Ingenieurs Geologische Kring
Netherlands Section of Engineering Geology
Secretaris: Dr. J.J.A. Hartevelt
Postbus 63, 2260 AB Leidschendam (the Netherlands)
Postgiro; 3342108, t.n.v. Penningmeester Ingeokring Delft.

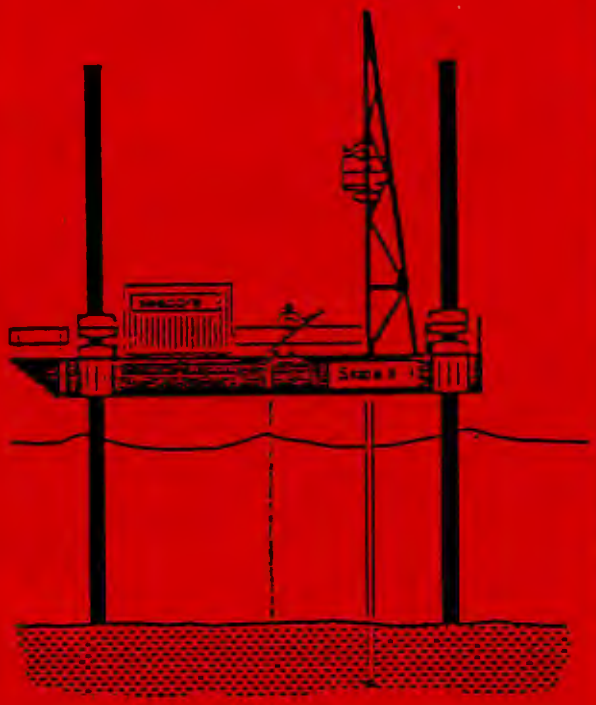
INGEOKRING NIEUWSBRIEF

JUNI 1990

Seacore

OVERWATER DRILLING ENGINEERS

- Marine Site Investigation Drilling
- Marine Exploration Drilling
- Anchor Drilling
- Pile Top Drilling
- Jet Probing
- Jack-ups, Barges, Drill Ships
- Marine Drilling Consultancy



Seacore Continental
Noordeinde 18a
P.O.Box 81
2501 CB The Hague
The Netherlands
Tel: -31-(0)70-65 60 73
Fax -31-(0)70-64 99 16
Telex 34349 palys nl

GeoCom Consultants

FIRST IN ENGINEERING GEOLOGY

(ON LAND AND OFFSHORE)

FEASIBILITY and SITE EVALUATION
- *Desk studies*
- *Site Reconnaissance*

SITE INVESTIGATIONS & (HYDRO)GEOLOGY PROJECTS
- *Planning, Contract Documents*
- *Project Management*
- *Supervision, Client's Representative*
- *Engineering Geological Mapping*
- *Overwater Environmental Surveys*

ENGINEERING GEOLOGY
- *(Hydro)geological Surveys*
- *Geophysical Surveys*
- *Geophysical Interpretations*
- *Sample Description, Core Logging*
- *Rock Testing*

CONSULTANCY & TUITION
- *Evaluate Potential Geological Hazards*
- *Lecturing, Training*
- *Arbitration*

GEOTECHNICAL ANALYSIS & DESIGN
- *Soil & Rock Mechanics*
- *Foundations, Rock Slope Stability*

GeoCom Consultants
Noordeinde 18a
P.O. Box 621
2501 CP The Hague
The Netherlands
Tel: -31-(0)70-65 07 95
Fax -31-(0)70-64 99 16
Telex 34349 palys nl

Nieuwsbrief Ingeokring

INHOUD juni 1989

Redactie:

Drs. P.N.W. Verhoef
A.R.G. van de Wall
J.E. de Groot

Van de redaktie

Voor U ligt de nieuwste uitgave van de Ingeokring. In dit nummer vindt U onder andere de laatste aflevering van het verhaal over het congres in China, de heer de Mulder schrijft over de toepassing van kwartair geologie bij de Rijks-geologische dienst en een stuk over 'Linear cutting tests' door de Heer Reinkink.

Het volgende nummer zal geheel gewijd zijn aan Informatie systemen en hun toepassingen.

Sinds het vorige nummer hebben enige veranderingen plaats gevonden. In de redaktie hebben W.O. Molendijk en F.Bisschop plaats gemaakt voor J.E. de Groot. Dit is samen gegaan met de bestuurswisseling van het Dispuut Ingenieursgeologie.

Het nieuwe bestuur bestaat uit:

A.R.G van de Wall	voorzitter
J.E. de Groot	secretaris
A.M. Scheerhout	penningmeester
T.Maasse	commissaris

Het oude bestuur wordt van harte bedankt voor hun inzet gedurende het afgelopen jaar.

Kopij kunt U nog altijd inleveren op onderstaand adres:

Correspondentie adres:

Redaktie Nieuwsbrief Ingeokring
Faculteit der Mijnbouwkunde en Petroleumwinning
Sectie Ingenieursgeologie
Mijnbouwstraat 120
2628 RX Delft
Nederland
Telefoon: 015-782543

Instalment 4 : Conference Field Trip Report

Conference on Underground Spaces and Earth Sheltered Buildings Shanghai, September 1988

CHRONICLE OF A TRIP TO CHINA

by P.M. Maurenbrecher

This is the fourth and final instalment on the visit of P.M. Maurenbrecher and Prof. Ir. H.S. van Lohuizen to China. The story thus far covers the tribulations at Hong Kong, a rainy conference at Shanghai and an overland trip by train and by bus to Xi'an stopping on the way at Kaifeng and Luoyang. Many historical sights were visited culminating at China's most recent archaeological wonder: the Terra Cotta Soldiers. Is there a danger that the conference travellers have been subjected to an overdose of tourist attractions or could they survive yet another onslaught of yet more wonders? Read on..

Sunday ensconced in luxury of the Wan Nian Hotel, Xian, Sept. 12th 1988

The Dayan (Big White Goose) Underground Palace and Civil Defence Shelter

Mr. Zhong of the Civil Air Defence is our host and joins us with two colleagues at our hotel to guide us to the Big White Goose Underground Centre. We leave at 9:00 a.m.. On the way we pass the Vienna Art Restaurant in the White Goose Pagoda street. Wiener Schnitzel and opera in the center of China? Something for the Eisenhoffers (Austrian/ New Zealanders). We passed a university, which we were told, was a sister university for a university in Shanghai. At the southeastern end of town we are at the Big White Goose Pagoda and next to it is the underground civil defence complex. As a shelter it hopefully will not have to be used so it is kept in use as an underground shopping and entertainment place. The complex is excavated 8 m below ground level into the Loess formation and is reached through a 200 m long 3 m wide and 3½ m high inclined tunnel. Excavation by hand digging. Lining for tunnels and spaces consists of re-inforced concrete. Air ducts for ventilation is underneath the floors. De-humidifiers by condensation pumps and using saw dust. The construction was started in 1980 and completed in 1982.

The *piece de resistance* was a rather macabre exhibition of in formaldehyde bottled Siamese twin babies, dismembered limbs, dissected infants and other anatomical features. To add to the surrealism the whole exhibition had background Chinese pop musac. Other entertainment consisted of a costume exhibition of Chinese emperors, an idyllic model of miniature palace with lake and boats pulled along on a revolving string conveyor, "parlour games": (TV games) and typical funfair games: ball in the hole, ring hoops, sharp shooting and similar delights. I was glad to get back into the open air.

The Big White Goose Pagoda

From the underground the visit changed to ancient high rise: the Big White Goose pagoda: Trying to offset touristic tendencies my notes recorded the following: The pagoda is approximately 34 by 34 m at the base and has 10 m

continued..

thick masonry walls and a centre stair-well. Two spiral staircases lead to the first level, thereafter one spiral staircase connecting the upper levels. The bricks are 350x165x75 mm, 400x165x80 mm and the paving bricks are 240x120. The pagoda was crowded with Sunday visitors. Once on top the views over Xi'an were extensive. The entry ticket (as are most tickets in China) contains a brief history and description of the pagoda. *Dayan Pagoda is situated in the Great Ci'en Temple to the south of the city of Xi'an. Hence also the name Ci'en Temple Pagoda. It was built in the 3rd year of Yonghui Reign of Emperor Gaozong of the Tang Dynasty (A.D. 652) and served as the place for the renowned Monk Xuanzhuang to translate Buddhist scriptures. The original pagoda had only five storeys and was rebuilt during Changan Reign of Empress Wu Zetian. The present Dayan Pagoda has seven storeys and is 64 metres high in the shape of a square pyramid. It is a brick structure with arched doors on the four sides of each storey. There are wooden stairways inside the pagoda for visitors to climb to the top and have a bird's -eye view of Xi'an.*

Hanyao underground village

From the White Goose a short bus trip slightly to the southeast was made to visit an historical underground village of Hanyao. The village consists of a vertical sided ravine, in loess. Into the base of the ravine cliffs are built arched facades consisting of brick with one window and a door. Behind the facades are one-roomed underground houses. Most appear to be lived in. A shrine to faithful wives consists of a larger complex of whitewashed rooms and connecting tunnels. The complex is an historical site and has the status of a memorial to faithful wives based on the following story, (obtained from the reverse side of the entrance ticket). *The membery of HANYAO, Xi'an China: Wang Bao-Chuan Story. During the end of the T'ang Dynasty, Wang Bao-Chuan is the third daughter of the prime minister. A beggar, Xue Ping-Gui, became the son in law of the prime minister because he was hitted with a coloured ball* (presumably at some sort of festivity such as a Chinese version of a Debutante Ball in which a girl throws a coloured ball to a group of potential husbands and the one touched by the ball is to become her husband). *But her father was against their marriage consequently they escaped to Wu-Dian Po and married. Xue Ping-Gui joined the army later and went on an expedition to Xi Liang. Wang Bao-Chuan had been living at the humble cave dwelling. She dug edible wild herbs to keep live. It was about eighteen years after the married couple was reunited because the T'ang and Xi Liang are unified.* There was tunnel where one purchased a long thin candle for lighting. I walked along the outside and met the Italians at the exit portal. They were disorientated and their candles were used up, thinking they had to grope their way back in the dark to return to the village. For once I could act as a tourist guide instead of the tourist somewhere in a loess ravine somewhere in central China.

Back at the hotel for lunch including husbands with their wives with renewed faith in the marriage institution we settled down for lunch having to negotiate various dishes from a menu written in Chinese and waitresses who could only speak in Chinese. Van Lohuizen, suffering from stomach ailment for which he got all kinds of interesting medicine in the morning, spent the day at the hotel. Just as well as the Great White Goose Underground Palace and Civil Defence Shelter's exhibition of bottled human anatomy does little for appetite or recuperation.

Hospital, museum, city wall and a mosque

A short visit was paid to Xi'an's general hospital to look at the basement in the south wing. In case of attack the basement doubles up as a civil defence shelter. Its present use is as rooms and wards for patients.

continued..

The next stop was the Shaanxi Provincial Museum located in a what appears to be a Bhuddist temple complex. The museum is situated next to the city walls. The museum is renown for its *steles*. Steles are black (basalt) stone tablets of about 2 m high and 1 to 1.5 m wide with chiselled inscriptions recording Chinese history, literature and philosophy. A whole forest of steles occupied three large halls in the end pavilion of the complex. "No scribbling" was the notice alongside the "No smoking" at the entrance to the pavilion. By "scribbling" was probably meant "rubbing" as is done often in European churches, i.e. brass rubbing. I suggested to Mr. Granit that his sketching may be construed as "scribbling". There was little time to admire the other pavilions which contained artifacts such as terra -cotta horses, vases, figures, bronze implements, wine decanter looking like kettles from between 1100 to 750 B.C. and a wine ladle with its own stand to keep it upright. One exhibition hall showed larger than life sculptures of panthers and rhino (without the nose-horn). The following excerpt was taken from an information display: *The periods of Han and Tang Dynasties are considered the hay time in the history of our country. The plastic art is blossoming in radian splendour since it represents the spring of* (the) *era*. Areas of "no entry" were signposted in English as *"Visiters* (sp) *Stop"*. Finally for those lucky to visit the museum in the year of the dragon can expect the following: *Historical Dragon Relics Exhibition Brief Introduction: China will enter Wuchen dragon's year from Spring Festival in 1988. On the support of Shaanxi Provincial Travel Agency, our museum collected more than 170 culture relics concerning dragon for the exhibition of Historical Dragon Relics to reveal dragon on the position of Chinese traditional culture and the evolution of its artistic form.*
Dragon was the totem worshiped by Hua Xia ancesters in the early time and it has a close connection with Huang Emperor in chinese legend. Dragon has now symbolized Chinese nation through five-thousand-year convention of cultural tradition. As China is titled Great Eastern Dragon, either overseas Chinese in the World or people between Taiwan and mainland are quite proud of being the descendants of Yan and Huang Emperors and the later generation of dragons. According to the textual reserch, Shaanxi Province is the original place of ancient tribe of Yan and Huang Emperor. So, the Historical Dragon Relics Exhibition to be held in Xian, as one of the programme in International Tourist Activities in Dragon Year, is extrordinary appropriate and meaningful.
May the Divine Land be promoting in Dragon Year. May our tourists be good luck and satisfaction of every wish,

Shaanxi Provincial Museum.

