[145] From a local farmer, I heard the following story. When he had asked the railway engineer why this realignment had not been a bit longer, the answer had been: **"Because I want to ensure that my son will also have a job."**
[146] This house and address no longer exist. The downtown commercial area just swallowed up this residential area.
[147] Used steel railway sleepers (called "railway ties" in North America) were also used for the corner fence posts.
[148] While working for MB&S in Bloemfontein a few years later, one specific farmer "went political" when asking about the location of the new highway between Bethulie and Goedemoed, necessitated by the construction of the Hendrik Verwoerd Dam, during the time that the field survey was being done. After some "doodling" and some

Compensation Meeting mostly needed to determine how much, and in which way(s), the owners, (of whom almost all were **real** farmers) would be compensated for the fact that they would lose income from the land on which the new highway was to be built. This compensation consisted of the following parts:

- Payment for the area of land taken. Because this was not an actual "take" (not to be registered by the Surveyor General), I want to make clear that the farmer basically only gave up his potential "income" from a strip of land, for an indefinite number of years. P 30/1 and A102 are now (2019) 48 years old, and still in the very same location. Until a few years earlier, the Provincial Administration had not paid any compensation for "pasture", but they had paid for "ploughed lands" only. In 1970, there were three separate "base rates", one for each type of land: Pasture, ploughed lands, and orchard[149].
- Provision of farm gate(s) for the property; one if the road reserve ran along the property boundary; and two if the land was being bisected. Gates had to be opposite each other, if at all possible. (Only if a parcel was bisected by a stream that crossed the road, an additional set of gates would be allowed.) The exact gate locations were to be "approved" by the Resident Engineer – and this was to be considered during the Compensation Meeting – while the gates (and the driveways) would be installed by the Contractor, "as directed by the Resident Engineer"[150]. (The Construction Drawings had shown no gates or driveways; the Compensation Diagrams had shown the "tentative" gate locations only.)
- Two types of "Water Compensation" existed, but only for parcels of land that were to be bisected by the highway. Farmers were allowed to choose between these, at the Compensation Meeting. Either:
  - Money to drill a borehole for water on one of the two portions where no windmill existed;
  - The installation of a 4" dia. galvanized steel pipe "from fence to fence", meaning 100 Cape feet, (say 104 feet) if at right angles to the centre line. Through this pipe, the farmer could at his own cost install a plastic pipe (between an existing windmill on one side of the highway to a proposed water trough on the other side of the highway) to get eater to the other side.
- Compensation for "borrow material" (as a royalty) to be taken from pits to be dug on the various farms along the route. (So in fact it was not "borrowed" but "taken"!) These borrow pits had already been explored by Louis van Wyk, with all testing in the Pretoria soils lab, and the farmers knew where substantial holes were to be dug on their farms. The OFS Provincial Administration had notified property owners about this. As Resident Engineer, my involvement was to verify the monthly statements of borrow from each pit, provided by the hauling sub-contractor to me through D&M, and I would write this up as a set of "statements" and drive over to all the farmsteads and receive the owners' signatures, and mail statements to Bloemfontein. After completion of restoration of the borrow pits and the dirt tracks where the hauling trucks had made some nasty ruts, including gate and fence restoration (all this was D&M's responsibility), I also needed to get "release forms" signed by the farmers.

On the day of the Compensation Meeting, it was "full house" in the ballroom at that the Friesland Hotel. Mr. Sturgess came from Bloemfontein and brought Mr. T.E.J. (Theo) Hoffmann with him, who was introduced as my new colleague. Theo had designed the bridges (and had surely also had a major hand in the design of the road). The Highway Maintenance Foreman (a Mr. van der Westhuizen) from Heilbron attended, the MEC was obviously there as chairman, and I believe that this was also the first time that I

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office discussions (by Mr. Frank Sturgess, civil servants and the MEC), a decision was made to relocate the centre line of the road further away from the farm's homestead. This was a rare occasion of some successful "after the fact" public input. See "Part 2".

[149] There were (obviously) no orchards on the P 30/1 project. Come on, this is the Riemland! I once heard a story of a dam (called a "reservoir" in North America) that was going to be designed and built by the Department of Water Affairs. In order to keep the costs low, and for political reasons, the site survey was done quite secretively. However, one farmer suspected something, and decided to plant 25 000 peach pips on the lower reaches of his farm, just in case. 0No irrigation, fertilizer or care at all, just the rain. But later, when the Department of Water Affairs came to this farmer, they found almost 25 000 peach trees, for which compensation then had to be made.

[150] The Contract between the OFS Roads Department and D&M actually abounded with this particular phrase.

met Mr. Grodsky from Bloemfontein. Almost all affected farmers attended, for both the Koppies section and the Greenlands-Coalbrook section. The MEC, (likely Mr. A.C. van Wyk) opened the meeting, and after introductions had been made (including me), he almost casually and "up-front" stated what the "base compensation rates" for the land on this project would be. It was clear that these rates had already been predetermined (in camera?) by the Provincial Council, and how he saw his role in making this statement, just fulfilling his former political promise.

The audience seemed to be satisfied. The amount that was then announced by the MEC for "borrow material royalty" was the (as expected) "half a cent per cubic yard". And then he started to speak and describe the other types of compensation, and how they would be handled on the many individual cases. Well, everybody already had a diagram in hand for his or her[151] own property, and had had this mailed to them prior to this Compensation Meeting, it seemed easy to just agree to that.[152] I remember that the MEC requested those with serious objections to come forward and then present their case. Not many people made use of the opportunity, but some did; a number of "sticky issues" were sorted out that evening. When time marched along and people wanted to get home, Mr. Sturgess said something (in Afrikaans, of course) along the lines like: "Jacob de Raadt, this young man here next to me, who is our Resident Engineer, will be available to meet with each one of you separately, during the next couple of weeks – and this is his phone number at Dover – will that be OK?"[153]

Our "field offices and soils laboratory complex" was on the same property as D&M's yard, on the gravel road east of Dover Station, a short distance south of the pedestrian railway overpass. (On GoogleMaps, one can still see it as a square "darker green" area, with some concrete footing remnants.) The first few weeks, we had to run over to D&M's office to accept a phone call; I later had a separate phone in my office. It was a real old fashioned desk type farm phone, which one had to crank to get the attention of the operator, the Postmaster in the Dover Post Office just across the railway line, only a pedestrian bridge away. That's where all our mail had to be picked up and handed in; the mail went out by the southbound train at 3 p.m., and it was good to know that, because I normally scheduled to finish any letter or report (including the monthly payment certificate) by that time of day, signed by D&M's representative (Uli). We knew that letters and packages from Dover would be delivered to Mr. Sturgess' desk the next morning. A payment certificate would clearly require his review, signature (he always wrote with green ink, I recall!) and then delivery to Mr. Grodsky, just a few street blocks away by foot.

D&M had leased this vacant but fenced land, a former pipe yard site, used when the first (oil products) pipeline (12" dia.), the "Bayhead to Langlaagte" pipeline (meaning: between Durban and the Witwatersrand), was built, around 1964.[154] This pipeline's route was about half a mile east of the railway line; it

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[151] Strange, but I cannot remember meeting any farmers' wives at that meeting. Later on, I met some of them.

[152] I do not know who sent out these Compensation Diagrams by mail. This could be easily viewed as the obvious responsibility of the consulting engineer, or just as easily as the responsibility of the Roads Department itself.

[153] Mr. Sturgess' father had been born in Clocolan in 1879, and his mother in 1880, both of 1820 Settlers stock. Frank (1920-1997) was their seventh of eight children. He completed his high school in Clocolan as the sole English-speaking student in his class. This was in 1938, the year that Afrikaner nationalism (and language consciousness) bloomed, called the Voortrekker Centennial Year. In his house in Bloemfontein, he once showed Lydia and me and his Standard 10 Class Photo, on which everybody wore "Voortrekker clothing" (and he had a beard!). He also told us that he had excelled in Afrikaans in Standard 10 (Grade 12 level), and we guessed that this was likely "Afrikaans Higher Grade" – or whatever they called it in the OFS. And he had worked with Afrikaners since completing his University studies after military service in WWII, together with many other young South Africans.

[154] The "Beira to Umtali" pipeline was also built in 1964, serving an oil refinery at Feruka in "soon-to-be" independent Rhodesia. This pipeline was completed on time, according to The Hume Pipe Company (South Africa) Limited's advertisement in "The Civil Engineer in South Africa", February 1965. It was a 10" internal diameter steel pipe, 180 miles long, operated by the "Companhia do Pipeline Moçambique Rhodesia, S.A.R.L." But

crossed P 30/1 half a mile north of the intersection north of the Greenlands Overpass. A second and quite new (crude oil) pipeline, (18" dia.), the "Richard's Bay to Sasolburg" pipeline, crossed P 30/1 further north, at a very skew angle, near ESCOM's Taaibos and Highveld power generation stations.[155] This pipeline also crossed P 9/1, somewhere near Heilbron, and this was obviously crucial to the NATREF refinery. D&M's work (in fact, B&R's work) included building crossings for these two pipelines, which I will now try to describe, giving you an indication of the "security measures" taken in light of the potential of terrorism, sabotage and attacks on infrastructure, to which South Africa had already been subjected since the 1963 Rivonia situation and Nelson Mandela's "Umkonto we Siswe" (Spear of the Nation).

Pipelines were under the control of the SAR; detailed drawings had been prepared for the pipeline crossing structures. They were concrete "Precast Portals" (5' x 5' their internal size, in 4' lengths) on a "cast in-situ" concrete slab, longer than the full road reserve width, with padlock equipped manhole covers on manholes equipped with manhole rungs on each side of the road reserve; padlocked access gates were built in the fences nearby. Efforts were made to stop water infiltration between precast portal sections: Asphalt wrapped burlap was to be "glued" with liquid asphalt to the concrete, on top of and along the sides of all the joints. Inside each of these culverts were steel "pedestals with saddles", so that the pipe was secured and not suspended, and also to allow future "inspections". During the short period that the pipeline was exposed, the pipe would be "rewrapped" with a special machine, and this work was done by a specialty firm. On completion of the project as a whole, when D&M's needed to be released of their responsibility, an SAR official came to inspect the pipeline crossings, with keys to gates and manholes.[156]

The MB&S Field Office was close to the gravel road next to the railway line; D&M's office was further back, and the yard was also used for equipment storage. In early 1970, D&M staff attended an auction where equipment was sold from the bankrupted firm that had built the Koppies overpass project. They bought two old Adams graders (for R 100 each) and brought the inoperable "junk" (by truck) to the Dover yard. But it so happened that the old Adams grader that D&M already had on site (which was only used for stripping and grubbing, because the blade mechanism was worn out and inaccurate) broke down and needed new driving chains – the chains within the areas connecting the axles. So the mechanic was asked to open up one of the scrap Adams graders, and found a set of almost new chains, which would have cost R 600 **if still available**. Mr. Appel[157], their site mechanic, then exchanged the parts and saved the day. He and his large family lived in the Dover School House, just north of the camp, near the sandstone

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less than a year later, on 11 December 1965, Mr. Ian Smith's government signed Rhodesia's UDI (Unilateral Declaration of Independence)? What happened then? Encyclopædia Brittanica, Vol. 18, (1972 edition) states: "In April 1966 considerable British diplomatic pressure was brought to bear on the Portuguese not to permit oil to be piped through this line to the rebel regime in Rhodesia. At the same time, a British naval patrol was mounted to intercept any vessels intending to discharge oil for Rhodesia at Beira. In December, responding to the UN Security Council resolution imposing economic sanctions, including oil imports, on Rhodesia, Portugal announced that it did not mean to supply oil to Rhodesia but that it would not attempt to control such provisions to Rhodesia. The interests of the Portuguese in Moçambique, however, clearly lay in maintaining white rule in Rhodesia, and the traditional policy of good neighbourliness continued." A South African firm gave Mr. Smith a car, South Africans collected money and sent many drums of petrol (=gasoline) across the Limpopo; followed by years of South African support of Rhodesia, as well as increasing sanctions of South Africa by much of the world.

[155] The aptly named Kragbron (="Power Source") Post Office served these facilities, housing areas and the colliery.

[156] At that occasion (February 1972) I accompanied the pipeline inspector on his visit, noticing that the one culvert was more than half full of water. All design efforts had somehow ignored that groundwater is very difficult to stop. I sometimes wonder if it would have been better to "do nothing at all" and leave the pipe covered up as it was.