The next visit was the massive wall surrounding the old city. The wall is about 15 m high and about 20 m wide built from 420x225x100 mm masonry. The views are quite extensive from which one could see towards the south in the afternoon haze the Big and the Small White Goose Pagodas. On the wall not many people as it is possibly for the Chinese tourist relatively expensive. One can go for long promenades. The paving slopes inward towards old town. The wall is castellated on the outward side. The moat contains flowing water, probably part of a river system as indicated by a weir built to maintain moat water levels. The wall has sentry towers at 400 m intervals. From a sentry tower discussed the possibility with Mr. El Husseini from Morrocco and Mrs. Neumann from Germany the probable whereabouts of a mosque that is described in Mrs. Neumann's guide book. Nothing could be discerned in the roof top landscape which might resemble a mosque. Mrs. Neumann was quite keen for Mr. El Husseini sake that we should make an effort to visit the mosque and with a minimal of lobbying we all agreed to visit the mosque. Its in the western half of the old city and after driving down a road with many indications of Moslem associations such as a restaurant such as the "Islamic Restaurant". We had to walk down a alleyway

continued..

fully lined with souvenir kiosks. Amongst the souvenirs the usual Delft blue wooden shoes and ashtrays with "Made in Holland". Would be interesting to discover where the Chinese Holland is. Purchased for 5 Yuan a bicycle bell and without having to haggle over prices suggested they throw in a pair of the Delft wooden shoes.

At the mosque entrance kiosk Mr. El Husseini got into an Arabic conversation with the vice-imam. The kiosk sold various souvenirs and Islamic publications. The vice-imam guided us round the complex, describing to Mr. El-Husseini in Arabic the various features and then Mr. El Husseini would in turn describe them to us in English. The complex has very much the Bhuddist temple layout, but did appear to be aligned towards Mecca. The Arabic writing mixed with Chinese, in some instances the Arabic letters are grouped to look like Chinese characters. The entry ticket to the Mosque has the following information on its reverse side: *The Mosque is a blend of traditional Chinese and Islamic architecture. Its construction started 742 (the 1st year of Tiambao period of the Tang dynasty) and additions were made during the Song, Yuan, Ming and Qing dynasties to make it and ancient architectural complex: its floor space is about 5,000 square metres. It's a key provincial historical site under special protections and place where Moslems lead their religious life.*

In the evening we returned by taxi to the area to eat at the Islamic Restaurant. We arrived a little on the late side so that some items such as rice was not on the menu. It was rather expensive, the food was good and the resident house pet, a rat, did not go unnoticed. (I kept quiet about it and so did Elizabeth Granit, who told me the next day). Despite the vermin no food poisoning. The taxi drivers joined us at table but did not eat, just made belching noises presumably to convey to us (they didn't speak English) 'have a good appetite'.

Monday in the lounge of the Wan Nian Hotel Sept. 12, 1988

We are sitting in the lounge not quite sure if we will be travelling to Beijing. Mr. Tiede, used to German puncuality, is making remarks about the organisation of the trip. An elderly American lady accompanying Mr. Hamburger leans sideways towards Mr. Tiede and says "You know what I don't like?". Mr. Tiede, a bit taken aback asked: "What don't you like?", Came the reply: "A smart ass man". Mr. Tiede is quiet for a change. I was sitting with them in the lounge half listening and half writing up yesterday's visits. Hence Sunday's journal was interspersed with observations on Monday's tribulations which reads as follows: "*Quite a discussion on our departure. At this moment I sit in the lobby writing up yesterday's tour. There was panic this morning; the plane departure is 11.25 instead of 13.45. So everyone had to leave except I was in the coffee shop with Tiede's and Granit's. Only after leaving saw a very distraught Zhou (our travel guide). Apparently we were back to the original (already revised schedule). Tiede reckons we will be on wooden crates on a 21 hr train ride to Beijing as bus broke down and there are no tickets.*
Next..*We have settled into a Tupolev 125 or something of that type which looks very similar to the British VC 10. It is well appointed with lockers above the seats. I am sitting in row 30c, rows go up to 33. Flying 1000 km, 1hr and 20 min at 10 000 m; take off. Its rainy (drizzle) and we are climbing through cloud, time 13.09. Plane is not very quiet, giving off a high pitched, almost piercing, whistle.*
13.12 brightening but no sun yet. Received an orange carton drink, could also have chosen tea or coffee. Then the stewardess came round with a serving plate of souvenirs, a double sided felt pen, with one end a thick nib and the other a thin nib, and it is leaking.

continued..

13.52 The sky is clearer even towards the ground. Had nodded off to sleep. Prof. van Lohuizen together with the Granits and some others left behind and will be coming on a later flight as there wasn't any space on this flight. Over the loudspeakers: We are due to land at 14.30, 18|C, Beijing main political centre, 16 800 km2, 12.3m population, capital of various dynasties, many historic sites (including outlying areas), temple of heaven, Forbidden City, Great Wall, in 1949 capital of the PRC, modernization, wish a pleasant stay. After speech we all receive a packet of jelly drops. Thats our lot (in tourist class).

The airport at Xi'an resembled air terminals of the 1950s. Departure and arrivals are all in one level. Plane is reached from departure lounge on foot. Driven by hotel bus to terminal. The route was through the western part of the city which meant through the old centre and through the city walls. A large gap in the wall accommodates the main thoroughfare. Large new buildings under construction for new hotels. We were in one of the four existing luxury hotels. One is a totally glass building, which is a novelty for Xi'an, a major tourist attraction... for the local tourists.

The following notes were written in the present:

Flying over grid patterned fields with villages at the nodes. The Yellow River delta. Up to now I have not seen the river, just near it. Hills to the North (?)... we're supposed to come from the West but sun is on port side. The plane is probably making a slight turn and so must be flying northeast. The stewardesses are collecting newspapers.

14.20 The engines are at full screech accompanied by a smooth landing. The airport embarkation/disembarkation similar to Schiphol.

We have a two hour drive to the Great Wall. The journey starts with a motorway with underpasses, it is tree lined and even has trimmed hedges. Colourful flags are attached to central lamp-posts. The soil is coloured dark brown and looks gravelly. In China there is billboard advertising, both for their own products and foreign. Foreign is usually film products. Advertising is also on television, everything from ball bearings to refrigerators.

We cross alluvial planes covered with lots of trees consisting of willow, pine, beech and wattle (mimosa). At an earlier town we were told that tree planting was post 'liberation', 1949, especially in the cities. Despite the building style being monotonous and in need of upkeep, the trees go a long way in making the towns attractive.

15.07 The road is now concrete paving and two-way carriageway on an embankment. Orchards of pear as a 50 m wide strip along road, behind fields. Beijing outskirts consist of high-rise apartment buildings up to 20 storeys. Newly built they look fresher and better finished then those in the provincial cities. Cars are more numerous, often Japanese but also VW Passat made in China, Fiat, Lada, Polski Fiats, Renault 12 (Dalia from Yugoslavia), Ford Sierras and Chinas traditional large sedan for officials which looks like a cross between a 1950's Mercedes and a 1960's Chevrolet. Buses in China made of two sections, the trailer section connected to driving section through a bellows joint section.

3.25 Turned right into wide avenue heading west then ten minutes later turn right again into wide avenue heading north. The road is now asphalt and has a speed limit of 40 kph. Plots adjoining road occupied by light industry and horticulture. Buildings are brick and utilitarian. Road is now four lanes and jolting reinforced concrete. We are heading in the direction of Chang Ping. Quite a lot of traffic. Corn (maize) to either side of the road. Road has overhead lights and is tree-lined. Secondary road runs alongside which is used for bicycles, pedestrians and farm vehicles. Hills appear about 5 km to the north with mountains beyond. Large quarries in

continued..

limestone with almost vertical faces. The direction is westwards towards Ba Da Ling.

4.19 Pass a large roundabout with an inner roundabout for bicycles reached through underpasses. Heading into the Ying Sang mountains consisting of limestone bedding dipping 40| towards the south.

The camera now takes over from the pen and very little appears in my notes of the Great Wall visit. I must have assumed readers will be bored as enough travelogues exist which describe The Wall. But The Wall is a personal experience. We travelled on a split dual carriageway into a Ying Sang valley. Suddenly walls are seen climbing steep slopes, and we stopped first to look at a monumental gateway. Many walls, not just one continuous wall. Souvenir shops are shutting. We get back on the bus and soon we are in slow traffic. It is 5 p.m. and one can see up on the mountain ridge a more substantial wall than the earlier we had seen. The traffic is not dual carriageway and finally the reason for the jam: the gateway through The Wall is single lane and parking is at the other side. We can still visit the wall which is just about deserted. The visiting area is what must have been a combination customs complex and garrison quarters for the sentry towers. It is situated on a pass and The Wall follows the ridge. My only notes on The Wall say something that the rock is plutonic and contains phenocrysts. The sun is now setting and lighting up the fortified side of The Wall with a deep yellow. Good for photographic effects. The walk-way is very steep, but luckily few people. At normal times one has to walk on the left, and I'm told, its slow because of the people. At the sentry towers one can walk down steps to leave The Wall for a wonder into unspoiled mountain countryside. I managed about four sentry towers, up to the point where The Wall makes a right turn towards the north. Further along restoration work is in progress. Return walk is down hill, sometimes along smoothed out paving. When it rains its very slippery.

In the twilight back to Beijing along an upper carriageway.

The hotel is the Beijing-Toronto and conforms very much to international hotels everywhere. A band in the upper lobby strike up a Chinese ditty. On reflection it is the Last Emperor music. I ate that evening with the Neummans in the hotel next door. Van Lohuizen arrived with Granits later that evening.

Tuesday, Beijing, 13th Sept. 1988.

We are crawling along the Dhong Changan Jie heading for Tiananmen Square. The square appeared after half-an-hour drives covering five city blocks each up to 1 km long. The bus parked at the entrance of the People's Palace. The square has large palatial buildings. In the North the entrance to the Forbidden City, in the middle Mao Tse Tung's mausoleum. After being scattered like chickens by a procession of official cars (all Nissan except for one aging limousine of Chinese make) we regroup. There is a long line of people visiting the Mausoleum but it moves quickly. Orderlies kept telling the ladies of our group "no bags". They also sold brochures at 0.50 Yen. Signs requested visitors to remove their hats and remain quiet. The train of people, all at fairly rapid walking space) split into two, turning right and other left. In the first hall is a seated statue of Mao Tse Tung and a tapestry filling a complete wall. This is followed by an antechamber where the embalmed body of Mao Tse Tung is displayed under a glass coffin lid. The guards look like waxen figures, absolutely motionless. In the following hall joined up with (in my case) the left stream of people to exit down a large flight of steps. At the base many kiosks where one can purchase souvenirs such as slides, soft drinks, momentos and postcards.

continued..

Much of the old city must have made way for the grandiose buildings of Tiananmen Square; many remain reflecting what was to come; the Forbidden City. Unlike the open balconied and veranda style housing of southern and western China, the Beijing houses look inward similar to Arab houses, with courtyards and walled gardens. They are mostly one storey, like the palaces of the Forbidden City.

Its a warm Indian summers day, a pleasant temperature. All our visits, or nearly all our visits have been guideless. There are hordes of visitors, many herded; they often wear identical sun caps and the guide holds up a flag and rattles off facts, about dates, dynasties, dimensions, and other extraordinary statistics. The groups all walk along the centre, first the Audience Palace, then the Wedding Place, The Toy Museum and lots of kiosks to satisfy an insatiable craving to purchase momentos of such a momentous experience. I leave the central stream of lemmings and there are quiet courtyards, even with shady trees. Not like the main areas, where trapped air in stone spaces is stifling.

Renovation work is in progress, to create more museum space to display China's vast historical heritage. One wonders the purpose: out of their own genuine pride in their heritage or as a consequence of a response to satisfy the Western tourist phenomena? Probably both. A toy museum in what was the living quarters. On display a Kaiser Wilhelm II model battleship with an upside-down Dutch flag. The last courtyard is the garden; a geological impertinence. A fantasia of karstic limestone rip-rap trowelled into a make-believe mountain with nooks and crannies. Rather hideous, but it was popular as were the gardens at Shu Zhou. The geological bedding abruptly alters course from one rock to the next. Through the exit on the North side the bus is waiting for us alongside many other buses. Across the road a park with a hill with a pagoda-like pavilion on top acting as a focal point along the north-south axis of the Forbidden City.

The afternoon visit was the Summer Palace, once a place in the countryside for the emperor and his family for a somewhat cooler time in the summer than at the Forbidden City. Now the large white apartment blocks are encroaching the palace grounds. Like the Forbidden City, the mosque in Xi'an and many of the Bhudist monasteries the Summer Palace exhibits a similar layout. Entrance, courtyard, side buildings (usually not of particular historical importance, so they are used as the souvenir shops or exhibition rooms), then the main building, either containing the first Bhudda and associated gods and followers, or if it is a palace, a throne, a protocol room, a ladies room..... One continuous stream of rooms separated by courtyards. "Not again" was the thought going through my head as I watched a packaged herd of sun-capped tourists keeping up with their flag poled guide. I see less of the art and more of the souvenir shops. Courtyard after courtyard? Well not this time. A lake, which once had a small scale paddle steamer. Now grounded, but a worthy background for a little Chinese boy in sailor suit saluting stiffly and earnest while being photographed by proud parents. The smile European parents look for in their children, did appear: after the picture. An arched stone bridge goes to an island. A long promenade along the lake-side and if the weather threatens there is an elevated covered walk-way, 750 m long and it catches the breeze off the lake. The palace grounds have hills on which were temples and other buildings. Hills are for climbing, if only to see the view from them. The main temple was under restoration but one could still see a view of encroaching urban Beijing through the scaffolding. To the west in the line of the ridge across flat lands to a distant hill stood a lonely pagoda. Will the high rise boys do what they do in most urban areas: pollute the sky-lines with their rectangular slabs of concrete and glass so that this view too will have to go?

continued..

The hotel coupon affair

I had walked for an hour and a quarter without retracing my steps and lost site of all members of our party until I finally came across the Eisenhoffers along the covered walk-way. We chatted sitting on the wide banister of the walk-way. They were still perplexed by the dinner vouchers given to the guests at the hotel on arrival yesterday. I didn't use mine as in the usual confusion it was not clear if they in fact covered the cost of a dinner or part of the cost of a dinner. Up to now dinners were at our cost, so all the more surprising that we were given vouchers. I ate next door in another hotel but some members, who had dinner at the rather expensive restaurant of the Beijing-Toronto, believed the vouchers did cover the cost. Well, they didn't. The Eisenhoffers are personal friends of the previous New Zealand Prime Minister Muldoon. Muldoon was the last statesman to visit Mao Tse Tung before he died. For the visit in September of 1976 4 million school children lined the road from the airport into Beijing. This is equivalent to total population of New Zealand. The conversation covers much of the do's and donates of China's new revolution. We all have our failings; how can we judge? Against what we take for granted in our own countries or what China was before. Gloated tourists ripe for home is what we are.

Van Lohuizen suggests on the way back a word of thanks. Zhou has had his fill from the diverse expectations of our motley group. I remember seeing a happy hour advertised at the Hotel's Crystal Lounge. So I volunteer on van Lohuizen's suggestion, thank Mr. Zhou and his colleagues for their enormous effort and as for the ups and downs, in the end its only the ups that one remembers. Applause for Zhou. Then to ensure a final UP I suggest we all on arrival at the hotel make for the Crystal Lounge. This suggestion does not go unheeded. The Italian, Mr. Silvestrini also gives an impromptu word, excusing himself as he can't make the final get-together as he has to leave for home this evening, but pays Zhou a better compliment than I could have thought up "A bit of confusion is very Italian, what more could I ask for."

Happy hour was happy. Vouchers, coupons and the unexpected did not figure. The Shimuzu people handed out folders. Photos all round. My fancy camera, the latest in camera chip operation from Olympus, didn't flash. The camera is more show and I'm convinced the manual camera's of over 15 years ago are better than the motorised electronic digitised aberrations we have now; I was on the Great Wall and the batteries gave in. No warning. My spare batteries were in the bus. Sunset over the wall was not to be in my photographic wonders. The reset button re-activated the flash. Don't take photos through glass as the camera focuses on the glass. The instruction book looks like a computer manual, it tells you how to override all the automatic operations: the best way to override them is a non automatic camera where the operator has control of and not some perverse semi-intelligent chip. Conversation was on fully booked hotel rooms. The Granits are staying a week. They went off with Zhou looking for a room. Others were off early in the morning. Van Lohuizen goes on the 15th. His visit to the university in Beijing is arranged. Dinner in the coffee shop-Beijing is expensive, even by European standards.

Beijing-Hong Kong Wednesday 14th September 1988

Van Lohuizen is off early to The Wall. Two telephone calls. One is from the laundry informing me a button on van Lohuizen's suit is broken. The second from the CSCEC Mr. Bai who I had hoped to visit. Too late to arrange a visit before taking the taxi to the airport. Thunderstorm outside. Lights are on inside the room. Taxi to the airport takes 50 minutes for 40

continued..

Yuan. The sequence of passenger handling involves going through customs first (sort of reverse order on arrival) which entails the formality of leaving paper behind about cash transactions. The check in for flight 109 is not yet open. When it does it is only first class that seems to function. So passengers check in at the first class desk. Then passport control, followed by the shops which are no more expensive than the kiosks and shops at all the tourists locations in China. This offers a good opportunity to ditch the remaining Yuans. The airport is very quiet compared to Hong Kong or Singapore despite it serving one of the major capitals of the world with fully booked hotels and the vast population of China.

Plenty of space on the Chinese Airways Boeing 747. Cloud obscures a view of the Yellow River. Patchwork fields appear in the breaks with nodal points forming villages and hamlets.

Hong Kong is under a blanket of steam. It is 31 degree C and humidity near 100%. Air-conditioning must be contributing to the steaminesss of the place. At the Hotel (The Marco Polo) phone Andy Malone of the Geotechnical Control office. (He was still at the office despite the time being six thirty. Over the much stronger San Miguel beer I understand that the Control Office is interested in underground spaces; for treatment works for sewerage, storage facilities for bulk goods, containers and oil, disposal .... The office has had contact with the Finns; they were impressed by the extent of their vast underground storage spaces.

Hong Kong to Singapore, Thursday 15th September, 1988.

Organising stacks of paper. The beer is stronger than in China and still feeling slight side effects of that and the Australian wine with the excellent lamb. Can't locate by breakfast vouchers, reception will not give me a replacement. Finally locate it in my file. Should not file in future. The morning spent at the Control Office discussing their plans with regard to underground spaces. Their intention is to proceed with a "benchmark" scheme to see what procedures, local ordinances, permissions etc are necessary to finally achieve rights to proceed with he construction of such a space.

In afternoon by Singapore Airlines to Singapore. Hong Kong is too expensive to stay for too long and too humid. Despite just about on the equator, Singapore a more refreshing place then the steaming and rather crass commercial ant-hill of Hong Kong. Three nights in a hotel at Singapore equals one night in Hong Kong. Visit Dr Khoo from the University of Singapore. He seems to be promoted each time I visit Singapore. He is now Dean of the Faculty of Building and Architecture. The faculty supports numerous computer rooms. The university provides excellent facilities for staff and students alike. The old alumni club supports an excellent restaurant. Staff can also become members. Good place to discuss business and entertain potential donors. Something we sorely miss at Delft. Unlike Holland, the government of Singapore regards education as its principal asset. No cutbacks were mentioned, "we are a small trading nation, we need education to keep ahead". No, not the Netherlands this time, but Singapore.

OPROEP

De redaktie wil alle lezers er op attent maken dat artikelen ten alle tijden welkom zijn op het onderstaand adres. Vooral artikelen over actuele zaken of ervaringen worden op prijs gesteld.

REDAKTIE INGEOKRING

** NB Kopy bij voorkeur inleveren op floppy, in WordPerfect of ASCII.

Correspondentie adres:
Redaktie Nieuwsbrief Ingeokring
Faculteit der Mijnbouwkunde en Petroleumwinning
Sectie Ingenieursgeologie
Mijnbouwstraat 120
2628 RX Delft,
Nederland.
Telefoon: 015-782543

EERSTE LUSTRUM DISPUUT INGENIEURSGEOLOGIE D.I.G.

E. Zwerver, Oud-president D.I.G.

Geschiedenis van het Dispuut Ingenieursgeologie

Het Dispuut Ingenieursgeologie is opgericht in 1985 door Kees van der Touw, Martin van Staveren en Pieter Swart. Dit bestuur bleef twee jaar aan en raakte bekend door haar vele bedrijfsbezoeken. In februari 1987 werd dit bestuur opgevolgd door Mats Vermeer, Renee Vreugdenhil, Sven Plasman en Edwin Smits. De statuten der D.I.G. werden meteen door dit viertal in februari 1987 opgesteld. Dit bestuur zorgde ervoor dat de redaktie van de Nieuwsbrief van de Ingeokring (Ingenieurs geologische Kring Nederland, een onderafdeling van de K.N.M.G.) door D.I.G. leden werd beheerd, Met drs P.N.W. Verhoef als eindredakteur. Ook zorgde dit bestuur ervoor dat het Dispuut Ingenieursgeologie een zetel kreeg in de Ingeokring.
Het bestuur dat in februari 1988 werd geïnstalleerd, bestaande uit Maarten Reinking, Jeen Kootstra, Silvia Clements en Erwin Zwerver, maakte indruk met het zeer goede symposium "Milieu en Aardwetenschappen". Van dit bestuur bleef in maart 1989 alleen Erwin Zwerver over, die tot en met april 1990 werd bijgestaan door Daan Vink, Jelle Nijdam, Rick Bisschop en Waldo Molendijk. Het in April geïnstalleerde bestuur bestaat uit Alexander van de Wall, Jenco de Groot, Allard Scheerhout en Tom Maasse.

Doel van het Dispuut Ingenieursgeologie

1. Het behartigen van de belangen van de ingenieursgeologische studenten.
2. Het bevorderen van de sociale contacten tussen de ingenieursgeologische studenten onderling.
3. Het bevorderen van de sociale contacten tussen de buitenlandse ingenieursgeologische studenten van het I.T.C. en de ingenieursgeologische studenten van Mijnbouwkunde.
4. Het tot stand brengen van betere contacten tussen het bedrijfsleven en de ingenieursgeologische studenten.

Aktiviteiten van het Dispuut Ingenieursgeologie

1. Het organiseren van borrels in "Het Noorden". Het bestuur probeert 5 a 6 borrels per jaar te houden.
2. Het organiseren van een jaarlijks diner ter kennismaking met de nieuwe I.T.C. studenten en de derde jaars ingenieursgeologie studenten.
3. Het organiseren van een eendaagse excursie, die in de eerste plaats bedoeld is voor de I.T.C. studenten en de derde jaars ingenieursgeologie studenten, maar waar ook de staf van ingenieursgeologie en de oudere jaars studenten van harte welkom zijn. In november 1987 werd een bezoek gebracht aan een bruinkoolmijn in Duitsland, in december 1988 aan het International Soil Reference and Information Center en aan een dolomiet groeve in Winterswijk en in november 1989 werd de bouwplaats van de spoortunnel in

Rotterdam bezocht.

4. Het houden van symposia: "The use of Personal Computers in Earth Technology" in februari 1987, "Milieu en Aardwetenschappen" in mei 1989. Beide symposia kunnen als zeer geslaagd beschouwd worden. Het grote aantal bezoekers, van wie vele uit het bedrijfs leven, en de vele stands maakten het de student mogelijk kennis te maken met vele bedrijven. Een aantal studenten hebben dankzij deze symposia een baan gevonden.
5. Het bezoeken van vakbeurzen en symposia. In maart 1987 werd een bezoek gebracht aan het "Coastal Lowlands" symposium, in april 1988 had het dispuut een stand op de milieuvakbeurs "Ifest", In november 1989 werd de Geotechniekdag te Utrecht bezocht en in april 1990 was een stand aanwezig op het symposium "Dealing with the Environmental Problems in the Mining and Petroleum Industry".
6. Het bezoeken van interessante bedrijven; vooral het eerste bestuur is hiermee zeer aktief geweest, maar ook volgende besturen hebben zich niet onbetuigd gelaten.
7. Sinds oktober 1987 is het Dispuut verantwoordelijk gesteld voor de Nieuwsbrief van de Ingeokring. De redaktie werd gevormd door drs. P.N.W. Verhoef, Erwin Zwerver, Edwin Smits en Annemarie Schouw. Deze laatste twee werden in maart 1988 vervangen door Rik Bisschop en Jelle Nijdam. In April 1989 werden Jelle Nijdam en Erwin Zwerver vervangen door Alexander van de Wall en Waldo Molendijk. Sinds februari 1990 bestaat de redaktie uit Alexander van de Wall en Jenco de Groot.
8. Het op de markt brengen van D.I.G. truien en D.I.G. dassen.

In 1990 bestaat het Dispuut Ingenieursgeologie vijf jaar. Ter ere van dit lustrum wordt samen met het geotechnisch en ingenieursgeologisch adviesbureau GEOCOM het symposium "Kustbescherming en Ingenieursgeologie" georganiseerd. Op 6 juni verwacht de symposium commissie, bestaande uit Waldo Molendijk, Jelle Nijdam, Erwin Zwerver en Daan Vink, een redelijk aantal toehoorders op dit zeer aktuele onderwerp. Ook zijn er in dit lustrum jaar speciale lustrum sweaters gemaakt, waarvan er nog enkele voorradig zijn

Zoals U heeft kunnen lezen, is het Dispuut Ingenieursgeologie nog een jong dispuut en is er nog geen sprake van echte tradities. Wel heeft u kunnen lezen dat het Dispuut vrij aktief is.
In de toekomst hopen we onze aktiviteiten nog verder uit te breiden om ons vakgebied beter te promoten. Dit is hard nodig daar Nederland is het enige land waar men nog zeer weinig weet van de ingenieursgeologie, al moet worden opgemerkt dat dit de laatste jaren enigszins aan het veranderen is.

Highway cost modelling and route selection using a geotechnical information system

dr. N. Rengers

Op 6 februari 1990 promoveerde aan de TU Delft Joseph Olusola Akinyede, Master of Science in geology uit Nigeria.
Als promotoren traden op Prof. D.G. Price (sectie Ingenieursgeologie van de faculteit der Mijnbouwkunde en Petroleumwinning) en Prof. Ir. H.J. Span (sectie Verkeersbouwkunde van de faculteit der Civiele Techniek)

De Heer Akinyede verrichte zijn studie aan het I.T.C. in Enschede onder de leiding van Dr. N. Rengers, die tevens als toegevoegd promotor optrad.

Hieronder volgt een samenvating van de promotiestudie.

The approach to the development of highway cost models has been based on theoretical GIS concepts and procedures which can be applied in most developing countries, including Nigeria. The methods applied open possibilities for modifying and expanding the approach to translate local experience in road design and construction into cost models which can be used to predict the potential costs of road construction in new areas. Pavement designs are typical for local application and also vary from one country to another, but the basic principle is the same, thus making possible the application and adaptation of the concepts and procedures for general use. The approach also opens the possibility for education and further research into road way cost modelling, to ensure a judicious utilization of local materials and thereby effecting economy in the cost of road construction.