[157] After one of D&M's bulldozers had broken down, a replacement Caterpillar D7 was rented. It came by lowboy, and was blue – unusual for that brand. Mr. Appel saw the machine and seemed to recognize it as the D7 that had tumbled down a ravine while working near Magoebaskloof, in Eastern Transvaal. The proof of the pudding? He sailed right under it, and directly noticed the rebuilt frame. Rental equipment may be suspect……..

Dover School. This family extended the life of the Dover Primary School by two years: when the four "Appeltjies" left, it was permanently closed, just like similar rural schools at Greenlands and Wolwehoek had already been closed. (Dover school and house are still visible on GoogleMaps, in a derelict state.)

It very soon became clear that the Mazda 1300 pickup was "just too light" for this rural highway construction project. Going along the recently cleared and grubbed sections, where fencing was being installed, on an almost daily basis, was tough, and more than a few times, I had an almost collision with the steering wheel. The one time that I did hit the steering wheel, I had a bloody but not broken nose. Josef also got some bumps now and then. The access roads to individual farms were sometimes not really passable, and then there was the "daily grind" between home and office, via Ywer Siding – a very rough gravel road. At Wolwehoek Station was a mill that ground (and sold) maize into a wonderfully coarse meal. We also bought coal by the bag for our living room fireplaces. Because the Contractor leased the house, and our 22 months old son Theo was soon seeing wandering into the neighbours' kitchen cabinets, a gate with a childproof closing mechanism was required at the driveway. The 2 200 square metres property had a very fine grass lawn, one to which seeds and pollen I was found to be allergic. D&M then agreed that Josef Molefi would occasionally come home with me one day after work and mow the lawn. We then gave him supper and I took him back to Dover. These black labourers obviously ate well, during clearing and grubbing and fencing operations: during the time when the maize is ripe, they picked some and we ate it at the lab. Louis and I also sometimes purchased a sheep from Mr. Dannhauser (or was it from Mr. Joep de Bruyn?) at a price of 10 cents per pound, live weight. The Postmistress' husband at Dover killed and halved it, (one half for Louis and one half for me, and we shared the neck), the soils lab completed the meat cutting and the black labourers received all the innards (and more) to feast on.

This reminds me of a lunch I once shared with Mr. Frank Sturgess at the Friesland Hotel, a basic meal without an actual menu; he had ordered. So we're eating along and here comes Mr. Sturgess' question (in Afrikaans, of course): "Jacob, do you know what you are eating?" Now I must acknowledge that I might have shown some discomfort, and also that I did not want to feel embarrassed about it, so I plainly replied: "No sir, not really." "It is tripe", he said, "and if you do not even know that, you are not a real Freestater yet; you don't need to eat it." Sometimes, he brought lunch with him, and we ate in the office.

The months of January and February were mostly spent by me near Koppies, until D&M started "clearing and grubbing" north of Greenlands. This was easy work for the older Adams grader, just blading aside the grass and grassroots in the areas considered "pasture", and pushing aside green maize stalks and whatever else in the areas considered "ploughed lands" elsewhere, generally the widths as shown on the design cross-section rolls, which Koos van Wyk came so see in my office, and for the minimum depth. In areas with a design embankment of more than three feet, actual "grubbing" was not needed; the grader operator only got rid of the grass, and those who know the Riemland area of the OFS, will realize this is not much. This work was started after fencing had been completed at Koppies, meaning that fences and cross-fences were connected as soon as possible, with the obvious reason to keep cattle and sheep where they ought to be – on their owners' property and not on his neigh neighbours' land. Near Koppies, the project location was mostly among unirrigated agricultural smallholdings, but north of Greenlands were substantial farms. Northeast of Dover, in the spring of 1971, I once had to deal with an irate farmer who complained that a neighbour's common sheep rams had somehow "hooked up" with his pedigree Merino ewes, blaming it on a gate that the gravel hauling contractor had left open one evening. Nothing came of that situation; but the reason for that is perhaps that South Africa was not a litigious country at the time.

I should say something about the land registration system in the OFS and how it differed from the system used in Transvaal. I do not know if the "one hour on horseback x one hour on horseback" system was initially used south of the Vaal River, considering that settlement started a few decades earlier, in what had been known as the "Model Republic" of Pres. Jan Brand (1869-1888). The Orange Free State

definitely had a lot more **farm names**. I had noted that already during my two months at the Bethelehem D.R.E. Office. Most farm properties, however, were smaller parcels than those in Transvaal. Perhaps the system had initially allowed that every "subdivision" of an originally registered farm would be allowed to receive its very own name. In any case, "Portion 1" and "Portion 2" farm names were very scarce around the P 30/1 project: only a few existed between Dover and Greenlands, and there were about 20 numbered "portions" of the farm "Schaapplaats" (or Skaapplaas in Afrikaans) north of the Wolwehoek-Heilbron railway line, east of Lissagally. (Herman and Thelma Heikens and their children moved into a rented farm house on a portion of Skaapplaas after completing bridge work near Koppies. We visited them sometimes. One night, we saw and heard transmission power lines "crackling" very close to their house.)

The OFS Roads Department had been struggling with some unresolved culvert design and construction problems at that time, and this P 30/1 project was supposed to address the issue of "bumps in the road while vehicles crossed them", as if the culverts rose up from the road. It was believed that the culverts (concrete pipe and precast portals as described above) rose because of the poor underlying material that would get wet and swell. Some large areas in South Africa contain a high content of montmorillonite clay. A Mr. D.H. van der Merwe had already studied this issue in 1964 for solving specific building foundation problems, (and this resulted in what is called the "Van der Merwe Method" of calculating total heave in clays), but this research had not yet been duplicated for roads. But the culverts on P 30/1 were to be installed so that the road would be stable and not rise. All reinforced concrete pipes were to have rubber gasket joints, and the "side backfill" was to be stabilized with Portland Cement to make it stronger. For the precast portal culverts, the concrete slab needed to be wider than actually needed, with a cast in-situ concrete "block" (about 150mm x 150 mm) on each side of the portal sections, and all the joints also were to be treated with hessian and tar. When Mr. Grodsky came and was taken around on the project site, he was very particular about what was actually being done, and he told stories on how the problem was being addressed on similar projects in the OFS that were built by Contractors. He must have reported on the issue to Mr. Nico van der Walt, the Materials Engineer, whom I met later in Bloemfontein.

The situation was that I, as a Resident Engineer, had to redesign the vertical grading of the road in various places, because what was shown on the Contract drawings would not give adequate vertical cover over the culverts. And I had to design every individual culvert, because "5 culverts per mile" may be adequate for estimating purposes, but one cannot tell a Contractor: "Just stick them into the ground at one thousand foot distances." Additionally, only after clearing and grubbing could one see where the culverts ought to be most appropriately located, seeing the basic principle of the restoration of "sheet flow" conditions where possible. From this, one may realize that my "actual work load" at Dover was substantial; all three types of engineering work that I had been taught by "Dirkie Beton" (= Prof. D.W. de Vos) came to pass at Dover. He had told us the 3 M's of Engineering Practice: (1) Materials, (2) Methods, and (3) Mankind. "Some of you," he had emphasized, "will mostly spend your career working with "**M**aterials, their characteristics and uses", some of you will work on "**M**ethods and formulae", and some of you on "hu**M**an relations and the perception of the profession". After more than half a century, I believe that I have had more than my share of all three M's, and the 26 months on P 30/1 were no exception.

As said before, the project affected many individual parcels of land; I saw many farmers, all of them Afrikaans speakers, and one Jewish farmer called Feltman (who may likely have spoken Yiddish or English at home). At that time, rural depopulation was already an unstoppable trend, and progressing[158]. Many farmers with whom I had to liaise, owned more than a single parcel of land, as they had inherited or purchased them over the years. Like in Canada, the reasons that the countryside has changed are multiple.

[158] Sam Helm had grown up in Marquard, OFS, and still had an aunt there when we were colleagues. He told me how a huge rural area had almost completely become "unpopulated" after the continuing droughts of the 1930's - the subject of many Afrikaans literary works by authors: C.M. van den Heever, Kleinjan and Jochem van Bruggen.

It deals with mechanization of equipment, higher wages in urban (industrial) areas, and other sociological issues. Corporate farming had also been started by the mining industry through "Vereeniging Estates", a company that owned much land between Sasolburg and Vereeniging, where there was another coal-fired ESCOM power station, at their Cornelia Mine. Farming could be for crops or for dairy. When the project neared Taaibos, we bought milk on a daily basis from a farmer named Kohler, straight from the milking "parlour" or shed. The price was 25 cents per Imperial gallon. Mr. Kohler rented the land on which he farmed, but I do not know if he rented from Vereeniging Estates or from ESCOM. While at Dover, I sometimes needed to get a signature (for "borrow material") from a farmer named Dannhauser, (between Greenlands and Dover, east of P 30/1) and he took me up to his second floor bedroom veranda, from where he pointed out to me all the locations where houses had existed in his youth. There were about a dozen of them, none of them any longer inhabited, some already reduced to rubble, with only eucalyptus (bluegum, or "bloekom" in Afrikaans) trees left to show where former generations had lived and toiled. One farmer had only 100 morgen (85.6 hectares) of flat land, all cultivated in maize, and he therefore needed to make a living on that. He had a house on the farm, of course, but only one tractor (with plough and harrow), and it would not be difficult to see how even two consecutive poor crop years would put him in dire straits or out of business. This was typical dry-land farming, and while there was crop rotation between maize, sorghum and sunflower, depending on market conditions and the when the first rains in October came or not, farmers still depended on adequate summer rain. That particular farm is now part of a large corporate enterprise; its entrance gate is visible on GoogleMaps, just east of the old railway crossing about a kilometre north of Dover Station. And the farmer's children have become city slickers.

During July 1970, Louis and Anka van Wyk and their three children had a severe traffic accident near Johannesburg, and Louis ended up in the South Rand Hospital for a while[159], so that Mr. Sturgess had to find a (temporary?) replacement soils technician from Bloemfontein, a coloured[160] man with appropriate qualifications and a Scottish surname (Mc-Something). He was to supervise the three black labourers' soils tests, reporting to me and ultimately to the Contractor and the Provincial Government. He was to stay in the servant's quarters at Louis's house in Sasolburg, (I had a key, Anka and the kids stayed temporarily with relatives near Johannesburg) and he would use Louis' Mazda 1500 pick-up truck. We thought nothing strange about this, (where else would he stay?) until he did not turn up at Dover on the Wednesday of his second week with us. Unbelievable, almost, but he really disappeared into thin air, with the vehicle. This caused some upheaval at work, and I was asked to enquire all over, reporting to the Police and making a trip to Evaton, the large black residential area beside the "Golden Highway" north of Vanderbijlpark (where it was known that vehicles often disappeared in those days already; things got much worse in the years that followed). He had left some of his personal belongings in the room behind Louis' house and also some stuff in Louis' office. I remember one item: the complete newsprint version of the book "Love Story", which later became a well-known movie. I even went to Mr. van der Westhuizen's office at the Roads Camp in Heilbron, because that town had a coloured population dating from the early days[161], and he might perhaps be able to ask around. All to no avail. It was a very hectic time, and I had to do Louis' job, of which I only had some "head knowledge" but no actual field experience. I relied on the black labourers who had been with Louis through the years. This happened just before Mr. Basie Lombard from the Pretoria office came to locate borrow pits for the Sasolburg-Heilbron road. When he arrived, it was agreed that he would also assist at Dover and do overtime for the soils tests for

[159] Louis broke a leg and was in crutches after his return; he had a limp since that time. On another occasion, Louis and Anka visited a cousin in a flat (=apartment) in Johannesbug, and all their familiy photos and colour slides were stolen out of the boot (=trunk) of their car. Lydia and I travelled **through** Johannesburg many times, accident free.
[160] The South African term "coloured" is vastly different from the use of the word in North America.
[161] After the British Government had freed all slaves in the Empire in 1834, many South African slaves in the Cape Colony stayed with their former owners (as paid servants) and also joined them when they moved north in the Great Trek. They became known as "mak volk". This occurred more commonly in the OFS than it did in Transvaal.

D&M's project. Just because one cannot keep a Contractor wait with results of his work; that would be the very first opportunity for a claim for "extras". When Louis returned eventually, we did not get another pick-up truck for him; the Volkswagen pick-up (called a "Transporter" in Canada) with TP places was kept on the project until completion – by which I mean completion of the Sasolburg-Heilbron project, used from the office near Clydesdale Collieries. From there, Louis must have taken it with him on his return to Pretoria, to the brand-new MB&S Office/Soils Laboratory building at 23 Rose-Etta Street,[162] Pretoria West, where Mr. Bergh put him in charge and I met him again after my stay in Bloemfontein.

While accompanying Basie Lombard to find new borrow pits along P 9/1 (meaning: mostly on the east side of it), and meeting other farmers in the process, I was asked to find the information about the conduits crossing P 9/1 for the fresh water pipes feeding the ESCOM power stations. Mr. Gilfillan told me that Highveld had a 24" x 24" square steel conduit, and Taaibos had a 24" reinforced concrete pipe, and both conduits had a cover of 2'6" cover. It was unsure if these conduits would need to be lengthened or strengthened with the minor raising of the road, and I was given names and phone numbers at ESCOM in Johannesburg. The highly mineralized waste cooling water from these two power stations must have crossed P 30/1 downstream, meaning somewhere on its way to the Vaal River below Barrage, but I cannot recall anything about them. Strange; it is unlikely that this water had would have been allowed to run into Molensteen Pan…. But it actually doesn't matter, both power stations have long been demolished…. Mr. Gilfillan also one took me on a tour through one of the (identical?) Power Houses. It was very nice.

Something about what we would today call the geotechnical situation. Road P 30/1 was built from "de-composed (or weathered) dolerite", which was the common underlying material in the area. One cannot say "gravel" because it is not gravel, it consists of "weathered" bedrock material – in an area that never experienced glaciation, which is almost unthinkable in a North American context. The quality of this de-composed dolerite varied, and that is why people like Louis and Basie (and others that I knew later) had to find appropriate sources. These sources were normally "on high ground", and not e.g. adjacent to streams like Kromelmboog Spruit. But they were on private property – and I cannot remember any non-private land (meaning "government land") along P 30/1. This may perhaps explain why "compensation" was im-portant (although the amounts were minimal) and "borrow pit restoration" was even more important, not only of the holes that were left in the ground, but also of the access trails. One farmer, (Mr. H. J. Jordaan, P.O. Box 5, Wolwehoek), at first declined to sign the statement for a certain amount of borrow at half a cent per cubic yard. He said that his signature would preclude him from later claiming additional com-pensation for damages to his farm, that "the government" had opened this specific pit contrary to normal procedures without his knowlewdge, namely that he should have been notified that a border fence would be broken. So I wrote a report about it to Bloemfontein, and cannot remember if and what happened next.

Some farmers wanted to do something with the restored borrow pit; in many cases nothing could be done but leave a long-term scar. On the Meyer farm west of P 30/1, a natural spring was discovered in the side of the borrow pit, and the request was then made **not to restore** it: Mr. Meyer (sr.) wanted to use it as a pond for ducks. And yes, it sometimes (= rarely) happened that borrow, (sub-base material), after having been excavated, hauled and placed on the road, before lime stabilization, no longer looked acceptable because it had "leached out" within a few days, supposedly due to exposure to air. In consultation with Louis, who had originally found the source, it was then decided to windrow this material to the side for eventual use as "side fill", and get new material from another borrow pit, paying more "overhaul" as well.

[162] This building (and the company that owned it, Inflo Investments Ltd.) was named after the wives of the firm's 2 principals – **In**a Bergh and **Flo** Sturgess. Structural design (and project management) had been done "in-house" by Mike Burgess, my colleague when MB&S staff (including me from Bloemfontein) all moved there in July 1973. The soils laboratory itself operated under a company name Roadlab (Pty.) Ltd., and was managed by Mr. Bergh.

But it happened seldom, so that I never became an expert in overhaul calculations.[163] I also remember that for P 9/1, geotechnical challenges were more substantial, as the old borrow pits from the early 1950's had been depleted or "no longer met current requirements". My 1962/1963 Vacation Work Report contains what the Bethlehem DRE staff told me – very little testing had been done during the late 1950's.

Additional to the full range of soil testing, (CBR's, gradings, shrinking tests, density tests – the latter by cone tests, long before anybody knew about nuclear densometers!), Louis' lab had an additional function: Quality control on structural concrete, by way of destructive compression tests. MB&S owned a hydraulic press for the testing of concrete cubes for all the bridge and box culvert works. For curing these cubes, the soils lab contained water troughs below the work benches, next to the large bin with "testing sand" in which our son Theo sometimes played when I took him to work. In fact, Theo preferred the lab to my office, and Josef's company over mine! As Louis drove by the actual construction sites, he sometimes made the cubes in B&R's steel forms, or sometimes Herman Heikens would already have made them. It was a matter of trust, and only very rarely, a series of tests "failed" at 28 days. (In North America, concrete cylinders are tested, but in much of the world, cubes are tested.) MB&S charged the Provincial Government for testing these cubes, at a rate of R 1 (one Rand) per cube, and we tested three cubes at 7 days and three cubes at 28 days. The test results (and also some of the cubes, to be tested by the Provincial laboratory) were all sent to Bloemfontein: Mr. Sturgess' car was normally loaded when he left.

While Mr. Koos van Wyk was the "earthworks foreman", D&M soon realized that they needed a full-time Clerk-of-Works on site, and they hired Mr. Johan van der Poel, a technician. He had been trained at the Technical College at Port Elizabeth, and had municipal and highway construction experience. He and his wife arrived in the early winter of 1970, and they bought a newly built house in Vaalpark, a private township where many houses were being built at that time. In this house, when moving in, he discovered that the toilet had been connected to hot water pipes[164]. Not an easy job to fix when water pipes in the house are covered up by mortar plaster of brick walls. Johan stayed on with D&M after completion of P 30/1, and we had a good relationship in getting things done when needed – and this was mutual. In particular, the preparation of "Payment Certificates" became somewhat of a joint effort between us, although Uli Wessmann (who had to sign each payment certificate with me, before I mailed it at the Post Office across the railway line) had his input. And also, normally, during the first year at least, when bridges were constructed, Mr. Adriaan Rouvoet visited at that time of the month; his partner, Mr. Berghout, came once.


SUID-AFRIKAANSE RAAD
VIR
PROFESSIONELE INGENIEURS

HIERMEE WORD GESERTIFISEER DAT

GEREGISTREER IS AS 'N
PROFESSIONELE INGENIEUR
KRAGTENS DIE BEPALINGS VAN ARTIKEL 18 VAN
DIE WET OP PROFESSIONELE INGENIEURS, 1968
(WET NR. 81 VAN 1968)

JOHANNESBURG

PRESIDENT

REGISTRATEUR

Whten the project started, Mr. Sturgess had given me 26 sets of pre-prepared payment certificates (meaning 17 pages of double size sepia prints each), one for each month of project duration. These showed all the pay items for the project, copied from the Contract Document, and I had to fill in the total numbers for the current month and the numbers for the previous month, so that the net numbers for the current months would be known. I had to extend the amounts from page to page, deducting the "holdback", and so on and so forth, even an "Adjustment under Rise and Fall clause". A supposedly straightforward task, one would say. This was made quite complicated by one situation that I will now try to explain – difficult, because of the lapse of time since it happened so long ago. To do that, I would first like to copy another excerpt from my favourite monthly magazine of those days, from which I glanced so much incformation that one could almost say that these issues provided "graduate training". (My SACPE registeration **at left**, dated 1970-08-11.)

[163] Mr. Florian Vedress, one of my Senior Technologists with the Government of Yukon (YTG) was a real expert.
[164] He said this had happened in the "badskamer", a typical Cape Province language use of the word "bad**d**kamer".

From "The Civil Engineer in South Africa" – July 1966, page 232:

STATEMENT OF POLICY
Recommendations approved

The South African Institution of Civil Engineers, the S.A. Association of Consulting Engineers and the S.A. Federation of Civil Engineering Contractors have approved recommendations given in the *Standard Method of Measurement of Civil Engineering Quantities* prepared by the Institution and available from it.

They are very much the same as those given in a similar document first published by the Institution of Civil Engineers, London. The main points are that the schedule must present the work to be done adequately but should not include items of insignificant cost in relation to the whole work, that quantities should be the result of computation and should agree closely with the work shown on the drawings, and that sub-division should be no more than is required to enable tenderers to insert different prices for items of substantially different cost.

Great Advantages.

Such a document has the great advantages that a minimum of time is spent by engineers or their aids in preparing it as also by tenderers in pricing it, and final measurement is simple.

In many recent cases the Schedules of Quantities for civil engineering works have been prepared in a manner entirely inconsistent with the recommended 'Standard Method of Measurement' and resemble more closely the form in use in the building industry. Civil engineering contracts should be carried out to plans and specifications and paid for under items each of which is known to include those aspects which are an essential part of it.

The impression must not be conveyed that the contract is to perform a host of scheduled acts, some of which are so insignificant and an obvious part of another that, through lack of further subdivision, the schedule may be deemed incomplete and arguments arise on what are 'extras to contract'.

Bearing in mind the constant need for clarity, efficiency and economy in the interests of client, engineer and contractor, any tendency to depart from the standards recommended by the bodies referred to should be resisted – as should any wasteful procedure.

Civil engineers should ensure that those engaged in the preparation of schedules of quantities for civil engineering works act in accordance with the aims and wishes of the guardians of the profession. The wisdom of so doing is indisputable.

I include this excerpt because it outlines the complication I faced calculating quantities for payment. In good faith, Theo Hoffmann had still used the "inconsistent" and very detailed "pay items" in the Schedules of Quantities for all the bridges and culverts. Items like "formwork less than 6" wide", "formwork between 6" and 12" wide", "formwork more than 12" wide", and the like, abounded. Also "concrete in blinding layers", "concrete in footing slabs", "concrete in footing columns", "concrete in decks", "concrete in wingwalls", "concrete in headwalls", "concrete in approach slabs", etc. etc. All concrete was specified to have a strength of "2,400 psi at 28 days", so why would one distinguish so much?, I asked myself. These items – for the 4 bridges and many box culverts – took up more than two thirds of the pages, and I regularly needed to measure dimensions on the drawings or go out and measure dimensions on site. I had not seen that level of detail before, thinking that this was probably OFS standard practice. Much later, after hearing that Theo Hoffmann also had a degree in Quantity Surveying (and was Senior Lecturer in QS at the University of the Orange Free State for a while), it dawned on me that this was the likely reason why I had suffered so much when trying to figure out how much D&M (or actually B&R) needed to be paid while these bridges and culverts were being built. It was because he had used his QS expertise (rather than his common sense engineering skills) when he had put all these pay items in the Tender Document, in mid-1969 already, when I was still in Pretoria! The excerpt on the previous page strongly argues for the more commonly accepted British "ICE" way of doing things – and common sense.

Another complication came (but only once) while preparing quantities for progress payment certificates. You may already have suspected, dear reader, that "inflation" was high at the time, as also in the rest of the world in those days. In early February 1971, during a joint meeting with Mr. Grodsky and Mr. Sturgess, I was instructed to ensure that the progress payment certificate for March 1971 (# 14) would need to be **for a specified amount** (which the three of us realized, would be much higher than the expected actual "work done" by D&M / B&R during that particular month). The reason for this was to enable a maximum amount of money to be "paid out" before the end of the Provincial Fiscal Year. Obviously, the progress payment amount for April 1971 would likely be much smaller. At that time, the 1971/1972 Provincial Budget was already being developed (or had likely been finalized), and Mr. Grodsky was somehow apprehensive about the effect that this "emptying the kitty at year end" would have on future construction. He was aware that the new departmental budget for 1971/1972 would be eaten up by construction money, and that the Provincial Administration would not have enough money for future design services by consulting engineering firms. The OFS Roads Department built their Provincial Highways like P 30/1 (not Special Roads, not National Roads) from "General Revenue", without funding from the central government or "borrowing". So it was known that the inflation bug was going to bite, sooner or later.[165] I did as was told. Three more additional career experiences about this "emptying the kitty" process are added:

1. In December 1962, at Bethlehem, I already commented in my Vacation Work Report that "they" (the OFS Provincial Administration) wanted to complete a specific project by the end of the fiscal year.
2. In the mid-1980's, in Whitehorse Yukon, Lydia, employed as librarian by Whitehorse Public Library (which is a YTG agency) was normally sent out during the last two week of March to "go buy many books" at the book stores on Main Street – whether these were specifically needed or not. Just to make the library ensure that the current book purchasing budget was all spent before the end of March, with the reasoning: "We may not get enough money for buying books in the new budget".
3. In March 1992, in Saanich, British Columbia, the Ministry of Transportation and Highways ignored their geotechnical consultants' advice to allow time for compacted soil layers to expel moisture and pore pressure, before adding additional layers. The idea was to spend the previous Fiscal Year's (and former political regime's!) moneys. (The NDP had recently ousted the Socred Government). This was the substantial embankment for the southbound lanes of Highway 19 (Pat Bay Highway), directly south of McKenzie Avenue Interchange, which I had designed as an employee of Crippen Consultants, a division of H.A. Simons Ltd. This effort backfired. One day during the last week of March, a major slip failure occurred, taking out all the fill into Swan Creek, destroying community gardens and a newly installed multiplate culvert. Efforts to put the blame on the geotechnical consultant Thurber (by government employees, there was no "Contractor" for the project) obviously did not succeed.