Highway construction costs are estimated in separate component costs for construction, earthworks, drainage crossings (and maintenance costs). The cost is determined for the individual pixel element (cell); the total cost and distance along the potential cheapest route or most direct route are obtained from the summation of the individual cell costs and cell distances.

Pavement construction cost models were developed taking into account the volumes of materials required for the different components of a flexible pavement and the cost of the materials with respect to the haulage distance from their source locations. The justification of this method is evaluated from the point of view of the suitable materials' source locations, the quantity of materials assumed to be available and their distances to potential construction sites. Essentially, these are some of the major factors in structural pavement design. The usual practice is to estimate the cost of materials at supply sources and at construction site. In NE Nigeria, additional cost items such as loading of materials, spreading, compaction and back haul (return of empty vehicle) and sometimes the cost of bitumen for asphaltic concrete are considered. Thus, the theoretical pavement costs obtained from this study may be approximately the same as the actual costs in field practice. Therefore, potential users must take note of the variations in cost items or in the allocation of cost to the various construction operations.

It is possible to analyze market values for the use of construction materials on the basis of the actual quantities of materials available at a particular source and the quantity it can supply at the marginal or economic cost. This can be used to build up a new source-shed or cost model in which materials of larger quantity will have a more extensive source-shed, so that the potential quantities of materials available for future use can be determined. In this study, however, the development of the pavement cost model has been based on the dominant soil or lithologic types which comprise at least 70% of the soil and material composition of the mapping unit and are estimated from the soil or lithologic complex and lateritic and calcareous hardpans which are more than 0.5 m thick. These factors allow for the creation of source-sheds in relation to the size of the mapping units. However, the actual quantities of soil and material which were used from a source location and which may still be available for future use were not determined.

The model has been used to compare alternative roadway designs and costs on the basis of the availability of alternative construction materials in and around the mapping units. It can also be used for the evaluation of high-quality materials which have a tendency to develop close source-sheds and become less competitive because of high production cost. The source-shed of the high-quality materials can be expanded relative to those of lower-quality materials by artificially reducing its production cost to make it competitive with the lower-quality materials. This can create some error in the cost model, which develops from the relative cost values, but such error will be minimal and negligible. Otherwise, it will be compensated in the maintenance cost, because a road built with higher-quality materials will be associated with a lower maintenance cost than the cost for maintaining a road built with lower-quality materials, assuming that all other conditions necessary for road design and construction are well balanced.

The existing infrastructure, such as roads, is another important factor which has been integrated in the pavement cost modelling. The material sources develop extensive source-sheds along an existing road, leading to a potential reduction in the cost of road construction with respect to the terrain. Such a theoretical approach is similar to field practice, in which the local trafficability is used as a criterion for the location and relocation of a new road alignment. However, its use in pavement cost modelling must be weighed against the geotechnical terrain condition along the existing roads and the cost of maintenance which may arise from road deterioration under the new construction traffic.

Earthwork (or grading) cost models were developed for potential route directions (N-S, NE-SW, E-W and SE-NW), using estimates of cut and fill volumes developed from data defining the terrain roughness and material excavation characteristics. Theoretical calculation of cost was based on the maximum internal relief, which led to a long and circuitous route because of extreme values of earthwork costs in some mapping units. The number of such units and their earthwork cost were reduced by more than 50% using the minimum internal relief, and this led to a shorter route that appears more realistic and comparable with those obtained in field practice. The usual practice, for example, is to avoid the most hilly areas and limit road cuts to the sides of the hills to minimize the earthwork volume. This can be achieved only at large-scale mapping (>= 1:50,000), which allows the delineation of smaller mapping units and land facets so that the areas of pronounced relief with high earthwork cost can be avoided.

Furthermore, some of the mapping units show some directionality which is related to the number of ridge/valley crossings. Higher earthwork costs are associated with roadway directions which traverse frequent ridges or valleys, such as the NE-SW direction. This implies that the largest number of culverts/bridges are located in this direction. In actual field practice, it is possible to reduce this number by following the drainage divide or the flood plain during the selection of the road alignment. This study has shown that such reduction can be achieved in theory by integrating the drainage crossing cost factor into the route selection analysis. However, the choice of a route along the drainage divide and flood plain must be weighed against the aggradation of the drainage valley slopes with possible erosion into the road shoulder and the possible flooding of the flood plain.

In relatively smooth terrain, the four earthwork cost models show general similarities in earthwork volumes and costs, which are related to the requirements of raising the road bed above the surrounding terrain to ensure adequate drainage. This is a road design standard which is also commonly used in practice.

This model is based on a geometrical representation of an idealized, symmetrical V-shaped valley. However, the actual natural terrain can be asymmetrical in geometry, hence the necessary adjustment must be made in the earthwork volume from the mean number of ridge/valley crossings. The volume can be adjusted by 1 or 2 standard deviations. Such adjustments must conform with local or field practice in earthwork operation.

In general, therefore, the earthwork cost can be modified by comparing the theoretical costs with those actually experienced. Such comparison, for example, will guide the development of methods of obtaining internal relief for earthwork cost modelling.

Drainage structure costs were estimated from the terrain and watershed hydrology data by relating the calculated field discharges of the catchments to approximate sizes and costs of culverts/bridges. This theoretical method can be considered with other factors, such as the valley frequency information and approximate valley sizes obtained from terrain roughness data and from the stream order. However, the determination of the actual drainage crossing cost requires site-specific investigation and engineering judgement at any crossing site, which involves factors such as changes in embankment heights, hydraulic computations related to flow velocity through culvert/bridge and foundation characteristics.

Maintenance cost models may be developed on the basis of pavement maintenance and other right-of-way maintenance costs. These can be estimated using basic terrain and local material durability factors, and assumed baseline traffic volumes. A common rule-of-thumb suggests that 60-70% of the maintenance costs are related to pavement repairs.

General right-of-way maintenance activities include the clearing of vegetation, removal of debris from ditches and culverts, and the repair of side-slopes (in either cut or fill) subjected to erosion. In addition, there may be occasional more catastrophic failures, such as landslides or "wash-outs" at drainage crossings. All of these conditions can be related to local terrain and soil or rock erodibility characteristics within a relatively uniform climate. Some factors, concerning the erosion of side-slopes, will also be affected by the amount of cut and fill. Research is currently being conducted by K. van Westen at ITC on aspects of slope stability analysis in mountainous areas, using a GIS. It is probable that the research will be applicable in the development of a general right-of-way maintenance cost model.

Similarly, under specified traffic loading, it should be expected that pavement deterioration will be related to subgrade conditions. With such relationships, it is possible to estimate annual pavement maintenance expenditures, useful pavement life and similar factors, or mapped data elements within each land system mapping unit (LSMU).

Accordingly, a maintenance cost model can be constructed which relates the terrain roughness and material characteristics for each LSMU to an expected annual maintenance level. However, this requires some empirical relationships, based on prior experience in the region, which can be used to predict anticipated annual maintenance efforts, or costs, according to such terrain characteristics. The development of such empirical relationships would allow the further application of this LSMU concept to road planning and management in the developing countries, including Nigeria.

The influence of social and economic factors, such as neighbourhood locale, recreation and conservation, are unique and important factors in the selection of a road route. The emphasis in this study, however, is on the influence of geotechnical terrain characteristics and this can be fitted onto or integrated into the social and economic considerations without much difficulty.

In the final analysis of a route selection, the cost of pavement construction is so small, compared with the costs of earthwork and drainage crossing, that it shows little or no influence on the total cost and selection of the cheapest route in the study area. The major determining factors are the earthwork and drainage crossings costs. On the basis of the pavement construction cost alone, for example, the cheapest route is 5% cheaper than the most direct route. Considering the effect of earthwork cost alone or the costs of pavement construction, earthwork and drainage crossing, however, the total cost of the cheapest route varies from 6-15% of the total cost of the most direct route, taking into account the minimum and maximum values of internal relief. However, the total distance of the most direct route is 10-50% shorter than the total distance of the cheapest route. The cost of the cheapest route seems to be justified with the use of the minimum internal relief, irrespective of what the users' costs and the influence of other social and economic factors may be along both routes.

CONCLUSIONS

1. The development and application of cost model procedures, based on the physical terrain factors, has proved to be a realistic approach to solving the problem of huge investment in road construction.

2. The concepts and procedures developed allow the creation of predictive cost models that can support roadway planning, even in regions with limited terrain data.

3. Roadway cost models were based on basic cost parameters, which are foundation characteristics, construction materials, earthwork, trenches, culverts and bridges and maintenance. However, the relevant geotechnical data and road design standards which are associated with these cost factors were considered as input into the cost models.

4. The three primary elements of highway cost models which were developed are the pavement construction cost model, the earthwork cost model and the drainage crossing cost model. The models also include a bituminous surface cost, base cost and sub-base cost sub-models and four directional earthwork cost sub-models, which can be used to predict and weigh alternative pavement designs to achieve a reduction in the initial cost of road construction.

5. The use of remote sensing image interpretation techniques, supplemented by aerial photography, allows for rapid collection of terrain data and creation of a geotechnical land classification and data format for a GIS.

6. A digital geotechnical information system, based on suitable PC GIS software, offers a considerable potential for the creation of image and attribute databases. The predictive modelling techniques create numerical models which define roadway cost factors by accessing such databases. Display of these factors as maps can be helpful in regional planning.

7. In some parts of NE Nigeria where the concepts were applied, the costs of pavement construction were minimized with respect to the construction materials' supply sources and local trafficability. Costs are greater in rugged areas and areas overlain by weak soils. A pavement with a base of low-quality laterite, with CBR >= 65% and a crushed stone surfacing can be cheaper than a pavement with a base of high quality laterite, with CBR >= 80%, and a sand-asphaltic surfacing. Similarly, the use of crushed stone as base material can be cheaper than the use of granular material for the road base.

8. Generally, the costs of earthwork show a similar trend for all investigated route directions: N-S, NE-SW, E-W and SE-NW. However, the NE-SW and SE-NW directions tend to give the highest and least total costs of earthwork respectively, which correspond to the directions of the highest and lowest terrain dissections, particularly in regions of pronounced relief.

9. Four classes of peak discharge were also determined in the test areas: <= 250, 250-420, 420-640 and >= 640 m^3/sec, which are related to stream orders 1, 2, 3, 4 and >= 5, respectively. These classes of peak discharges can be related to appropriate sizes of culverts/bridges which can be used to estimate the costs of drainage crossings, taking into account other engineering decisions in culvert and bridge designs.

10. The cost models were further applied for the selection of the cheapest route, based on a pavement of typical trunk F or state road in NE Nigeria. The cost of the cheapest route was found to be 6-15% of that of the most direct route. Thus, the application of the cost model can stimulate the development of more roads, even in areas where the terrain condition is critical.

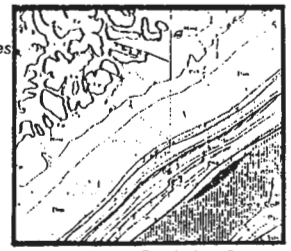
11. Field visits in Nigeria and existing road construction reports were used to check several of the parameters used in the predictive models, but it has not yet been possible to compare the estimated route costs with those actually experienced.

12. The concepts have been developed with examples from NE Nigeria, but similar procedures can be applied to other areas in Nigeria and in many other developing countries.

13. The route selection model is relatively simple to use and its application and data requirements are well within the capabilities of potential users. It is a decision-making tool for transport planners, as well as a cost-saving method that will be effective for the management of the economy in the road sector.

ASTM *Standards for Materials, Products, Systems & Services*

Committee D-18 on SOIL AND ROCK

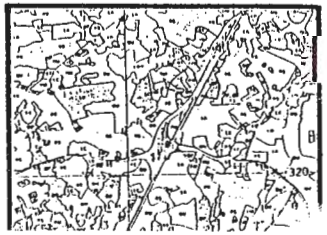


INTERNATIONAL SYMPOSIUM ON MAPPING AND GEOGRAPHIC INFORMATION SYSTEMS

On 21-22 June 1990 in San Francisco's Hyatt Regency Hotel, the American Society for Testing and Materials (ASTM) Committee D18 on Soil and Rock, and its two sections on Mapping and GIS and on Remote Sensing, along with the U.S. Geological Survey, are co-sponsoring an International Symposium on Mapping and Geographic Information Systems. Cooperating organizations include the American Congress on Surveying and Mapping, American Society of Photogrammetry and Remoe Sensing, AM/FM International, Association of Americn Geographers, Urban and Regional Information Systems Association, Canadian Geosciences Advisory Committee, and International Association of Hydrological Sciences.

The purpose of this symposium is to bring together an interdisciplinary and international group of engineers and scientists to (1) provide a forum for many professional disciplines to exchange experiences and findings related to the needs and methods for GIS, maps, and remote sensing and the potential for standardization of some elements of each; (2) learn from both successful and unsuccessful case histories; (3) promote technology transfer between the various disciplines and countries represented; (4) provide an educational resource for those attendees who may be considering entering for the first time into use of the three elements (GIS, maps, and remote sensing) that make up an overall land information system. The official language will be English.

Invited and offered oral and poster papers will be presented on each of the three main topics -- mapping, remote sensing, and GIS, especially in relation to the general state-of-the-art and development of standards. Papers approved by peer review will be published by ASTM in a Special Technical Publication. This symposium will be preceded by meetings of all subcommittees of ASTM Committee D18 on subjects relating to soil, rock and contained fluids, during 18-20 June 1990. Potential attendees desiring hotel and other meeting information should contact Ms. Dorothy Savini, ASTM, 1916 Race Street, Philadelphia, Pennsylvania 19103 USA (Phone: 215/299-5413; FAX 215/977-9679). Persons desiring additional technical information related to the International Symposium on Mapping and GIS, should contact Ivan Johnson, A. Ivan Johnson, Inc., 7474 Upham Court, Arvada, Colorado 80003 USA (Phone: 303/425-5610).



Geotechnical Applications of Remote Sensing and Remote Data Transmission

ASTM ICRSDT IAHS AISH

Sponsored by:
ASTM Committee D-18 on Soil and Rock
and
The International Committee on Remote Sensing and Data Transmission of the International Association of Hydrological Sciences (IAHS)

News Release

303/425-5610

PUBLICATION ON GEOTECHNICAL APPLICATIONS OF REMOTE SENSING AND REMOTE DATA TRANSMISSION

The publication Geotechnical Applications of Remote Sensing and Remote Data Transmission has been released as ASTM Special Technical Publication 967. The volume results from an "International Symposium on Geotechnical Applications of Remote Sensing and Remote Data Transmission," sponsored by the American Society of Testing and Materials (ASTM) Committee D18 on Soil and Rock and the International Committee on Remote Sensing and Data Transmission (ICRSDT) of the International Association of Hydrological Sciences. Co-editors for the STP are Ivan Johnson of A. Ivan Johnson, Inc., Arvada, Colorado and Bernt Pettersson of Brown and Root, Inc., Houston, Texas. Johnson is Past President of ICRSDT and Pettersson is Chairman of ASTM D18 Subcommittee on Surface and Subsurface Reconnaissance.

The purpose of the symposium and its proceedings was to develop information that could be used to prepare guidelines for the use of remote sensing techniques and of satellite and meteor burst instrumentation for remote data transmission for a variety of projects involving the geotechnical sciences. The volume discussed advantages and disadvantages of a variety of remote sensing (RS) and remote data transmission (RDT) techniques, equipment and programs related to soil mechanics, rock mechanics, geologic engineering, ground-water and flood hydrology, and other scientific input to geotechnical projects. Authors are from Australia, Canada, China, and England, as well as from the United States of America.

ASTM Special Technical Publication 967 Geotechnical Applications of Remote Sensing and Remote Data Transmission may be ordered, for $59.00 to non-members and $47.00 to members, from the Publications and Marketing Division, ASTM, 1916 Race Street, Philadelphia, PA 19103, USA, (Phone: 215/299-5400).

COGEOENVIRONMENT:
EEN NIEUWE COMMISSIE VAN DE I.U.G.S.

Dr. Ed F.F. de Mulder
Secretary General COGEOENVIRONMENT
p/a Rijks Geologische Dienst, Haarlem

Op 14 februari jl. is tijdens de executive meeting van de International Union of Geological Sciences, te Moskou een groene loot aan de tak met commissies en subcommissies van de I.U.G.S. ontsproten: de **Commission on Geoscience for Environmental Planning**, kortweg: COGEOENVIRONMENT genaamd. De oprichting van deze Commissie vond plaats op initiatief van de Noorse Geologische Dienst.

Doelstelling

COGEOENVIRONMENT heeft zich tot doel gesteld om kennis en ervaring op dit gebied op internationale schaal te mobiliseren, te bundelen en aan landen, die hiervan gebruik willen maken, ter beschikking te stellen. Dit doel zal o.a. worden verwezenlijkt door informatie over dit onderwerp te verspreiden en door specifieke trainingscursussen te organiseren. Hierbij zal zoveel mogelijk gebruik gemaakt worden van bestaand cursusmateriaal. Voorts zal een poging worden ondernomen om op mondiale schaal milieuproblemen met een aardkundige dimensie te inventariseren. De resultaten van deze inventarisatie zullen op het volgende International Geological Congress te Kyoto (1992) worden gepresenteerd.

Op uitnodiging van de Koninklijke Akademie van Wetenschappen en financieel ondersteund door UNESCO is de eerste vergadering van COGEOENVIRONMENT in Nederland gehouden. Deze bijeenkomst vond plaats in Breukelen en duurde van 4 tot en met 7 april jl. Tijdens de vergadering werd o.a. een werkplan voor de komende jaren opgesteld en werden besluiten genomen over de wijze waarop de internationaal beschikbare kennis en ervaring op dit terrein aan ontwikkelingslanden ten dienste zal worden gesteld.
De Commissie bestaat uit: Dr. Fred. Wolff uit Noorwegen (chairman), Prof. Dr. A. Cendrero uit Spanje (vice chairman), Dr. E.F.J. de Mulder uit Nederland (secretary general), Prof. Dr. Sci. G.S. Varanyan uit de U.S.S.R., Dr. Li Lierong uit China, Prof. Dr. M. Hermelin uit Colombia en Dr. A.R. Berger uit Canada. Aan de vergadering namen ook vertegenwoordigers van de aanverwante organisaties deel: Prof. Dr. M. Langer (namens de I.A.E.G.), Drs. E.Romeyn (namens de I.A.H.), Dr. H. Diederix (namens A.G.I.D.). UESCO werd vertegenwoordigd door Dr.V. Sibrava en Dr. R. Missotten uit Parijs.

LINEAR CUTTING TESTS IN ARTIFICIAL SAND-CLAY MIXTURES TO STUDY THE INFLUENCE OF BRITTLENESS ON ABRASIVE WEAR OF CUTTING TOOLS.

Ir. M.W. Reinking

Delft University of Technology, Faculty of Mining and Petroleum Engineering, Section of Engineering Geology.

Abstract.

Linear cutting tests on an artificial kaolinite clay were performed to distinquish different failure modes during the drying process. The influence of brittleness on abrasive wear of cutting tools was studied by drying an artificial sand-clay mixture.
Three different failure patterns were examined: a ductile mode, at which the chip sticks to the cutting blade, a transitional mode and a brittle mode, at which chips were broken off.
Brittleness is expected to influence the wear mechanism during cutting: the more brittle the rock or soil, the more three-body abrasion will occur. In ductile material two-body abrasion is expected to be of main importance.

1 Introduction.

Abrasive wear of rock-cutter picks is one of the main problems occurring at many rock-cutting dredging projects. To develop reliable site-investigation techniques which can predict the severity of abrasive wear, one has to get a clear insight of all parameters influencing the abrasive wear process.
One aspect which is expected to influence this is the brittleness of rock [1]. According to Robberts [2], rock can fail in a brittle and a ductile manner during cutting. In purely brittle material, a rock chip would break off after penetration by a wedge-shaped bit and the bit would again penetrate the fresh rock. In a ductile rock the contact between the rock and wedge is continuous. From this point of view the abrasive wear is expected to be larger in rock which fail in a ductile manner [1].

In a study of the influence of failure mechanism on abrasive wear of cutting tools, the main problem is to obtain a test specimen which can deform in both brittle and ductile failure mode. Furthermore, to compare the abrasive wear in both modes, the other properties of the specimen which influence the wear process have to be constant. This pilot study describes how a ductile and a brittle failure mode were obtained in different clay specimens.
For the experiments a French shaper, trademark Guillemin-Sergor et Pegard (GSP), was used.

2 Linear cutting tests with a drying kaolinite clay.

2.1 The test procedure.

The clay used for the testing, was an artificial kaolinite clay (table 1). The mixture has been chosen for its excellent drying properties. No shrinkage cracks appeared during the drying process.

Table 1 Properties of the kaolinite clay.

Property	Value
Atterberg Limits:	
Liquid Limit (LL) (cone penetrometer)	37.0%
Plastic Limit (PL)	16.5%
Plasticity index (PI)	20.5%
Moisture Content	22.1%
Shear Strength (lab. vane test)	
peak	27.2 kPa
residual	13.7 kPa

This kaolinite clay is an artificial mixture of 60% clay, mainly kaolinite, 30% quartz powder, and 10% calcite.

To prepare the samples for the cutting tests, specimens measuring 21 cm in length, 12 cm in width and 7 cm in thickness were cut from the clay blocks.
In order to observe the failure modes during the linear cutting, 7 samples with different moisture contents were tested. These different moisture contents were developed in the clay sample by allowing them to air-dry. The average moisture contents at which the specimens were tested were: 22.1% ; 20.2% ; 18.6% ; 16.7% ; 13.7% ; 11.6% and 7.7%.
Within each specimen, two types of cutting were performed:

Type A: The cutting was performed at the center of the sample. The effects of the sides as well as the proceeding of the chip could be studied.
Type B: the cutting was performed at the side of the specimen. The cutting pattern at the cutting edge could be studied.

The following mechanical test parameters have been used:

- cutting angle: 30°
- cutting velocity: 6 m/min
- cutting depth: 5 mm
- stroke : 150 mm

The cutting blade was of a simple chisel shape, 49 mm wide, 150 mm in length, a surface roughness of 0.2 μm and made of steel 37.
The test arrangement is shown in figure 1.

2.1 Discussion and results.

From the linear cutting tests, it was found that during the drying of the clay specimens three types of failure behaviour can be distinguished. Samples with a moisture content greater than 17% failed in a ductile manner. Samples with a moisture content lower than 16% showed a brittle failure mode and between these failure modes there exists a transition zone.

To characterise the different failure modes four parameters have been studied: the behaviour of the soil chips, the sides of the cut, the cutting surface and the cutting pattern in front of the cutting edge.

The ductile mode (fig. 2):

This failure mode has the same characteristics as the "flow" type of failure described by two Japanese investigators Hatamura and Chijiiwa [3]: a zone appears where shear deformation occurs continuously when the cutting blade proceeds. The soil chip sticks to the cutting blade along its whole length. In the direction of the cutting edge the thickness of the soil chip increases slightly. The cutting sides are straight and the cutting surface is smooth.

The transitional mode (fig. 3):

As the cutting blade proceeds a chip develops on the cutting blade face as is the case during the ductile mode. However, instead of sticking to the blade, the chip curves away from it. The cutting side pattern and the cutting surface shows the same characs to the cutting blade along its whole length. In the direction of the cutting edge the thickness of the soil chip increases slightly. The cutting sides are straight and the cutting surface is smooth.

The transitional mode (fig. 3):

As the cutting blade proceeds a chip develops on the cutting blade face as is the case during the ductile mode. However, instead of sticking to the blade, the chip curves away from it. The cutting side pattern and the cutting surface shows the same charac^P fixed in the clay matrix.

More detailed investigation of the wear processes within the ductile mode is necessary to obtain a measurable quantity of wear. Since it is known that cohesive soils containing quartz can be the source of excessive wear, this is certainly an important topic for further investigation.

REFERENCES.

[1] Verhoef, P.N.W.: "Towards a prediction of abrasive wear of cutting tools in rock dredging", Delft Progr. Report 13, pp 307-320, 1988/1989
[2] Roberts, R.: "Applied Geotechnology", Permagon Press, 1981
[3] Hatamura, Y.; Chijiiwa, K.: "Analysis of the mechanism of soil cutting"
(1st Report), Bulletin of the JSME, Volume 18, No. 120, 1975
(2nd Report), Bulletin of the JSME, Volume 19, No. 131, 1976
(3rd Report), Bulletin of the JSME, Volume 19, No. 137, 1976
(4th Report), Bulletin of the JSME, Volume 20, No. 139, 1977
(5th Report), Bulletin of the JSME, Volume 20, No. 141, 1977
[4] Roxborough, F.F.: "Cutting rock with picks", the Mining Engineer, Vol. 132, pp 445-452, 1972

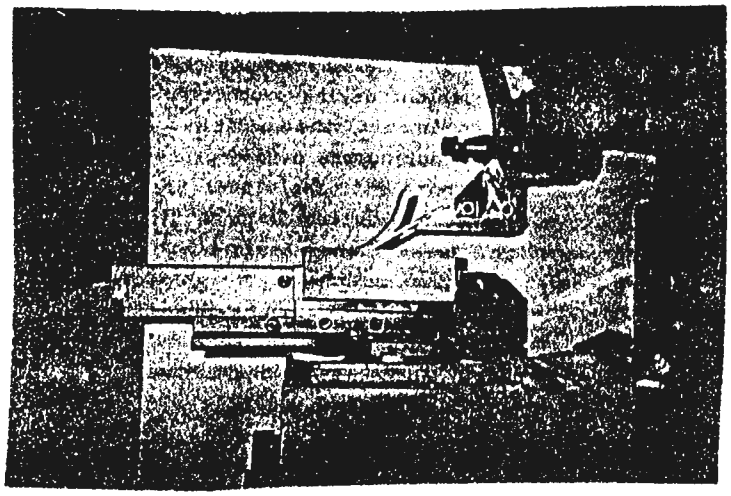


Figure 1. The test arrangement with the test specimen clamped lengthwise in a bench vice.

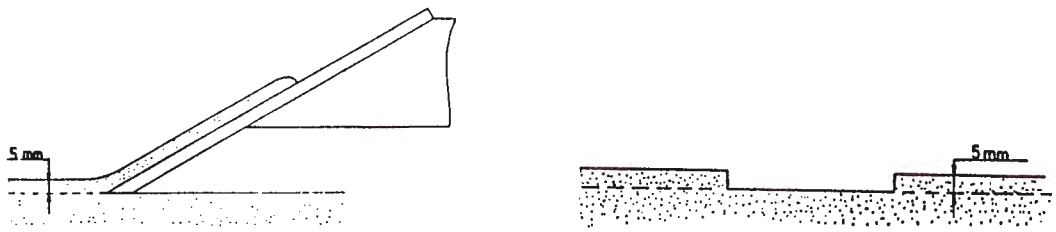


Figure 2. The ductile type of failure.