As work progressed north from Greenlands, the day arrived for the second "Public Forum" by which the MEC would finalize the rearrangement of minor roads that connected with this new route P 30/1. These were all "Secondary roads" and "Tertiary roads", designated with a letter "S" or "T" in front of their number, like "P" meant "Primary"[166] and "A" meant "Access". Various sections of Secondary and Tertiary roads would become redundant after opening of the new route, and as described before, farmers would just take repossession of the land within the "road reserves" which were 80 Cape feet (for a Secondary

[165] Much later, I learnt (from the Driessen Report – see "Part 2") that the "old" National Road system was in fact "dumped" on Provincial Roads Departments on **1 April 1971**, for **R 479 million** or **R 54 000 per km** of two-lane road, with a 3:1 equivalency for double carriageway roads. From that day on, the National Transport Commission was going to build a new National Road system, as freeways. <u>This explains **much** of what follows, also in Part 2".</u>

[166] Moreover, the secondary road numbers had three digits and the tertiary road numbers had four digits. Confusing perhaps, but in Washington State a similar system is used for the system of "minor roads" with different ownership and levels of maintenance. In Yukon, "secondary roads" were numbered in the 100, 200 and 300 series, due to the three Area Superintendents (for Central, Northern and Eastern Yukon respectively). Miles Canyon Road was #101.

Road) and 50 Cape feet (for a Tertiary Road). The exact intersection locations with P 30/1 had not been given any thought during the design period, and that is why the Public Forum was needed to establish which S and T roads were actually needed. These roads were obviously lightly trafficked and only very occasionally maintained (which meant that a grader from Heilbron would sometimes make some passes on the thin layer of gravel on an S road – non-existing for most T roads – when people got stuck). It was known that some OFS roads had been awful in the past, although improvements had been promised.[167]

This matter of road maintenance brings to mind one particular visit to the Dover office, when Mr. Sturgess brought an important visitor, Mr. Ken Harpur, Chief Engineer of the OFS Roads Department. Perhaps just out of courtesy, perhaps because they were long-time colleagues and friends, perhaps just because Mr. Harpur was close to retirement.[168] Mr. Sturgess later told me that Mr. Harpur had had some particular obsession about road maintenance: He believed that with a certain (fixed) mileage of gravel roads in a district, a certain (fixed) number of graders in that district, and a (fixed) number of working days per year, any road traveller could expect to see a grader working for each calculated number of miles. He had checked this out over many years, when travelling from Bloemfontein to his sisters on the Witwatersrand, always taking a different set of gravel roads (back and fro). Whenever he met a grader during these travels, he made a note. Back in Bloemfontein, he would then phone all road superintendents between Bloemfontein and the Vaal River, asking them where their graders had been on such and such a day. "I drove seventy miles through your District, and did not notice a single one", he would likely state, or "I noticed this and this section of gravel road, and want you to send a grader there as soon as possible; it is in poor shape." You may call that "management from a driver's seat", but they all knew it.

The second Public Meeting was also held in the Ballroom at the Friesland Hotel at Koppies. Prior to starting time, I had already had ample time to discuss the farmers' wishes. The new S and T roads were to intersect with P 30/1 at appropriate locations, mostly adjacent to farm boundaries, and would be gravelled during construction. Abandoned S and T sections were to be scarified and the fences were to be left in place if the owners wanted them. In some areas, farmers wanted only one fence removed and the other one left in place. One section of Tertiary road, just north of the bridge at Kromelmboog Spruit, leading east (to Meyer's farmstead and eventually to Skaapplaas) was kept in place and continues to this day (see GoogleMaps),[169] but the one further north was completely ripped up, and on aerial photos taken a few years later, one could not even see that a road had ever existed there. One of the new Secondary roads that D&M had to build (as an "extra work" item, resulting from this meeting), was a new road link between Wolwehoek Station and Taaibos Village, replacing two existing but separate Secondary Roads. On short notice, I had to lay out the location of this road, without having any survey equipment. (For construction purposes, D&M had a surveyor who reported to me – a strange scenario, but it worked except on one occasion, see below.) I decided to lay out this Wolwehoek-Taaibos road's centre line using the "first principles" of a **vertical curve**, which is not a circular curve but a parabola. Aided by Josef Molefi and with only a 100 feet tape measure and a few long poles, I measured 300 feet each side of the horizontal point of intersection, and then calculated horizontal offsets at 100 feet distances, by hand – just as I would have done for a the design of a 600 feet vertical crest curve. The fences would be 40 Cape feet on each side of this centre line; these were in straight sections, assuming a maximum deflection from the actual "road reserve". D&M's grader operator found this satisfactory, and so did Mr. Sturgess and Mr. Grodsky during their next site visit. What more could I have asked for? What more could they have asked for? And lastly, how would a "legal surveyor" have interpreted this, if and when surveying a right-of-way....?

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[167] During the fifteen months that our family lived in the OFS (1952-1953), the only paved road from Kroonstad to Bethlehem went through Ventersburg, Winburg & Senekal. Yes, of course, that was the original "National Road".
[168] When working in the MB&S Bloemfontein office a few years later, Mr. Harpur worked for the firm, supervising construction on a project on jail property east of the City, and I met him there once again, with Mr. Moodie (?).
[169] In March 1991, during a visit to South Africa, Lydia and I drove south up to this point; the maize was very high.

The route of P 30/1 crossed two ESCOM sets of transmission power lines, originating at the Taaibos and Highveld generating stations. These crossings were at very acute angles, and it appeared as if the route of the road had been "squeezed in" between sets of steel poles – there were no actual "towers" – with high voltage electricity. The one system was 220kV and the other (newer) one was 350kV or more (I am not sure of the exact numbers, but they are **unlike** voltages used in North America.) While ESCOM operated nationally (except at Pretoria and Port Elizabeth, which had their municipally owned systems), transmission lines were integrated into a single network,[170] and the system was very dependable. ESCOM had insisted that these large steel power poles, at 5 feet (and more) beyond the fence, were to be protected by guardrails, located on the "road side" of the fence. The logic of this measure baffled all of us, of course, but we did it – although these lengths of guardrail had not even been shown on the project drawings.

When the earthworks had been completed (with two or even sometimes three layers of lime stabilized sub-bases[171], the crushed rock base course was delivered by the truckload from somewhere in Transvaal – I guess the material was deep gold mine waste, quite competent and easy to compact into a dense[172] 6" thick base course. D&M's foreman, Koos van Wyk, was responsible for the compaction, "slushing" and final levelling of the base course.[173] But the final elevations of the sub-base had to be surveyed and provided to me for the "go-ahead" on base course dumping. This was particularly important on curvature, because the sub-base course elevations would be based on final superelevation. This is where the "survey situation" took a wrong turn: I discovered that D&M's surveyor had supposedly provided me with these final sub-base elevations for a section near the bridge at Kromelmboog Spruit, and D&M had already started dumping base course on that section. The matter came to the fore when preparing a payment certificate, together with Mr. Wessmann. He claimed a section of completed sub-base, and I said I had not seen the surveyed information, consisting of a list of elevations at 20 feet left, centre line and 20 feet right. He then walked to their office at Dover, and the surveyor provided him with a book full of "data" even extending the area much further north than built on that day. **No actual survey had been done**, only some writing into a book. That surveyor (and his surname was Uys, just like Herman Heikens' sidekick) was fired that very same day, by Uli Wessmann, who seemed to be upset.

Just like D&M, B&R worked from south to north. During construction of the Lissagally railway overpass, a few things happened that need to be mentioned. All concrete columns (including columns for the two abutments) had to be founded on solid bedrock, and tests had shown that this was fairly deep (more than 4 metres) and was not exactly level but on a slight slope to the east. So when backhoe excavation had uncovered all the overburden, the top layer of the decomposed dolerite had to be jackhammered off, to expose the competent rock. On these six sloping surfaces, a "blinding layer" of low quality concrete had to be poured, so that the base for the particular set of column footings would be "level". Footing mats of rebar were then placed and the column footings were poured. Rebar lengths in the columns themselves were then adjusted for in-place pouring of the columns. I believe that there was a measure of overdesign in that rebar, due to uncertainty during the design process. An alternative way of design would be to drill more holes around the exact footing locations. Perhaps there had been no time to conduct these tests. It is no wonder that (in Canada) of all sub-disciplines of civil engineering, geotechnical engineers pay the highest professional liability insurance premiums.

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[170] Unlike today, where a legacy of shortages of electric power, a lack of maintenance and material pilfering over many years has become a huge nightmare, (as we hear from Lydia's sister), the South African electricity network was something to be proud of. But I also remember the pre-ESCOM days around 1954, when my hometown still had its own municipal generating station, and the lights sometimes started to blink during the early evening hours. My father then used to say: "Potchefstroom **sonder** stroom", (meaning "Potchef **without** current").

[171] The decomposed ("weathered") dolerite varied a lot. Quite a lot of local research had been done on this subject.

[172] To 98% of "AASHO" density, based on US (and not British) requirements, which used "Proctor" densities.

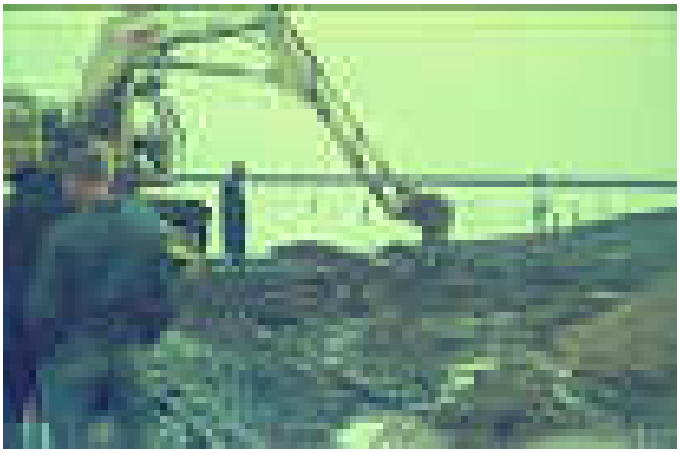
[173] The specifications required certain equipment, a certain moisture content and a certain number of passes. It was all very detailed in the "method", very unlike the "performance outcome" type of specifications used today.

The four photos below show that in the early spring of 1970, (September), there was a major downpour of rain at a time when this railway line had already been relocated from the second span from the south to the third span from the south of this five-span bridge. Why was that needed? The centre sections of deck slabs for spans 2 and 4 were "drop slabs" with special insulating materials and connecting rods. (The gravel road was also to be relocated (to that third span) after the railway line had been restored to its original location.) The whole area around the bridge site was flooded, including maize fields to the south (barren at the time, as this early rain was before plainting had occurred) and the B&R equipment shed.

Looking north from existing slab over span 1. Contractor's shed location was behind white car.

Also looking north to Coalbrook and, showing formwork for the centre piers between spans 2 & 4.