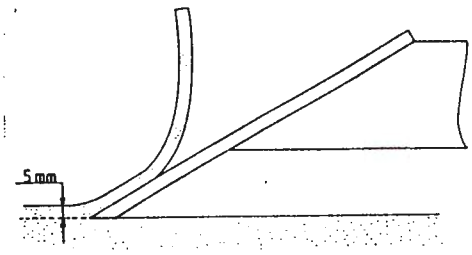


Figure 3. The transitional type of failure.

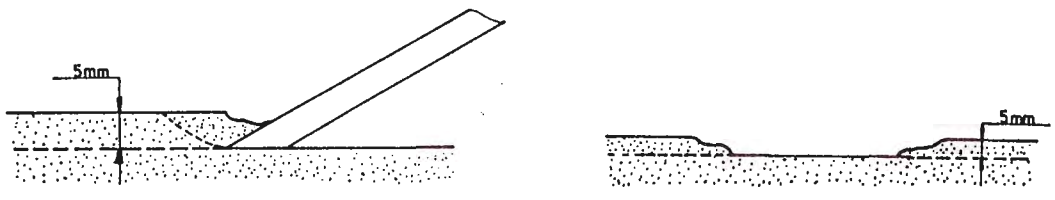
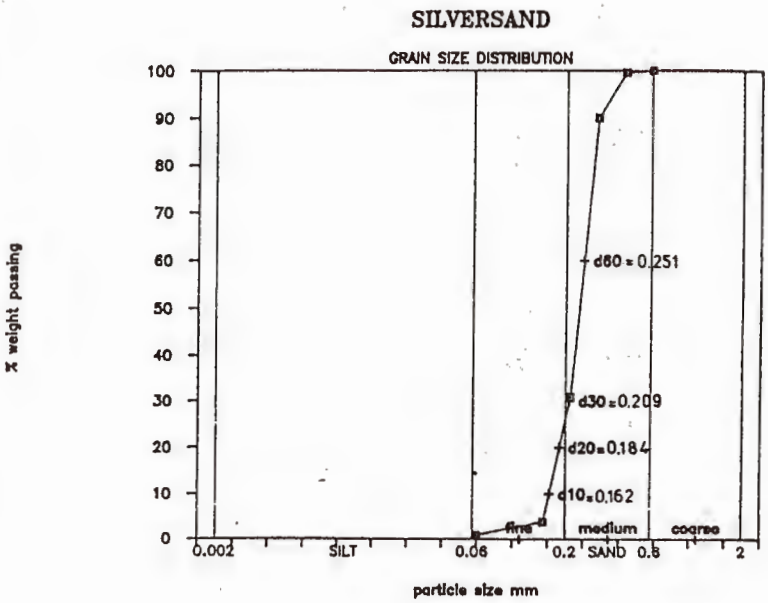


Figure 4. The brittle type of failure.

Table 2. Properties of the sand-clay mixture.

Sand-clay mixture characteristics		
Property	**Test**	**Value**
Atterberg Limits:		
Liquid Limit (LL)	cone penetrometer	24.6%
Plastic Limit (PL)		12.75%
Plasticity Index (PI)		11.85%
Linear Shrinkage (LS)		5.29%
Moisture content (Mc)		14.5%
Shear strength:		
Peak	lab. vane test	31.5 kPa
Residual	lab. vane test	11.1 kPa
Brittleness index		1.84
Sensitivity		2.84
Cohesion	undrained triaxial test	30.0 kPa
angle of internal friction	undrained triaxial test	4.5°
Unconfined Compressive Strength (UCS):		
- dry (110 °C)	UCS test	2700 kPa
- wet (Mc = 14.5)	UCS test	37.3 kPa
Bulk density		2.17 g/cm³
Dry density		1.89 g/cm³



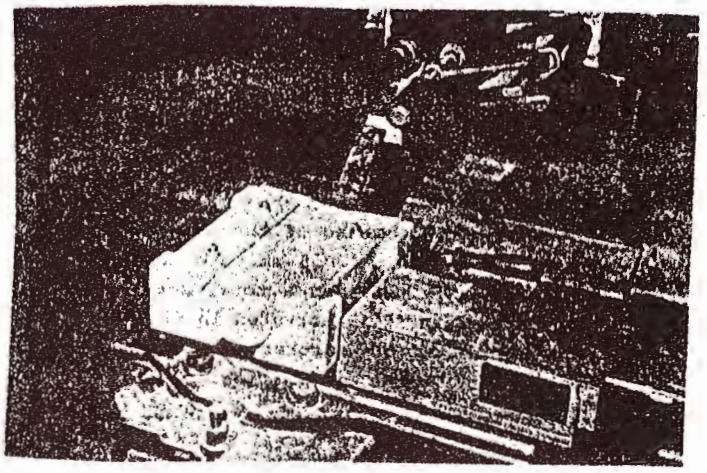


Figure 6. The test arrangement.

DIG TRUIEN

Ze zijn er weer, de nieuwe digtruien!

De speciale lustrumtruien zijn uitgevoerd in een rood/donkerblauw combinatie met kraag. Beschikbare maten: XL.
Deze zeer bijzondere trui kost slechts F40.-

aula / congress office TU Delft

Delft University of Technology
P.O. box 5020
2600 GA Delft
The Netherlands

Mekelweg 5
2628 CC Delft
Telephone (15) 78 52 29
Telex 38151 butud nl
Telefax (15) 78 67 55

EERSTE AANKONDIGING

SYMPOSIUM BODEMDALING IN NEDERLAND

Datum: donderdag 8 november 1990
Organisatie: Technische Universiteit Delft, Faculteit Mijnbouwkunde en Petroleumwinning/ Ingeokring/ International Society for Rock Mechanics
Plaats: Senaats-zaal van de Aula, T.U. Delft
Ontvangst 9.30 u, Voordrachten 10.00 u-17.30 u

INHOUD

Eerst zal een algemeen overzicht gegeven worden van een aantal aspecten van bodemdaling. Verschillende mechanismen van bodemdaling, zowel veroorzaakt door menselijke activiteit als door natuurlijke oorzaken, zullen worden behandeld. Deze mechanismen treden op, zowel in de ondiepe als in de diepe ondergrond. Er zal aandacht besteed worden aan de gevolgen van bodemdaling voor de leefomgeving en vervolgens zullen meet-technieken en voorspellingsmodellen voor bodembeweging besproken worden.

Aansluitend zal de bodemdaling door gas-onttrekking in de diepe ondergrond in Groningen ter sprake komen. Het primaire mechanisme hierbij is een geleidelijke compactie van het reservoir. Behandeld worden de theorie en het experimentele werk t.a.v. de compactie van het reservoir, toetsing van het compactie-gedrag en het voorspellen van de bodemdaling aan de hand van modellen. Ook zal kort worden ingegaan op de problematiek van het interpreteren van peilmerkmetingen.

MEDEWERKING

Medewerking wordt verwacht van o.a. Staatstoezicht op de Mijnen, Provinciale Staten van Groningen, Nederlandse Aardolie Maatschappij, Koninklijke Shell Exploratie en Produktie Laboratorium, Rijks Geologische Dienst en diverse Faculteiten van de Technische Universiteit Delft.

J.P.A. Roest, T.U. Delft

Symposium Bodemdaling in Nederland
8 november 1990
Organisatie: Ingenieursgeologische kring/TU Delft/ISRM
Faculteit Mijnbouwkunde en Petroleumwinning

Ik ben geïnteresseerd in het symposium "Bodemdaling in Nederland" en wil graag
O deelnemen (uw inschrijving wordt schriftelijk bevestigd)
O t.z.t. nadere informatie ontvangen

Naam: .....

Functie: .....

Bedrijf/Instelling: .....

Adres/Postbus: .....

Postcode: ..... Woonplaats: .....

Telefoon: .....

Datum: ..... Handtekening: .....

Technische Universiteit Delft
Congresbureau
Mekelweg 5
2628 CC Delft

TOEGEPASTE KWARTAIRGEOLOGIE BIJ DE RIJKS GEOLOGISCHE DIENST

E.F.J. de Mulder

Geschiedenis

Toegepaste geologie van de kwartaire afzettingen (Pleistoceen en Holoceen) wordt in Nederland bij de Rijks Geologische Dienst (RGD) al meer dan 25 jaar bedreven. Reeds bij de opzet van de 3e generatie geologische karteringen van het Nederlandse landoppervlak, in het begin van de jaren 60, werd bij de legendakeuze van de holocene afzettingen al nadrukkelijk rekening gehouden met het gebruik van deze informatie voor civiel-technische doeleinden. De geestelijke vader van deze later ook internationaal veel nagevolgde legenda, was Ir. B.P. Hageman, de vorige directeur van de RGD. De start van deze nieuwe kartering vond daarom ook plaats in Zeeland waar toen juist de Deltawerken in volle uitvoering waren. Door de kartering van dit gebied nam ook de kennis van de opbouw en samenstelling van de Zeeuwse ondergrond sterk toe, wat mede door een intensieve acquistitie, bij de ingenieurs van Rijkswaterstaat niet onopgemerkt bleef. Een groot aantal opdrachten aan de RGD was hiervan het gevolg en vele honderden rapporten zijn inmiddels over de (ingenieurs) geologie van dit gebied uitgebracht.

Huidige stand van zaken

Op dit moment wordt de toegepaste Kwartairgeologie bij de RGD gecoordineerd en deels ook uitgevoerd door de afdeling Toepassingen. Deze afdeling telt momenteel 9 mensen: te weten een ingenieursgeoloog (F. Schokking), een geofysicus (T. Stavinga), drie projectgeologen (R. Hillen, A.F.B. Wildenborg en K. van Gijssel), een electrotechnicus (T. de Beer), een assistent- ingenieursgeoloog/GIS specialist (B. Hoogendoorn), een geofysisch assistent (R. Picavet) en een hoofd/toegepast Kwartairgeoloog (E.F.J. de Mulder). Samen met een groot aantal geologen en assistentgeologen uit de 4 distrikten (Alkmaar, Lochem, Oosterwolde en Nuenen) voeren deze RGD-ers het projectenwerk (meestal in opdrachtvorm) uit.

Werkzaamheden

De aard van de toegepaste geologische werkzaamheden kan sterk variëren. Zo is de R.G.D. o.a. betrokken geweest bij het funderingsonderzoek in de Oosterschelde-monding, de bestudering van de geohydrologische gevolgen van de aanleg van de Markerwaard polder, lokatiekeuzes van vuilstortplaatsen, de zettingsgevoeligheid van de bodem in diverse provincies, onderzoek naar het voorkomen van diverse oppervlakte delfstoffen in heel Nederland, in vele provincies en op de Noordzee, het vaststellen van 25-jaars verblijftijdzones t.b.v. bescherming van waterwingebieden, de bestudering van de grondgesteldheid t.b.v. potentiele bollenteelt, onderzoek naar de oorzaak van verzakkings verschijnselen aan maaiveld nabij

begraven zoutstructuren, bepalen van de toelaatbare dynamietladingen t.b.v. seismisch onderzoek in gebieden met zoute kwel, onderzoek naar de stijgsnelheid van Nederlandse zoutstructuren, lokatie keuzes uitbreidingswijken van diverse steden, onderzoek naar de invloed van ijsbelasting op de stabiliteit van zoutstructuren, onderzoek naar de afbraak van nitraat door in sedimenten aanwezige pyriet, en onderzoek naar de relatie tussen grondkosten en de grondkwaliteit in Nederlandse gemeenten.

Publiciteit

Om aandacht te vragen voor de mogelijkheden die de toegepaste geologie kan bieden voor landelijke, provinciale en ook lokale beleidsmedewerkers heeft de RGD, samen met Stiboka (het huidige Staring Centrum) en DGV-TNO vier jaar geleden een brochure uitgebracht. In deze brochure, getiteld "Bodem in beeld" ("Subsoil uncovered" in de engelse versie), wordt aan de hand van 15 kaarten antwoord gegeven op vragen die bij het beleid leven of zouden kunnen leven.

In een volgende aflevering van dit blad zal op enige van de hierboven genoemde projecten nader ingegaan worden.

Sea Core Excursie Ingenieurs geologie

19 februari 1990

J.E. de Groot

Het vertrek

Rond een uur of een vertrekken we richting Rotterdam. Ons excursie doel staat daar midden in de Europoort vlakbij de Benelux tunnel: het boorplatform van Sea Core.
De zon schijnt in het gezicht en de temperatuur is aangenaam, een prima voorjaarsgevoel is ons deel. We stoppen boven de ingang van de Beneluxtunnel en zien wagens onder onze voeten door, onder de Maas verdwijnen. Bij de ventilatieschacht aan de overkant moeten ze weer boven komen. Halverwege het water staat daar het platform van Sea Core, het is een bijzonder kleine 'jag up' van ca 10 * 10 m2.

De lokatie en een touwladder

Temidden van enorm grote voorbijvarende schepen, probeert het ponton zich letterlijk op vier poten staande te houden. Een containerschip dat komt aanvaren presteerd het om het hele platform uit ons gezichtsveld te nemen! Als de kapitein even geen rekening houdt met z'n dooie hoek, zal het platform als een notedop overvaren worden. Hier is aan gedacht, duwbootjes varen in de buurt van de boeg om een eventuele aanvaring te kunnen voorkomen.
Met een pendelbootje worden we naar het platform overgevaren. De zon is inmiddels verdwenen en er staat een stevig briesje, maar het heeft totaal geen naam vergeleken met de stormen van de afgelopen weken. Alleen een touwladder scheidt ons nog van het platform. Vijf minuten later staan we op het eiland en mogen we rondkijken.