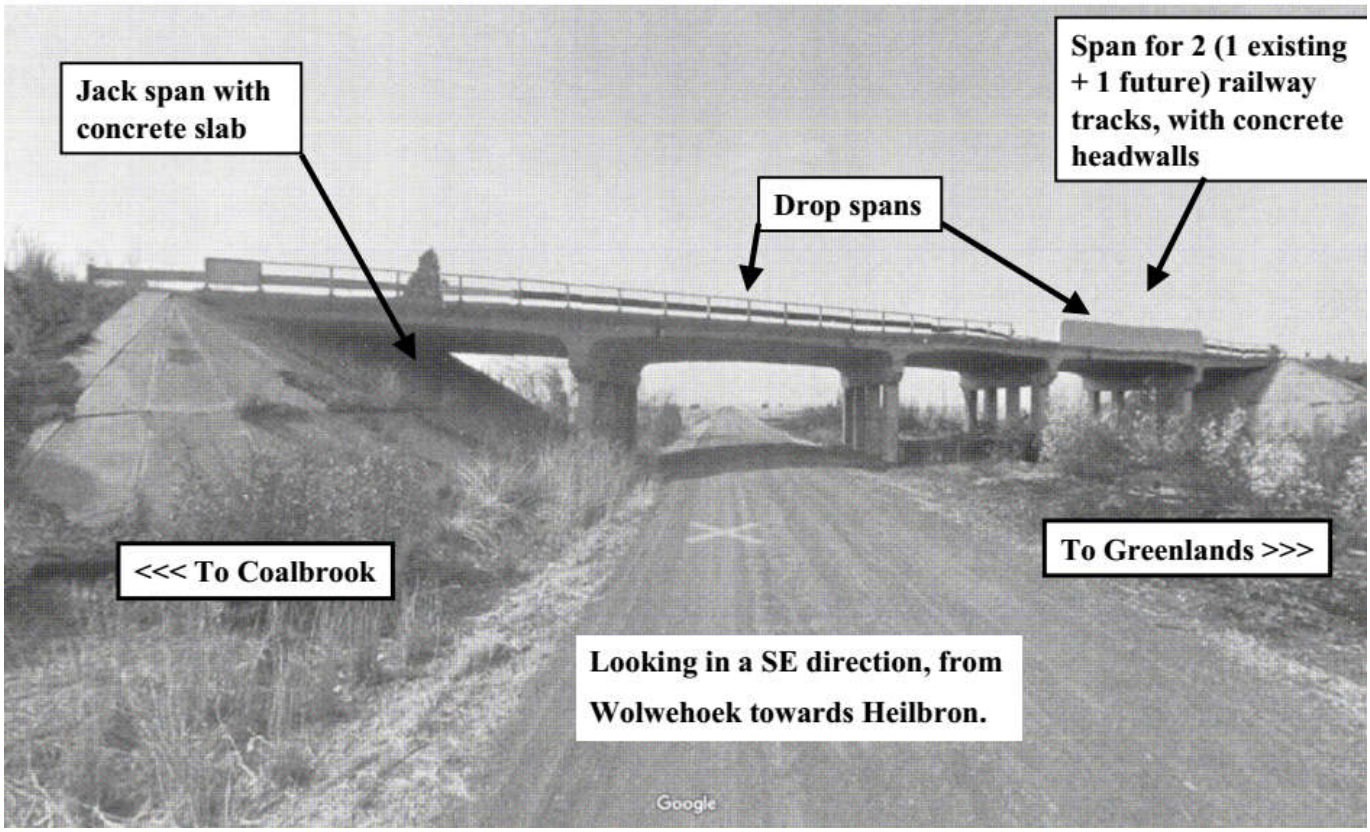
Johan van der Poel reviewing the railway washout. This was in September, before crop seeding.



Herman Heikens (left front) and Johan van der Poel (at right) reviewing temporary ditch digging.

Then, about three weeks after this one-week work stoppage, the equipment shed burnt down one night, causing another period of slow days….

The road link between P 30/1 and the Secondary Road parallel to the railway line ran through two rows of cypresses bordering the long driveway of the homestead on the farm Lissagally. I met these farmers, and discovered that there had been no actual discussions about this "infringement" of their farm. While their driveway would become much shorter (off the sharp curve of the link road), the lady of the house felt very sad that the cypress trees that she had personally planted and hand watered during the extended droughts of the "dirty thirties" would so unjudiciously be destroyed. I could do nothing but agree with her. The **next page** shows a recent GoogleMaps image of the bridge, looking from the NW (Wolwehoek Station) side. The road link connecting this Secondary Road to P 30/1 is about 100 metres behind the camera.



I did not have a lot of input in the design of the reconstruction of P 9/1, except for the fact that I knew that it was to match D&M's project as well as the project "under construction" to the west, of which BSB&P was the consulting engineer[174], that it was to be designed in metric, and that it would be a twinned roadway that connected to the double railway crossing overpass north of Coalbrook Station, which was a BSB&P project and was in fact "under construction" when Louis and I drove to work each day. When the site survey for the "twinning" had been completed, a rock "gravesite" was discovered in the proposed median, on the farm Leitrim, close to the remnants of an old north-south wagon trail. Mr. Sturgess asked me to investigate, on behalf of the Provincial Government, whose grave this might have been. There were specific rules for reburial that needed to be followed. It had been fairly common practice that farm owners would allow their black labourers to bury their dead somewhere along the farms borders, in an out-of-the-way location; it was also common for the local South African Bantu tribes to place rock piles on top of these graves; one really saw them all over countryside. Knowing about what Sam Helm had done in Eastern Transvaal, I knew what I had to do: I needed to enquire who that buried person had been, and if possible, when this burial might have occurred.

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So it was agreed that would go to the farmhouse of the person who managed the agricultural operations of farms in the area, on behalf of Vereeniging Estates. This mining conglomerate owned large tracts of land. I had met this person before, because there was one borrow pit on VE owned land. He scratched his head when I asked him; he told me that he (and his parents before him) had owned the farm Leitrim, and that he had grown up there, and he also acknowledged that he knew about that particular single gravesite. On further questioning, he remembered that many years ago, some black labourers had lived in raw clay huts

[174] One day, on the way to Dover, Louis and I saw a UNIMOG mounted auger that drilled holes for guardrails on the brand new Coalbrook overpass. MB&S later bought a Toyota Land Cruiser and a similar auger, for Louis' use.

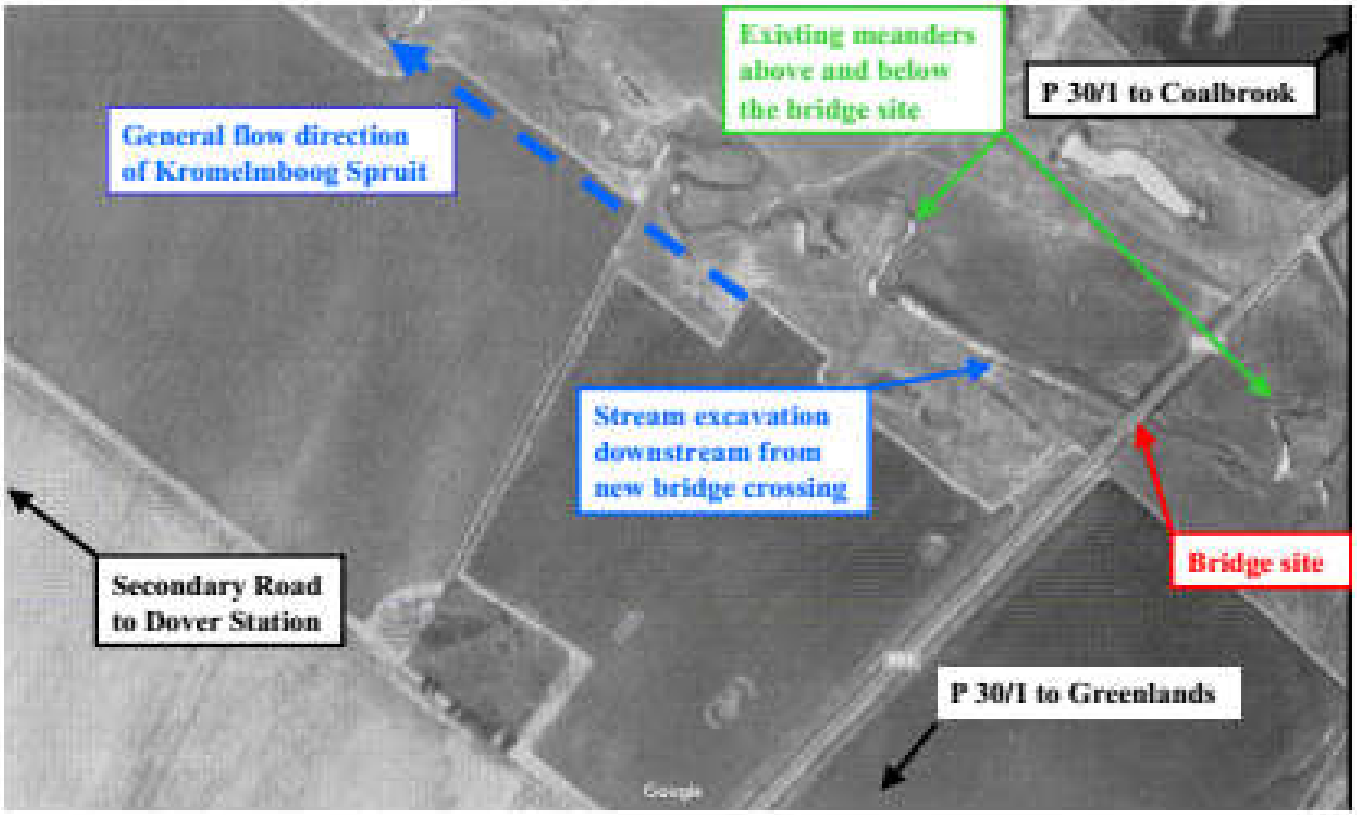
close to that corner of the farm. One of the 'pikkanins' who had grown up there, actually worked for Vereeniging Estates, he said, and was that day on a farm about 5 km north of the triangular road camp. So we decided to drive there and ask that labourer. He knew about the gravesite, he said, and then asked: "Why don't you ask my grandfather; he should know." Hearing that this man was still alive, the farm manager asked where he lived, and the grandson directed us to a group of huts on another farm in the area, where we found a 103-year old man, sitting on the ground, basking in the sun, with blankets all around him. With respect, in Tswana, the farm manager greeted him and then asked if he knew about the old gravesite – "there by the old wagon trail" – "Yes, nkosi, I know", was the answer. Next question: "In what year did you come to this area?" (and I cannot remember the exact reply, but it must have been before the farm manager was even born.) Then: "When you came to this area, was that grave already there?" To which the answer was: "Yes, nkosi, it was there already, bij the fence. We lived fairly close to it, but I have no idea who might have been buried there. Nobody told us anything when I was this tall,"[175] (while making the gesture in the footnote). Now this was in 1971, so the gravesite might have been 90 or 95 years old.

With this information, it was fairly easy for me to write a hand-typed report to Bloemfontein. I reported the efforts in trying to find out, the names of all those giving information, that our quest for the facts had been unsuccessful, and that it was the grave of an "unknown" person with no "next of kin". But the location of the gravesite triggered my guess response that the date of the grave might have been long before 1895, when the wagon trail was still in use, before it was abandoned by oxwagons supplying the ZAR with all kind of goods, as a result of construction of the railway line from Kroonstad to Vereeniging. Historical musing normally does not do any harm, I thought. A week or so later, a Notice appeared in the OFS Provincial Gazette about this situation, asking the general public to come forward with objections to the provincial administration's proposal to rebury this long dead person. Having received none, I was then asked to solicit funeral director quotatios. There was only one such firm in Sasolburg, a firm called AVBOB[176], and I received their quotation and mailed that to Bloemfontein. A contract was drawn up, and I was asked to supervise the performance (meaning the digging up part) of it. The funeral director, a Mr. Abraham van Aarde[177], came with an assistant in a Volkswagen squareback station wagon (black, of course!) and a little unpainted timber box (about 18" x 18" x 18"). The rocks were removed, they started hand digging, and soon found a fairly well preserved skull, with an ants' nest inside it (which had prevented the rotting), plus a few pieces of large (thigh?) bones. The box was filled, the hole was backfilled, the VW drove away, I wrote a little report to Bloemfontein, and AVBOB was paid. Rest In Peace, unknown traveller on the old wagon trail, who probably died from an unknown disease, so many years ago.

The importance of actual survey during construction was pressed upon me once again, in a situation that I did not have control over. Lydia and I went on vacation for three weeks in April-May 1971, and during our absence to Eastern Transvaal[178] and Kruger National Park, Theo Hoffmann came to Sasolburg for a while. He may have needed a site trip for a number of issues to be sorted out for the design for the P 9/1 reconstruction project, so his visit was worth the effort. On our return from vacation, I checked the records and noted that sub-base levels had not been provided around the long curve to the left, a kilometre or so north of Lissagally. Crushed rock base course had already been completed on my return. I later asked Theo why he had let this go, and he said it was not that important. However, in February 1972, we experienced a more than typical summer rain storm, and the next day, on my very last visit to Koppies, I

[175] A typical South African Bantu way of indicating the age of a child is to show a hand with the fingers turned up; the back of the hand would show his "height" and the fingers would show that he could "stand and walk".
[176] A nationwide firm "Afrikaanse Verbond Begrafnis Ondernemers Beperk" (=Afrikaans Union Funeral Directors Limited), that was normally called "**A**lmal **V**rek **B**ehalwe **O**ns **B**esigheid" (=Everybody Dies Except Our Business).
[177] Oom (= uncle) Apie van Aarde was an elder in the church we attended; his surname means "of the earth". Is it possible to have a more appropriate surname for a funeral director? And he spoke in an **extremely low bass voice**!
[178] On this trip, we drove the roads I had designed: From Breyten to Chrissiesmeer and Lochiel, almost to Oshoek.

noticed "ponding" on the completed chip seal surface, at a few locations around that particular horizontal curve. This was something that would perhaps not have happened if I had not been on vacation. A lesson learnt from this is that horizontal and vertical alignment cannot be seen in isolation.



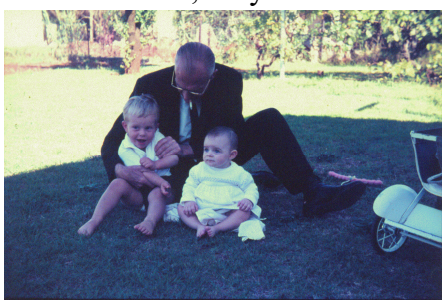
During that same final "handover" of the project to Mr. Grodsky, I recall that a group of us stood on the bridge at Kromelmboog Spruit, hands on the railings, looking west and watching the water rush under the bridge and into a substantial outlet channel that Theo Hoffmann had verbally requested me to have excavated by D&M. So I had "straightened out" this very "crooked creek" under a Change Order. The project drawings had not shown this, but a fairly recent Google image (**above**) does. Seeing that control conditions for "supercritical flow" are on the downstream side of an obstruction like a bridge opening, I had used the principles of my Hydraulics 4S textbook (Hunter Rouse, ed., Wiley) and saw the results that day. The bridge was not flooded, although the rushing water was very close to the bottom of the deck. While standing there, a farmer came by from Skaapplaas, and joined us in looking down at the torrent of water. I had met this man before, though his farm was not directly affected by P 30/1. After intro-ductions had been made, out of the blue, he made an interesting statement: "This is definitely what is called a one in fifty year flow." Now that is not what one expects a farmer to say. So we (collectively, it was not I who did) responded by asking him: "Perhaps it is. How do you know?" (*while in the back of our minds, we obviously meant: "Does this man know what he is talking about?"*) His reply was: "Well, I grew up in a farmhouse east of here, within the catchment of this creek, and we had one occasion where floodwaters just reached the front doorstep. I was five years old when that happened, and remember it well. I am now 55 years old, and this morning, I happened to drive by the old house. The water was at the front doorstep, for the very first time since my childhood. That is what I would call a "one in fifty year flood", **what do you engineers call it**?" It then appeared that he was a member of the Heilbron District Roads Advisory Board. Ouch! I was very glad that I had not said more at first.

The next page contains some of the very many family photos from those years.

Sinoville, May 1969.

Sinoville, May 1969.

Sinoville, October 1969, (Plonia)



Potchefstroom, February 1970.

Sasolburg, January 1971.

Pretoria, March 1971.

Roadside picnic, near Leslie, Transvaal, April 1971.

Lower Sabie Rest Camp, Kruger National Park, May 1971.

Satata Rest Camp, Kruger National Park, May 1971.

Sasolburg, July 1971.

Sasolburg, February 1972.

Harmonie, March 1972 (Sara)

← **Harmonie, October 1971**. This is a family photo of Lydia's parents and all their children and grandchildren (at the time), on the front stoep of their farmhouse west of Hartebeespoort Dam. My parents-in-law are at far left and far right. My three brothers-in-law (from left to right Leon du Plessis Joh van Tonder and Chris van Tonder) are in the middle back; my sister-in-law Loekie is next to my mother-in-law; Lydia and my sister-in-law Adri are next to my father-in-law, and I sit in left front among the 9 grandchildren. Chris was still single at the time, although we had already met his girlfriend Martha during the time when we lived in Sinoville. They married in Silverton, Pretoria, on 17 June 1972.

Because P 30/1 was (at least during the first half of the construction period) in the middle of nowhere, it was a temptation to some members of the public to "steal the road" north of Greenlands, as soon as chip-sealing was completed. This practice was obviously not allowed, and people did this at their own risk (as they do all over the world). Now while a local farmer like Joep de Bruyn does this to get home a few minutes earlier from the time he may arrive by using the poorly maintained gravel roads (some of which will be abandoned shortly anyway), that is understandable. But when someone comes from Koppies, and continues to go straight at the intersection north of the Greenlands Overpass, just for the kick of it, with his pedal on the metal, that's different, particularly if a near fatal accident can be the result. We had one such case. One afternoon, I left the Dover office and wanted to drive along the newly chip-sealed road and do some visual checks along the way. (I did not work from 8 to 5 only, and have never done that.) At the Kromelmboogspruit Bridge (where I knew that guardrails were being installed) I noticed a collision. A northbound private Toyota Corolla sedan had driven straight into the uncovered end of the W-beam guardrail, which had entered the engine compartment, skid by the spark plugs, and rammed through the firewall, ruining the car radio. Both driver and passenger were unhurt (except for whiplash) but as white as sheets, thinking of how else this "joy ride" could have ended up. I cannot remember if D&M even called the police. (I now (2019) wonder what the Insurance Company handled this.) Koos van Wyk later told me of a project where a Contractor had placed oil drums with barbed wire and some orange marking tape (did we have that in those days?) to protect a newly prime coated road section. That was common practice, and the public knew quite well that, just driving through the drums at a low speed, would move them out of the way. But in this case, the Contractor had put rocks in the drums, and fence posts through the rocks into the underlying material. That stopped people getting through, and caused some major "property damage" as the terminology is. Other horror stories also existed about "how to protect an uncompleted section of base course from damage by people stealing the road."

With completion of the earthworks from south to north, and with the completion of the design of P 9/1, changes were at hand, and my days at the Dover office were numbered. On award of the P 9/1 construction project to D&M, Mr. Sturgess hired Mr. John Robertson, a fairly recently immigrated engineer from England, who had already worked in South Africa for Murray & Roberts, the well-known construction company. He was married to Pat, a Bloemfontein born-and-bred girl, and they also came to live in Sasolburg, in a concrete walled house[179]. The MB&S "site office and lab" was then relocated to a Contractor-rented farmhouse[180] just east of P 9/1, off the gravel Deneysville road, and it made good sense that the office at Dover was to be vacated, and yes, Jacob would also have an office in the farmhouse. This change occurred in the winter of 1971. My regular trips "beyond Greenlands" had ended. There was a long prickly pear hedge behind the yard of this farm house, with an angry ostrich behind it, which caused our son Theo to gape at his blown up neck. And we got an automatic telephone (although a party line), with South Africa's system that is different from what is used in the rest of the world.[181]

I do not know how long John Robertson continued to work for MB&S, but Lydia and I had a strange visit from him and Pat, on our very last night in South Africa, in November 1977, when in a hotel in Arcadia,

[179] This was an experimental house, like a "tilt-up" of concrete slabs, topped by a solid flat concrete roof. John and Pat sometimes complained that the house "creaked" at night. There were other experimental houses in Sasolburg as well, but they were timber. Friends of ours (he was a SASOL employee) has such a house. South African timber is not good for construction purposes, it grows too fast and warps a lot. It is only good for roof trusses and plywood.

[180] This farmhouse had been "condemned" for residential purposes after the 1960 mine accident, and had been vacant since. Like all houses, it was of clay "face" brick construction, but with many visible cracks, and a bee's nest within the cavity wall at the window of my office. (= bbbzzzz all day long.) The house shows up on Google-Maps. Its access was not off P 9/1 itself, but off a secondary road to the east. (I cannot remember the farm name.)

[181] In the mid-1990's, Lydia and I met a South African trained and experienced telephone technician who had emigrated to Mission, British Coluimbia, Canada, with wife and two children. Only after their arrival, he discovered that he could not get any telephone related work, because "everything was completely different" in Canada.

Pretoria. They had somehow heard that we were emigrating, and came to ask us if, once settled, we would be prepared to assist them with Canada's immigration process. They had a disabled son at the time, and without mentioning this "slight problem" to them, we just wondered. As an curious "aside", both of them did not look well, and Lydia thought that "drug use" might be their problem….

In early 1970, I enrolled for graduate studies at the Vanderbijlpark campus of the Potchefstroom University for Christian Higher Education. I completed the requirements for HBA (Honours in Business Administration) by two years of evening classes, held at a High School in Vanderbijlpark. These classes were held every second Monday evening, and we had a lot of homework, meaning reports on financial statements, topics like the "Replacement Value Theory"[182] and in 1971, analytical studies of aspects of three specific industries in South Africa: The **timber industry** (with pulp and paper), the **clothing industry**, and the **iron and steel** industry. For the latter industry, our class toured the ISCOR works at Vanderbijlpark on a Saturday morning, and their computer department as well on a weekday evening. Professor Albert Sorgdrager (from Potchefstroom) gave some of the classes, and Mr. Theuns Eloff (quite a young lecturer, the same age as most of the students) gave some other courses, and if I dig deep enough, I may perhaps find the names of the other lecturers. Our class consisted of about 25 males, all holding a bachelors' degree, as "prerequisite". About half of us were engineers of some kind, the rest were scientists and (self-employed) pharmacists. The "paper" (by a group of five of us) on the clothing industry focused on "neckwear", meaning ties and cravats, and how this fashion driven part of the industry really operated, from materials, fashion design, manufacturing, distribution and marketing. This while I never wore a tie to work in those days! Exams were held in Potchefstroom, together with the silimar Saturday morning classes held on campus. My HBA degree was conferred in March 1972, one month after we had moved to Bloemfontein. From there, I continued Saturday classes for one more academic year, completing my MBA that November and receiving my MBA degree certificate in March 1973. (See "Part 2".)

Toward the winter of 1971, Mr. Sturgess sat down with me about my continuing career with MB&S, after completion of the P 30/1 project – which was still half a year ahead. At that time, the Bloemfontein office was designing the Reddersburg-Smithfield Road, a former National Road that had been taken over by the OFS Provincial Government.[183] As mentioned before, this (country-wide) changeover had not gone very smoothly; all four Provincial governments baulked at first, and then decided to require reconstruction (at the costs of "National Transport" of course) before "formally" taking over these roads. In the OFS, planning had already started for the Bloemfontein Bypass (a National Road) and through Louis van Wyk, I was aware that potential borrow pits were being sought for the proposed north leg of the National Road west of Greenlands (that would be a freeway) and would cross the Vaal River just below Barrage. MB&S had had success in getting an assignment for the reconstruction design of Reddersburg-Smithfield, and Mr. Sturgess wanted me to supervise the Contractor that would construct this project. So he requested that we come to Bloemfontein for a few days and drive out to Reddersburg and find out if we would be amenable to live in that small town for about two years. Future design work in the Bloemfontein office was not even mentioned at the time, although it must have been in the back of my mind (and his mind). So we drove down with our Volkswagen hatchback and visited the Bloemfontein office (meeting Miss Flo van Heerden for the first time) and then went to see Reddersburg, the first town south. I had only been through there once, on a dreaded trip to Edenburg in December 1954, but remembered nothing about this town. My father (who had worked at the Theological School at Potchefstroom from 1958 to 1964), knew the minister in Redderburg, who was a distant relative of Lydia. Lydia also had an uncle and aunt

[182] This interesting economic topic has been entirely differently approached by American and European economists. I had to write a paper on the differences between the two approaches, using an American as well as Dutch textbook. I "roneoed" (although Xerox existed, it was still was much too expensive) my report and afterwards had the opportunity to present and defend it to the class in a seminar format.

[183] Currently shown on GoogleMaps as Route N 6.

(my father-in-law's sister) on a farm halfway between Trompsburg and Bethulie. We found that there was one particularly nice vacant house "for rent" in Reddersburg, a former bank manager's residence, although it seemed that the bank office had been run from a part of the building corner in downtown, of which we took some pictures. While in Bloemfontein, we also drove up to the top of Naval Hill, the flat mountain in the centre of Bloemfontein, showing Theo and Plonia the pretty downtown visible from there, all the way south to the cooling towers of the City's power station, some of the wild game, and the observatory. Although Lydia was pregnant, we seemed to be prepared to move to Reddersburg in 1972.

Lydia at the house at 19 Collins Crescent, Sasolburg, OFS.