De constructie

Het eiland is speciaal door Sea Core ontworpen om op zee te boren en samples te nemen. De ponton constructie is zo klein en compact dat het eenvoudig demonteerbaar is als het met een 60 ton kraan op de kade gehesen is. Het geheel is dan vervoerbaar met vrachtwagens en kan elders binnen een dag weer in elkaar gezet worden. Ook te water is het geheel eenvoudig verplaatsbaar door het platform tot op het water te laten zakken, de ca. 20 meter lange poten,die tot wel drie meter in de bodem zitten, los te trekken, en met boten te verplaatsen.

Het onderzoek

Hier in de waterweg wordt onderzoek gedaan voor een eventuele tweede Beneluxtunnel. Grondmechanica Delft is de hoofdaannemer en verzorgt het elektrische sonderen. Sea Core is onderaannemer. Deze groep boort en neemt, afhankelijk van de cohesie, zowel 'valve' als 'hammered' samples. In zandig materiaal wordt continu 'gehammerd',

om de bulkdensity en vooral de korrelverdeling te bepalen, terwijl in kleiachtig materiaal om de meter een valve sample wordt genomen, voor consolidatie en celstest metingen. Na twee a drie dagen wordt het platform weer een stuk verder verplaatst boven de nieuwe tunnelbaan, om verderop nieuwe metingen te doen. Het project neemt zo'n drie weken in beslag.

Dat monsters nemen niet zo maar gaat blijkt als een valve sampler leeg naar boven komt. Een hammered sample name blijkt meer succes te hebben. Als Grondmechanica Delft klaar is met het binnenhalen van de cone penetrator komt de boot ons weer halen en vertrekken we naar de wal. Met een biertje in Schiedam besluiten we een geslaagd uitje.

Ben en Michiel bedankt.

Report on meeting: 7-3-89 of the Engineering Group of the Geological Society, London

by P.M. Maurenbrecher

MILITARY ASPECTS OF ENGINEERING GEOLOGY

As is often been the case in the past with the engineering industry in the Netherlands paying scant regard to what exists below ground level so the situation is more pronounced with the military. This is not the case in the United Kingdom where geologists are considered an essential contributor towards the military infrastructure. The reasons why are given in a report on a meeting held at the Geological Society of London at Burlington House, on 7th March 1989.

The themes were:

1. The operational requirements for engineering geologists with particular reference to terrain analysis (Dr. M. Rosenbaum, Imperial College, London)

2. Film: Terrain analysis on the battlefield

3. Well drilling and the command of a specialist team

4. Practical engineering geological solutions to works problems (Miss. Judith Chalmers)

5. Basic military and professional training requirements for engineering geologists (Major P. Nathanial)

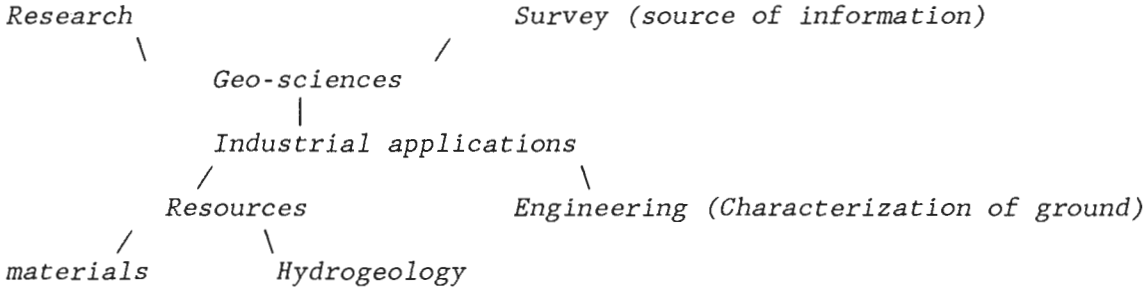
6. The use of geology by the armed forces in the past and in the future.

The following summaries are taken from the Geological Society Newsletter (1989), with some comments taken from notes by the author who attended the meeting in italics:

1. **Operational Requirements**: The requirements for engineering geology within military operations in times of war will be outlined. Particular attention will be paid to the applications of engineering geology to terrain analysis since this is a major user of such expertise in modern warfare. The likely conditions under which engineering geological information could be obtained and evaluated will be described and the implications regarding training and preparation discussed.

The presentation was given by Dr. Mike Rosenbaum, Lecturer in Engineering Geology at Imperial College, London. He presented the Battle of Waterloo as a case history to illustrate mobility in the field. Napoleon's tactics were not thwarted by his opponents; it was the environment: Weather and the soil. The artillery got bogged down in wet clayey soil after a night of rain and so that any element of surprise he had hoped to gain that night failed. The low shear strength of soil was illustrated by a contemporary slope failure in the mound commemorating the battle.

Elements of engineering geology are illustrated as follows:



Aims of the military are to **deter, defend and attack**. *Examples are:*

1. Protection Effectiveness of trenches with respect to explosions. The cross-section of a bomb crater showed three zones of soil: the plastically deformed zone, the rupture zone and the fall-back zone.
2. River crossings Bank stability, bearing capacity and tractability are all functions of river morphology.
3. Mobility Sources of hard-core are sited to ensure tractability as well as maps showing terrain tractability.
4. Resources Water is much underestimated: On Ascension Island there is only one minor spring so that most water has to imported over relatively large distances.

Role of engineers geologists in the army:

Survey Directorate (Terrain analysis, e.g. Falkland Islands)
/
Army Geologists (Territorial Army; Sandhurst first)
*/ *
Works Operations: Military activity, Corps level (higher level of command not for making decisions on dig-ability but identifying the "choke" points .

The geologist must:
a. Identify and understand
b. Acquire relevant data
c. Analyse
d. (Not listed in my notes): Act and achieve.

Falklands remapping as the centre of the archipelago was situated on the corners of four maps all having a different scale; need for GIS geographical information system to produce maps supplying the relevant data in the relevant format.

Other case histories:
WW I: Passiondale Eep clay in remoulded state very low shear strength
Cambray: *The chalk only had thin cover which soon worn away causing reduction in traction.*
WW II Operation D-Day Knowledge coastal geology played significant role in success of allied landing.
Netherlands operation Veritable Overlooked to great extent deltaic environment of numerous streams and soft soils so that traffic easy target as was concentrated on dikes and slow progress.

2. **Film: Terrain analysis on the battlefield** Graphical illustration demonstrating the importance of the assessment of ground conditions in the field of terrain analysis including the role played by engineering geology.

3. **Well drilling and specialist team**: Geologists have for a long time had a close association with military drilling teams. The general role of the Royal Engineers Volunteer Specialist Well Drilling Team and its organisational structure will be described. The practical and theoretical training of the well drillers will then be covered in outline. The methods of command and control will be discussed and the demands that are made upon the commander of such a team will be explained with reference to a typical well drilling task. This task will be reviewed from its inception, through the desktop study phase and preliminary site reconnaissance, through to mobilisation, drilling, pump testing and completion of well. The review reveals the enormous time and effort required to produce a well under operation conditions, but demonstrates

that the procedures have a wider application.

The presentation was given by Captain Chris Eaton of the Territorial Army The type of rigs used are Dando 250 and 800 (collapsable tripod frame trailer rigs) and also truck mounted auger rigs. Difference with commercial firms is that the army personnel are not full time drillers and hence efficiency dependent on regular exercises rather than experience from jobs. Other considerations: use of green foam for camouflage.

4. **Practical solutions to works problems**: In peacetime military geologists provide engineering geological advice for a variety of tasks. A recent case history from Gibraltar will be presented to illustrate such applications.

This is concerned with the widening of a congested single carriageway road currently cut into the limestone of The Rock. This would entail removal of rock buttresses and required an appraisal of the likely rock mass characteristics in order to permit an assessment of the stability of the rock cutting both during and after construction. Recommendations had to take into account the constraints on time, equipment and manpower available within the constricted time.

This presentation was covered by (Second Lieutenant) Judith Chalmers who presented a case history not unlike that found in normal practice. The road is the responsibility of the Gibraltar garrison so that its widening was done from within the army. The principal concern was the use of explosives for excavation. It was felt that the shock waves may trigger rock landslides. Use was made of chemical fracturing, where an expansive chemical grout is used.

5. **Professional military training requirements**: Engineering geologists in the Army must be Commissioned Officers. The process of gaining a Commission involves four phases of military training culminating in a two week course at the Royal Military Academy, Sandhurst.

Upon successful completion of this training the engineering geologist is appointed to the rank of Second Lieutenant and is then in a position to begin to put his/her professional expertise to practical use.

The basic training concentrates on developing leadership qualities of man-management, decision making, planning and execution, general under conditions of extreme physical and mental pressure. Practical techniques such as map reading, report writing, extraction and delivery of orders and fieldcraft are also taught.

Captain Paul Nathanial Talked about training requirements for one wishing to serve as a geologist in the Territorial Army. Much of the attributes he mentions are not dissimilar to what one expects in commercial practice; the essential difference one has to be trained for combat as well work as an engineering geologist. Leadership attributes also play possibly a stronger role then in a civil situation as one has to
a. Work in conditions which normally would not be acceptable in a commercial situation
b. Supervise personnel who are not normally experienced with drilling (usually drawn from maintenance crews or combat soldiers)
c. The combative aspect especially in war zones or areas subject to insurrection or in "neutral zone" such as United Nation peace keeping duties where self protection is as much part of the mission as installing wells or maintaining roads.
Hence he emphasized that the military training at Sandhurst is crucial in the success of becoming a Commissioned Officer Geologist in the Army. The success of such training depending very much on strength of character and physical endurance. He even suggested (despite the presence of many "civil" engineering geologists that with this extra training the military engineering

geologists were better than their civilian counterparts.)

6. **Geology past and future**: An overview is given of the use made by the military of geology with the emphasis on engineering geology and the historical and likely future needs on the battlefield. Geologists were first used as such in the Armed Forces of Australia, Britain, Germany and the United States during the 1914-1918 War. Essentially static warfare on the Western Front necessitated their use in groundwater development, siting of dugouts, and tunnelling. The 1939-1945 War was more a war of manoeuvre, in North Africa, Europe and the Far East. Geologists' roles were therefore extended to terrain analysis. Subsequently, military geologists have been widely used in tasks associated with groundwater development, aggregate extraction, and site investigation, to develop expertise to aid restoration of facilities if devastated by war. Such peacetime tasks continue to provide geological aid to many communities overseas.

Bill King, also with the Territorial Army gave a short history of the first geologists/ engineering geologists in Military service. He said the first was Sapper Grey who as a graduate in Geology held the function of truck driver in the First World War. He made use of his travels to collect geological information and produced maps which were found to have strategic importance, essentially showing sources of rock aggregate for roads.

He noted that the British Army had only a handful of geologists compared to the German Army. The German Army geologists, for example, had held their 6th conference in 1940. The fact that the German army had more geologists than the British was not, as far as Bill King knew, the reason Germany lost the war.

An advertisement reads as follows

GEOLOGISTS IN THE TERRITORIAL ARMY

Qualified geologists are needed to serve as Officers in the Territorial Army (in the Royal Engineers). These Officers will join an existing team of geologists who provide a worldwide consultantcy service for the Army, the Royal Navy and the Royal Air Force. Recent tasks have been located for example in Cyprus and the Falklands as well as closer to home in Germany and the UK. Such tasks include the geological aspects of terrain analysis, assessing the potential for abstracting groundwater, establishing quarries and site investigation for various types of construction projects.

Since these geologists are Territorial Army Officers, they are only committed to about 20 days service each year, including 3 weekends of military training as well as geological tasks. Pay per day is appropriate to rank held. In addition a tax-free bounty is payable on satisfactory completion of each year's service.

Applicants should possess a good Honours degree in geology or engineering geology, and preferably should have both experience and civilian employment in the fields of either engineering geology or hydrogeology. A postgraduate degree is an asset. Applicants who have not previously held a Regular or TA Commission should be under 30 years of age and prepared to undertake military training in order to gain a Commission before appointment as a TA Geologist.

Traditionally, most TA geologists are in the 25-35 year age range, and are members of University teaching staff, major engineering, petroleum or mining companies, or national or local government organisations. Younger geologists of potential who as yet lack appropriate professional expertise may also be considered for Commissioning.

For further information on the training commitments and the terms and conditions of service, please write to:

Central Volunteer Headquarters,
Royal Engineers
Minley Manor,
Blackwater,
CAMBERLEY,
Surrey GU17 9JU

Tel: (0252) 87 66 22 Extension 381.

Extra reading on aspects of Military Engineering Geology:

ANON, 1971, Design Manual: Soil Mechanics, Foundations, and Earth Structures, NAVFAC DM-7 March 1971, 260p Department of the Navy, Naval Facilities Engineering Command Alexandria, Virginia

ANON, 1976, Applied geology for engineers., Editor: Ministry of Defence and Institution of Civil Engineers Military Engineering Volume XV Army Code No. 71044, 378p Her Majesty's Stationery Office London

ANON, 1989, Military aspects of engineering geology, Editor: Brooks, J. Geological Society Newsletter, vol 18 no 2 pp 19-20 Geological Society London

Curran, H.A., Justus, P.S., Perdew, E.L., and Prothero, M.B., 1974, Atlas of Landforms, Department of Earth, Space and Graphic Sciences U.S. Military Academy, West Point, 2nd Edition, John Wiley & Sons, Inc. New York

Den Held, J.J., 1984, Behoud van de natuurfunctie in militaire oefenterreinen. Genie.