House at Boshoff Street, Reddersburg, OFS.

Close to the end of our stay in Sasolburg, we heard from Mr. Sturgess that redesign of the Reddersburg-Smithfield road had been completed, but that the Provincial Administration had decided that it would be constructed by "government forces", meaning without involvement of a Contractor or MB&S. In return (somewhat just like what I had been aware of around Chrissiesmeer, Transvaal), MB&S was to become involved with the redesign of a (longer) section of the old National Road beyond Smithfield, namely Smithfield-Rouxville-Aliwal North[184]. This work was to entail something very extraordinary, very different from design based on a longitudinal profile and cross-sections, with material design. This exercise was to be an analysis of the computer printed output of a LaCroix Deflectograph. This was a large truck mounted machine, owned by the NIRR of the CSIR, which had been contracted by the provincial road departments, to analyze how these roads needed to be "rebuilt" for a certain "design life" with a certain number of "passes" of a "design load". The concept of ESAL, (the Equivalent Single Axle Load) was an American concept. I was also told of a substantial (normal) design project in the Bloemfontein Office, the Tweeling-Reitz road, which was in a route location study phase. Mr. Sturgess had in fact already once brought and introduced Mr. John Woodcock MBE PrEng to the Dover office (I think it must have been just before we vacated Dover, so likely in the fall of 1971). This John Woodcock, a graduate of Loughborough University in Great Britain, had worked in the Public Works Department of the Government of Malaysia for more than a decade, and as a result, had been awarded the "Member of the British Empire" decoration. He then sailed a yacht around the world for more than one revolution. The first time around, he met a South African girl named Elizabeth, in Durban, and when returning there after 360 degrees, they married there. They then spent a few years in Abu Dhabi, in the United Arab Emirates. When Elizabeth's parents (who lived in Bloemfontein) suggested that they settle in South Africa, they came to the

[184] Aliwal North is just across the Orange River, and is therefore in the Cape Province, not in the Orange Free State.

capital of the OFS, John became a partner in the firm[185] and he was responsible for this particular "Route Location Study". Once it was completed, I might become involved in preliminary and detail design of this project in the Bloemfontein office, now that going to Reddersburg was no longer an option, was the line of thought that he presented to us. Would Lydia and I think about moving to Bloemfontein, with a certain salary increase? We thought about it, and said: "Yes, we'll do it and go."

By the end of December 1971, it was clear that D&M would not be able to complete construction by the end of January. Clean-up work was needed and also a lot of paperwork. But completely unexpected, I received four letters by mail (and note that this happened during the "vacation break" that almost everybody took – I did not record the dates that these four letters arrived:

1. A typed letter dated 27 December 1971, signed by the Owner of 19 Collins Crescent (as if I were the person renting the house – the heading showed "P&D Padaanleg"), stating that they (he and his wife, former Sasolburg residents) had sold the house and wanted us to vacate it within a month.
2. A typed letter dated 29 December 1971, signed by a certain "Williams" on behalf of S.G. Roger, Director of Dux Agencies (Pty.) Ltd. of Sasolburg, stating that they had received a letter from the Owner, in which he had notified them that he had written to D&M Padaanleg, giving them "notice" because the house had been sold. This letter asked me to contact Dux Agencies for further information, if needed.
3. A typed letted dated 30 December 1971, signed by the Owner of 19 Collins Cresent, referring to Letter 1 above, and stating that the house had not been sold, but he still wanted us to vacate the house within a month.
4. A copy of a letter from De Beer & Claassen, a Sasolburg law firm, dated 5 January 1972, addressed to "D&M Padaanleg (Edms.) Bpk., **Posbus 6, Dover**", stating that I, being D&M's employee, had advised one of "their clients" (not Dux Agency, but both **S J Agentskappe** and the **Owner** in Pretoria) that I could not vacate the house before the end of February 1972. (And this letter carried on and on, about the fact that this was a "brutal breach of contract" and that, if a new tenant would arrive on the first day of February, he would need to be refunded for additional living expenses.)

Now obviously, D&M no longer received any mail at P.O. Box 6 at Dover; their yard there had been closed for quite some time. When I showed these letters (including Letter 4, which they had not received) to Mr. Johan van der Poel, things started rolling. D&M's obligations, in terms of their Contract 1/1968 with the OFS Provincial Administration, were to provide accommodation for the Resident Engineer and a Soils Technician for the duration of the Contract that had 25 February 1982 as its Completion Date. Their "pay item" for the accommodation of Louis van Wijk's residence had already been "closed out" for the P 30/1 contract, and they were now paid for renting Louis' house on the P 9/1 contract, as a totally separate "pay item". Moreover, I was not their employee, and I still needed to be in Sasolburg for final handover during February. We had already purchased a house at 5 Clarens Road, Bayswater, while making a short trip to Bloemfontein in December, and this had an anticipated date of occupancy on 1 April 1972. Because with all this uncertainty, it needs to be added that Lydia had once again become pregnant during 1971, and she was due to deliver Sara in February 1972. That was virtually toward the end of construction activities, and **could** we really vacate the rental house in Sasolburg?

My involvement with P 30/1 remained as the person responsible for the final "Completion Payment Certificate" and then afterwards, responsible to provide "red-line" as-built information for the project. Whatever had been changed from the original design as shown on the Contract drawings, needed to be shown on a set of paper prints (ammonia prints, of course) and I had already started doing this over the

[185] I believe that this may have been occasioned by the retirement of Mr. C.S. Mackintosh PrEng, who had to be paid out. He retired in Hilton, Natal. Mr. Jack Fasken PrEng also became a partner at that time.

months. I therefore asked that I (= we) be allowed to stay at 19 Collins Crescent till the end of February, and then complete this work during the month of March 1972, out of the Pretoria office of MB&S.

This was agreed to; I never heard how D&M actually sorted out this "comedy of errors" with this angry Mr. J.P. de Beer and this ambivalent Mr. W.J.H. Steyn (whom Lydia only once met when he came over during a visit from Pretoria to our neighbours). We vacated 19 Collins Crescent on 29 February 1972[186], when Sara was nineteen days old. She was born in a normal "residence", converted into a maternity institution – there was no actual hospital in the Town of Sasolburg at that time, while it had the youngest population in the whole Province; three babies were born there on that particular day. Our stuff was packed and taken to storage (in Bloemfontein or Vereeniging) for a future delivery to our house there.

During that month of March 1972, we stayed at Lydia's parents' farm at Bokfontein, about 40 kilometres west of Pretoria. They had just vacated the farm, moving into a flat in Arcadia, Pretoria, because Lydia's father (during his retirement employment!) had been promoted into a full-time position[187], directly reporting to Dr. P.S. Rautenbach, Director of the Department of Planning. From early 1966 to end of 1971 he had worked part-time, and that is why they had initially moved to Bokfontein. The only piece of furniture that moved with us from Sasolburg to Bokfontein was our fridge, on the back of a brand-new grey Mazda 1600 pick-up truck, purchased at Hoppy Motors at Vanderbijlpark for an amount of R 1389. During that month of February, just before Sara was born, we also purchased a used black Mercedes-Benz 280S (ex Dr. Rautenbach) through Lydia's father, and we sold the two-tone grey VW 1600 fastback.

Working one month in the Pretoria office, I was also requested to do quite some liaison with the aerial survey firm that had been engaged for the Tweeling-Reitz road alignment project, on acceptance of the route location study. There was then no firm in Bloemfontein that did aerial surveys; a few years later, a firm started whose name escapes me. On my arrival in Bloemfontein, I would then bring all these rolls of mylar, field books (including prints of legal drawings) and aerial photos, ready to start actual design. The Pretoria office was still above the Universitas Bookstore in March 1972 when I "sojourned" there.

This therefore concludes "Part 1", covering the first six years of my professional career. "Part 2" intends to cover the next six years, until our emigration from South Africa, on 1977-11-26, the day before my 35th birthday. This period will also cover three specific employment situations and working milieus, as follows:

1. Sixteen months in the office of MB&S in Bloemfontein;
2. Three full years in the office of MB&S in Pretoria-West;
3. Sixteen months at the National Institute for Transport and Road Research (CSIR) in Pretoria

From the Completion Payment Certificate (**on the next page**), some interesting things may be glanced:

- The "Total for all works" was **about 10% lower** than the "Amount of tender" from the Contract between the Provincial Adminsitration and D&M, that had been started and signed in November 1969.
- Mr. Sturgess' signature predates the completion date for the Contract by **exactly 2 days**.

[186] It was a leap year!

[187] The reason for this was (as he told me later) that he had discovered that the Minutes of a specific important land development meeting (written by Mr. Fred Barnard, the former private secretary of Dr. H.F. Verwoerd) had not been truthful. On subsequent complaints by other attendants of that meeting, Mr. Barnard was exposed – and fired. Prior to this, my father-in-law had been mainly responsible for a study about "Airport Noise" and planning of residential areas near airports, and the location of proposed industrial townships.

- On 17/2/72, on page 17 of the Completion Payment Certificate (not shown), both Johan van der Poel (for the Contractor, D&M) and I (as Resident Engineerr, for MB&S) stated: **"As this is a completion certificate, and no more claims have been submitted since certificate no. 16, (May 1971), the claim still stands at R 3 437-31."** The already mentioned issue of the wrong quantity of reinforcing steel for Bridge No. 1409 (Lissagally) formed the main part of that amount.
- The high value of Payment Certificate No. 14 stands out. This was the one for March 1971.

So it appeared that I had "brought in" the project to the Client "within budget" and also "on time"!

ORANGE FREE STATE PROVINCIAL ADMINISTRATION KOPPIES - SASOLBURG PRIMARY ROAD P.30/1 AND LINK ROAD A102 Page 1

Description : THE CONSTRUCTION OF EARTHWORKS, SUBBASE, BASECOURSE, BITUMINOUS SURFACING, ROAD OVER RAIL AND RIVER BRIDGES AND SUPPLEMENTARY WORKS.

Certificate No. TWENTY-THREE

Contract No : 1/1968

Period from : 1-1-72

In account with : D. & M. Padaanleg (Edms) Bpk., P.O. Box 1907, Pretoria. (Completion Payment Certificate)

to : 17-2-72

Period of contract : 25.11.69 TO 25.2.72 SUMMARY PAGE

Amount of tender : R2,113,105-35

O.F.S. File No. P.32/1/17/1

Total of previous payments to be deducted			SUMMARY OF PAYMENTS	B/F from page	Grand total for work done.	
Certificate No	Rand	cents			Rand	cents
1	54 357	47	Road construction		1 671 216	93
2	69 787	32	Bridge no. 1408 - Item 23		31 491	52
3	81 007	78	Bridge no 1409 - Item 24 + fill + overhaul		103 756	080 9
4	87 126	30	Bridge no. 1410 - Item 25 & fill		61 267	17
5	62 763	41	Bridge no. 1412 - Item 26		27 677	570 0
6	83 913	99				
7	78 484	62				
8	93 248	81	Adjustment under Rise and Fall clause	17	3 437	31 -
9	107 238	80	Total for all works		1 898 848	62 60
10	74 659	07				
11	140 508	49				
12	87 113	64				
13	93 254	12	Deduct retention : ~~5% of total~~ ½ of 5% of total Contract Amount		47 471	21
14	110 105	78	Total for work done, less retention		1 851 377	39 41
15	86 129	08	Materials on site			
16	69 537	42	Total value as on page 15.			
17	68 715	68	Deduct 20% retention			
18	61 545	29	Add allowed value		—	—
19	54 706	20	Value of work done, less retention + materials on site		1 851 377	39 41
20	85 357	60				
21	39 022	42				
22	60 408	74	Subtract previous payments as this page		1 748 992	03
23			NETT AMOUNT NOW DUE AND APPROVED FOR PAYMENT		102 385	36 38
24						
25						
26						
27						
28						
29						
30						
Total value of payments already made.	1 748 992	03				

I certify that the abovementioned services were satisfactorily rendered and that the quantities and prices are correct.

23-2-72

for Mackintosh, Bergh & Sturgess,
Consulting Civil Engineers,
P.O. Box 1056, Bloemfontein.

Date:

J de Raadt Pr Eng
Resident Engineer
Date : 17-2-72

for Aannemers Beperk.
Contractor
Date : 17-2-72

and then, **just look at it**, I made an error of **2 cents**, corrected by Mr. Sturgess in Bloemfontein…!!