Maurenbrecher, P.M., 1986, 1989 Military engineering geology, notes on lectures given at the KMA and the Genie, TU Delft Engineering Geology, 17p.

Morpurgo, J.E., 1973, Barnes Wallis, 476p Penguin Books Ltd. Harmondsworth

Patrick, D.M. and A.W. Hatheway, 1989, Engineering geology and military operations: an overview with examples of current missions, Bul. of the Assoc. of Engng Geol., v 26 n 2 p265-276

Vertegaal, P., 1989 Milieuvervuiling door militairen, Intermediair 24, 16 juni, p63-67

OPROEP

De redaktie heeft het idee opgevat om voortaan (frappante) stukjes over geologie, ingenieursgeologie, en verwante onderwerpen die in de dagbladen te verschijnen, ook in dit blad te publiceren. Mocht men een dergelijk artikeltje tegenkomen dan zouden wij dit graag toegestuurd krijgen op onderstaand adres. Natuurlijk zijn ook eigen artikelen van harte welkom.

De Redaktie

Redaktie Nieuwsbrief Ingeokring
Faculteit der Mijnbouwkunde en Petroleumwinning
Sectie Ingenieursgeologie
Mijnbouwstraat 120
2628 RX Delft
Nederland
Telefoon: 015-782543

Conferences, Seminars and Symposia:

1990:

10-13 June — **2nd Symposium on Strait Crossings.**
Trondheim, Norway.
Topics: Technology; Safety and Traffic Operation; Social and Economic Effects. Strait Crossings, Att: Mr. Vidar E. Storvik, Norwegian Society of Chartered Engineers, Kronprinsensgr. 17, N-0251 Oslo 2, Norway.

18-20 June — **ASCE Special Conference on Design and** Performance of Earth retaining Structures. Ithaca, NY, USA.
topics: Wall selection and performance; Mechanically stabilised systems; In-Situ walls, Waterfront retaining structures; Contracting practice; Gravity walls. Dr. Phillip Lambe, Dept. of Civil Engeneering, N-Carolina State University, Campus box 7908, Raleigh, NC 27695, USA.

6-10 August — **6th International Congress of the IAEG.**
Amsterdam, The Netherlands.
Topics: Engineering Geological Mapping and Site Investigation; Remote Sensing and Geophysical Techniques; Hydro-Engineering Geology; Surface Engineering Geology; Underground Engineering Geology;Engineering Geology of Land and Marine Hydraulic Structures; Construction Materials.
Info: Dr. L. Primel, Secretary General IAEG, Laboratoire Central des Ponts et Chausees, 58 Boulevard Lefebre, 75732 Paris Cedex 15,France.

8 august — **Computer use in engineering geology**

Environmental protection, pollution and waste disposal

Coastal protection and erosion, including the engineering and environmental consequences of rises in sea level.

Engineering geology in the oil industry.

these four symposia will run simultaniously and are part of the congres mentioned above.

3- 7 September **Tunnels and Underground Works.**
Chengdu, China.
Topics: Design and Construction of Railway Tunnels; Design and Construction of Metrod Urban Underground Works; Design and Construction of Hydro Tunnels; Rock Caverns for Storage; Use of Numerical Methods in the Tunnel Design.
Info: Secretariate CCES, P.O. Box 2500, Bai Wan Zhuang, Feljing, China.

10-12 september **Static and Dynamic Cosiderations in Rock** Engeneering, Swaziland.
Topics: Static and dynamic considerations in related to the behaviour of discontinuities and the relation with seismicity.
info: Mr. M.Foure, chairman organizing committee ISRM International symposium.
P.O. BOX 112, Mbabane, Swaziland.
FAX: (International +27)-11-339-1821.

8 november **Bodemdaling in Nederland, TU Delft.**
Topics: Overzicht van aspecten van bodemdaling, mechanismen van bodemdaling zowel door menselijke aktiviteit als door natuurlijke oorzaken, gevolgen van bodemdaling voor leefomgeving, meettechnieken en voorspellings modellen voor bodembeweging. Bodemdaling door gas-onttrekking in de diepe ondergrond in Groningen.
Info: Technische Universiteit Delft Congresbureau, Mekelweg 5, 2628 CC, Delft.

1991:

27 may-1 June — **10th European Regional Conference.**
Florence, Italy.
Topics: Deformation of Soils and Displacement of Structures.
Info: Ing. G. Baldi, Secretary, Associazione Geotechnica Italiana, Viale Regina Margherita 183, 00198 Roma, Italy.

19-21 june — **Fracture processes in brittle disordered** materials, Noordwijk, The Netherlands.
Topics: fracture mechanics modelling of failure processes, continuum mechanics based approaches, Damage and micromechanical modelling, rate effects, fatigue and sustained loading, structure and non-linear behaviour of heterogeneous materials, nummerical modelling of failure processes, fracture mechanics test-methods for concrete, rock and ceramics, applications of fracture mechanics.
Info: (for registration and papers)
Mrs. R. Kommen-Zimmerman, Congress Office ASD
P.O. BOX 54, 2640 Pijnacker, the Netherlands.
tel. 31-(1736) 5356, fax. 31-(1736) 2242

21-22 june — **International symposium on Mapping and** Geographic Information systems.
Topics: Exchange of experiences and the potential for standardizations. see also the ad in this paper.
Papers: Ms. Dorothy Savini, ASTM,
1916 Racestreet, Philadelphia, Pennsylvania 19103 USA
phone:215/299-5413; fax: 215/977-9679

26-30 August — **9th Pan Am Regional Conference.**
Santiago, Chile.
Mr. Luis Valenzuela, Secretary, SOCHIMSYF,
San Martin 352, Santiago, Chile.

16-20 September — **ISRM 7th International Congress on Rock** Mechanics, Aachen, Germany.
Topics: Rock Mechanics and Geology; Stress-Strain Behaviour, Dynamic Behaviour and Water Permeability of Jointed Rock; Underground openings in Rock; Rock Excavation; Dam Foundations in Rock; Slopes.
Info: Deutsche Gesellschaft fur Erd- und Grundbau E.V., Kronprinzenstr. 35A, D-4300 Essen 1, Germany.

1991

9-13 december **Ninth Asian Regional conference on** soilmechanics and foundation engeneering. Bangkok,Thailand
Topics: Development of theory and practice in geotechnical engeneering; Problematic soils and their engeneering behaviour; Soil-structure interaction, and foundations; Embankments, excavations and buried structures; natural hazards and environmental geotechnics; groundimprovement techniques.
Info: Prof. A.S. Balasubramaniam, Secretary,South East Asia Geotechnical Society, Asian Institute of Technology, P.O. Box 2754, Bangkok 10501, Thailand.

1994

23 - 26 august **Mining into the 21st Century.**
International Congress on Mine Design. Ontario, Canada.
objectives: to establish a forum in which state of the art technology, innovative mining practice and participated evolution of mining trends can be presented and discussed. The international scope of this forum will be used to introduce global changes in technology which will shape the future of world mining into the next century. Official languages are English and French, translation will be available.
Abstracts are to be submitted by january 1992.
info: Peter Scott, P.R., ICMD. Department of Mining Engeneering, Queen's University. Kingston, Ontario, Canada K7L3N6

ANNOUNCEMENT:

POST CONGRESS ENGINEERING GEOLOGY EXCURSION

"NETHERLANDS FROM 60 MILLION YEARS TO THE PRESENT"

Date: 10-13 AUGUST 1990

Start: RAI CONFERENCE CENTRE 18.00 hrs 10th AUGUST 1990
Europaplein 1078 GZ Amsterdam

End: SCHIPHOL AIRPORT 18.00 hrs 13th AUGUST 1990

For those IngeoKring members who feel there has been a distinct lack of field excursions a golden opportunity to make up for this presents itself this summer. The excursion is meant for the 5th IAEG Congress delegates who need to recover from five days of listening and talking to spend a few days touring by coach in the Dutch countryside, starting with Maastricht and ending in the flatlands of Noord Holland and Flevoland. There are still some spare seats available for non-delegates. The cost for the excursion is *f* 750, which includes hotels, meals guides and transport.

The programme is as follows:

Friday, 10th August 1990:

Leave from RAI by coach for Maastricht. Stop on way for dinner. Arrive in Maastricht in time for a beer or two at the Vrijthof.

Saturday, 11th August 1990:

Visit the deepest hole in the Netherlands in the Maastrichtian at the ENCI, Maastricht. The effects of the excavations on the groundwater will be shown. This will be followed by the Albert Canal Cut, Maas River Gravel Terraces topography on the slopes of the Plateau of Margraten, underground building stone mine stability at Valkenburg, Miocene silver sands at Brunsum and gravel and loess exposures at Spauwbeek. The evening will again be spent in Maastricht. An after dinner walk is planned to inspect the geology of natural building stones used in Maastricht buildings and to taste the many beer types that Limburg has to offer at the Vrijthof and Onze Lieve Vrouweplein.

Sunday, 12th August 1990:

Travel north along the Maas valley stopping along the way at one of many dredged gravel pits. Look at the effects of the rift faulting in the Peelhorst region followed by a stop at the city of Nijmegen's glacial ice-pushed ridge, and inspect the effects of glacial tectonics. As the next hotel will be made from brick it is appropriate that the final visit for the day will look at clay pits for the brick industry the fluvial clays being trapped in the still waters of old river flood basins.

Monday, 13th August 1990:

After traversing the ice pushed ridges of the Veluwe the excursion theme for the remainder of the day will be the flatlands of Noord Holland and Flevoland inspecting the drainage methods employed in historical, old polders and the younger contemporary large polders. The problems concerned with drainage and settlement especially those polders with extensive peat deposits will be highlighted. The visit will pass along the very Dutch areas of Enkhuizen and the excursionists will have the opportunity to see a number of dykes. Appropriately a visit will be made to the State Public Works Department at the Netherland's youngest province of Flevoland (most of it was still under water when the IAEG was founded in 1965).

The visit not only takes the excursionist from the oldest to the youngest geology but also from the oldest to the youngest city in the Netherlands. It is also a good opportunity to meet engineering geologists from abroad. You may apply for this trip by returning the application form below unless you have already registered for a long weekend trip through your registration for the 5th IAEG International Congress.

- -><

Application Form for 5th IAEG Int. Congress field trip

Netherlands from 60 million years to the present

18.00hrs 10-8-90 from RAI to 18.00 hrs 13-8-90 Sciphol via Maastricht, Nijmegen, Noord Holland en Flevoland (Lelystad)

Surname/Family name _____

Title _____ Initials _____

Adres_____Postcode_____Place_____

Telephone (home)_____(work)_____

Fax _____ Date _____

Please return to:

Meindert W. van den Berg
NL IAEG Field Trip Coordinator
Rijks Geologische Dienst,
c/o Soil Survey Institute
P.O. Box 98
6700 AB Wageningen

Please note: Priority is given to IAEG conference delegates and to first applicants.

Logisterion brengt

ARC/INFO

ARC/INFO, het meest gebruikte **Geografisch Informatie Systeem,** integreert (topo)-grafische en administratieve gegevens in een topologische en relationele datastructuur. Hierdoor kan ARC/INFO voor een breed scala van toepassingen worden ingezet. ARC/INFO is nu verkrijgbaar op de volgende hardware platforms:

PC'S

IBM AT
IBM PS/2

WORKSTATIONS

DEC VAXstation, Tektronix, HP, SUN,
IBM RT, Apollo, Data General

MINICOMPUTERS

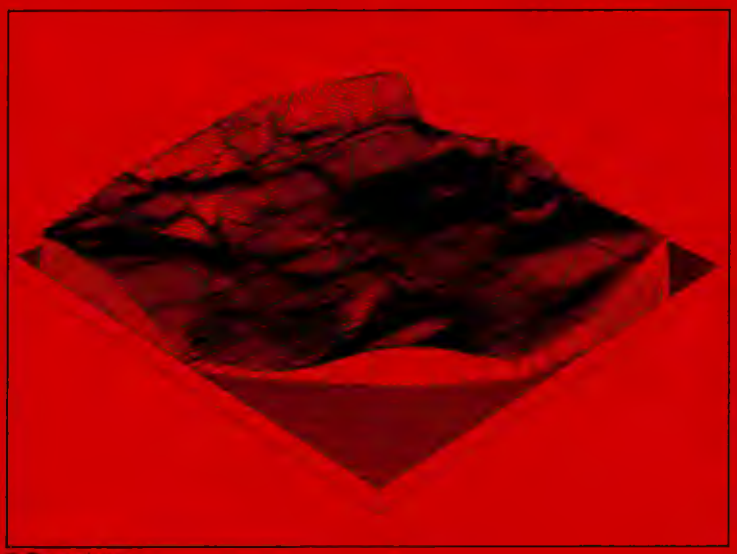
Prime, DEC, IBM, Data General

MAINFRAMES

IBM

TOEPASSINGEN

ARC/INFO kan toegepast worden in de volgende gebieden: planning, beheer, water-huishouding, vastgoedinformatie, kartografie, bosbouw, landbouw, milieurapportering, ruilverkaveling, demografie, verkeer, 3-D analyse, expeditie, hydrologie.



3-D analyse

vastgoedinformatie

Logisterion b.v.
Automatisering

Stationsplein 45 Postbus 29 080 3001 GB Rotterdam
Telefoon: 010 - 411 88 55 Telex: 23688

Het ARC/INFO systeem is een
produkt van Environmental Systems
Research Institute, Inc., Redlands, USA