Conclusion:

1. As shown above, I commented on the written report on my compulsory vacation work at the Bethlehem District Road Engineer's Office (27 November 1962 – 26 January 1963), submitted to the University of Pretoria, with a formal review by Mr. B.R. Steer. I re-discovered this document in July 2018, read it, and confess that I had never realized (or rather, I had completely forgotten) that my English was so rudimentary at that time, and particularly, that my **technical** English vocabulary was so utterly limited! That is why I copied one page of text. Three specific things stand out in this report, as my "poor excuse":

- I was required to write my weekly report on the Saturday: It had to be on my supervisor's desk on Monday morning, either Mr. Steer's or Mr. van Niekerk's. I therefore had no time to prepare drafts, and must have typed it in English almost from memory, in an entirely Afrikaans milieu, where only Mr. Steer was an "English speaking South African". Yet I considered this as a wonderful opportunity……. (**not knowing that I would spend the last ¾ of my career in an English milieu!**)

- I wrote this report before having had any exposure to **surveying** or **soils mechanics**. I encountered both these subjects only during my third year, very soon after returning from Bethlehem to Pretoria.

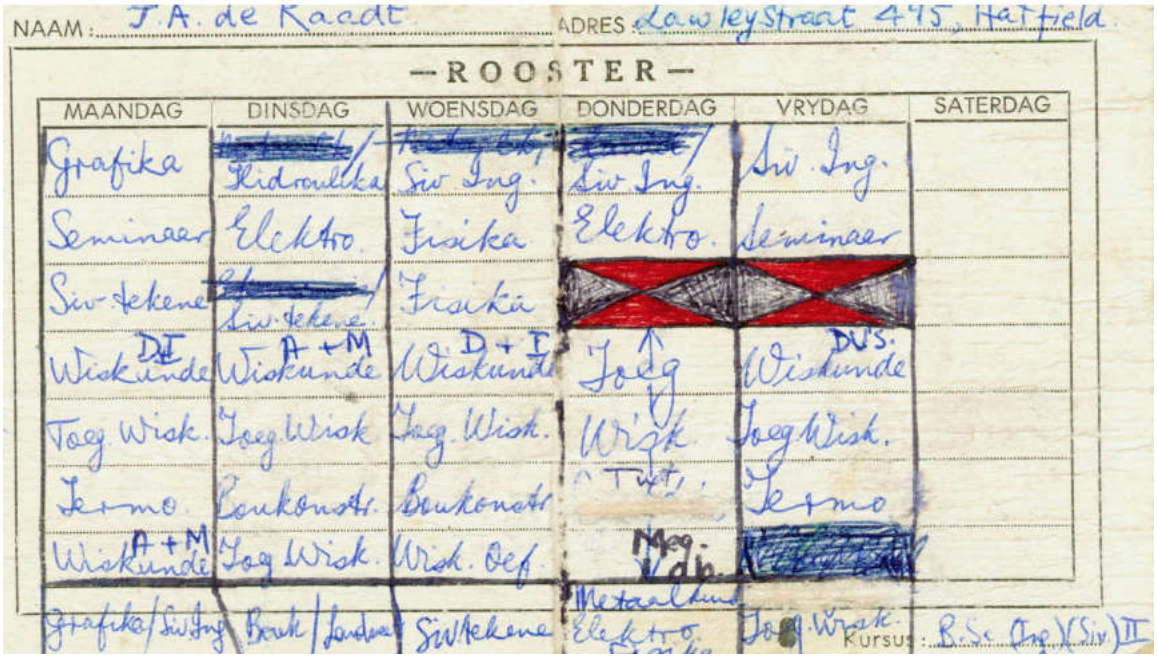
- The University had suggested that in my written report, I should try to **discuss (and even provide a critique) of the organizational set-up of my "employer"**, and I did this as follows: I explained the systems used, and (having grown up in a relatively inpecunious household) saw a lot of "**waste**" within the OFS Roads Department, due to all kinds of "**over-centralization**" in Bloemfontein. A mere ten years later, as Resident Engineer at Dover, on behalf of a consulting firm for the OFS Roads Department, I felt almost unrestrained by Messrs. Sturgess and Grodsky, and had gained enough confidence by my years at BSB&P and the City of Pretoria. I believe that the mentoring that I had received at those two previous employers had helped me tremendously. Perhaps "Government" had also changed for the better, or that the use of consulting engineers assisted in a better managed system.

2. Perusing information on the 17 tightly typed foolscap pages of text[188], with many additional pages (and even some annotated black and white photos taken during the last weeks – as an afterthought) helped me to somehow reconstruct those student days, as well as to remember all the things that I had already learnt for practical use during the first six years, after standing on the podium in the Tortoise Hall. It humbles me greatly to think how different my professional career might have been become, if I had not been so marvellously mentored, trained and also tolerated by those who supervised me during those first six years.

3. I somewhere opined that today's University students have it easy. How difficult were my years at UP? The Schedule of Classes (**next page**) for my second academic year (1962) clearly shows that our morning lectures (from 7:30 a.m. to 12:50 p.m.) were almost "fully booked" for all weekdays, with only three "open periods" on Thursday / Friday, and that we had laboratory classes (from 2:00 p.m. to 5:00 p.m.) for nine out of ten weekday afternoons. Only 70 minutes for lunch, only one afternoon per fortnight to do all other things. No wonder that many of my classmates dropped out that year. I only failed one subject, Electro 2S, as already mentioned. Many others failed more than one subject. One fellow-student who had had five or six A's in Standard 12 (his final year in High School) failed miserably. I met him later for his second year Engineering Drafting, when I was a "demi". His name shall rather remain unrecorded; he had a full scholarship, and in 1963 had to take up a full-time working position, returning to UP in 1965.

[188] The reviewer "D.G." (Mr. D.G.S. Wolmarans, unknown to me at the time) noted: **"A bit long. You deviate too much from your point – soil tests and road design."** Very true perhaps, Mr. Wolmarans, but how else could I enjoy this now, more than 55 years later? I recently had a chance to show this report to my youngest grandson James de Raadt. Would he (and my other grandchildren) be interested in a "bone dry" vacation work report?

When I completed my final yeat at UP, I had an amount of **R 62.10** in a Savings Account at Volkskas Bank; an older vehicle, a littlle bit of used furniture, some books, some student loans, but also **a degree**.



NAAM: J.A. de Raadt ADRES: Lawley Straat 475, Hatfield

—ROOSTER—

MAANDAG	DINSDAG	WOENSDAG	DONDERDAG	VRYDAG	SATERDAG
Grafika	Hidroulika	Siv Ing.	Siv Ing.	Siv. Ing.	
Seminaar	Elektro	Fisika	Elektro	Seminaar	
Siv tekene	Siv tekene	Fisika			
Wiskunde D+I	Wiskunde A+M	Wiskunde D+I	Toeg	Wiskunde DU'S.	
Toeg. Wisk.	Toeg. Wisk	Toeg. Wisk.	Wisk	Toeg. Wisk.	
Lesmo	Boukonstr.	Boukonstr	Tutt.	Lesmo	
Wiskunde A+M	Toeg Wisk.	Wisk. Oef	Meg Vak		
Grafika/Siv Ing	Bouk/Landm	Siv tekene	Metaalkunde Elektro	Toeg. Wisk.	

Kursus: B.Sc. Ing. (Siv.) II

After I had sent **this 1962 Schedule of Classes** as a .pdf file to Jaap Zuidam last year, he responded by e-mail **that he did not want to do it again**!

4. As this "Part 1" seems to have proven, I have been aided much in my professional career by reading and re-reading articles in "The Civil Engineer in South Africa", as well as the Proceedings of the 1963 Convention of the SAICE. I had the issues from 1964 to 1969 bound when we left Pretoria; I never had the others bound and must have discarded them somehow and somewhere. Pity! I also have the complete proceedings of the 1968 SAICE Convention, held that June at the Aula of the University of Pretoria.

5. Additionally (and lastly), I would like to divulge that for several decades I have had a printed version of a short poem on my desk or on a wall close by. My mother sent me the hand-written text of its first three lines[189] (without the title), while I was a student at Tukkies. On the **next page** follows the full text of the original poem (by one of the most well-known master poets of the Golden Age of Netherlands poetry) and then follows my own (fairly accurate) translation into English.

6. Obviously, the content of this poem can only be understood from a truly Christian (and I mean a Calvinistic) perspective, particularly in terms of what theologians, but also sociologiosts like Max Weber (but please, do not believe him!) et al[190] have called the "**Protestant Work Ethic**", and e.g. Proverbs 10:4 and many other texts from Scripture itself, clearly tech.

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[189] In the original 17th century spelling, as my mother may have remembered it from her literature textbook at the Christelijke H.B.S. of Rotterdam. The text in the top box is in the current ABN (Algemeen Beschaafd Nederlands or "Generally Civilized Netherlands") which I found on the internet. She was the one who taught me to keep my languages separate, and never forget my mother tongue, although so close to Afrikaans that many other immigrants children forgot their Netherlandish heritage. Just like in North America, our own children "lost" their Afrikaans.

[190] My distantly related 'cousin' (who is actually somewhat closer related to Lydia than to me), Dr. J.D.R. (Donald) de Raadt, currently from somewhere on the coast of N.S.W., Australia, has written extensively on this topic as a Systems Scientist. One of his writings is a book titled "Intellegent Christianity in an Age of Folly" – Melbourne Centre for Community Development (2013). Another book is "The Rise of Bureaucracy and the Decline of Work – their Roots in the 2nd and 3rd Century Church" by the same MCCD (2017). Other books by him and his wife Veronica D. de Raadt (all available for free downloading at www.melbourneccd.com) are: *Information and Managerial Wisdom; A New Management of Life; Redesign and Management of Communities in Crisis; A Method*

LIEVE ARBEID

Die 't Ambacht wel verstaat daar van hij leven moet,
En die 't, niet wel alleen, maar wel en geerne doet,
Beleeft het grootst geluk dat iemand kan begeren.
Hij spoedt, en spoedt met vreugd, hij wint, en wint met ere.
O aller staten staat, daar voordeel gaat met lust,
En lof en dank met beid', en werken zelf is rust!

Constantijn Huygens (1596-1687)

DEAR LABOUR (*or* WORK)[191]

Who knows the business well from which he needs to live,
And does not only do it well, but also eagerly,
Experiences the topmost bliss that someone can desire.
He speeds, and speeds with joy, he wins, and wins with honour,
O state above all others, as profit joins delight,
And praise and thanks with both, and work itself is rest!

(translated by JAdR, 2018)

Luke 17:10: "So you also, when you have done all that you were commanded, say, 'We are unworthy servants, we have only done what was our duty'."

Three questions ought therefore to be asked, (and I would like you, dear reader, to answer them as I have already asked and answered them myself many times before, also during the writing of this "Part 1" of "My Professional Career" over the past two years:

(1) Was I knowledgeable/happy/content or even fulfilled in my chosen career (vocation), at the end of 1971?

(2) Did I do my work (as a "Professional Engineer by the Grace of God") **well** and **eagerly**, **with joy**, with zeal, and **with honour**?

(3) Did I give "**praise and thanks**" to Whom it actually belongs?

I firmly believe, as I did then, that the answers to these questions are affirmative, as they ought to be, though very imperfectly.

But in doing that imperfectly, referring to the title page and to the text at left, absolutely no glory be to me at all, but SDG.

The photo on page 6 (taken at the four columns near the entrance to the University of Pretoria) shows that Institution's crest and motto ("**Ad Destinatum Persequor**") from Phillipians 3:14: "I **press on toward the goal**" – but somehow (unfortunately) failed to continue with the remainder of that text: "**for the prize of the upward call from God in Christ Jesus**." That thought, dear reader, may perhaps have been in the mind of the founders of UP at the previous "turn of the century", and was lost for brevity sake, but it is more importasnt that – after so many years – I realized that it ought to have been my goal, as a professional engineer, in my vocation. Was it; consistently? Have I always been a "profressional engineer by the grace of God"?

JAdR – 2019-12-19; 09:56

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and Software for Designing Viable Social Systems; Ethics and Sustainable Community Design; From Multi-Modal Systems Thinking to Community Development.

[191] In the (footnote?) section of p. 1185 of Webster's "**New International Dictionary**" (1934 edition), I found the interesting Latin phrase "**hoc opus, hic labor est**" – Virgil, *Aeneid,* VI. 129 – which does not really explain the difference between **work** and **labour**, but a tautology, as explained: "**This is work, this is labor**; i.e., **this is the truly difficult thing to do**." – and yes, I know, this is the American English spelling that I have been trying to avoid so much up to now.