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New Subscription Rates

At the 1975 Annual General Meeting of the Institution the subscription rate for Active List (AL) Members was fixed at 0·67 of a basic day's pay per annum. The rates for Non Active List (NAL) Members were increased on the basis that subscriptions should cover total publication costs. The rates varied from £5·00 to £8·00. It was suggested that these rates should give stability for three years. The projections were based on 20% rate of inflation per year and as this magic figure did not materialise during the three years the period of stability was extended to four and then five years. It has never been the aim of the Institution to make a "profit" but to remain viable whilst maintaining the service required by its Members.

We have now reached the stage when increases in subscriptions are necessary. The rate of inflation has been increasing steadily and as it has a compound effect it is difficult to catch up and financially painful to get ahead of the inflationary effects. But this is what must be done if we are to have any semblance of stability. As a self-service body, if we need a helping hand, we need look no further than at the ends of our own arms!

Without publishing tables of boring figures it is of interest to note the actual and projected costs of publications supplied to each Member:

1974	1976	1980	1982
£4·02	£4·51	£7·50	£11·98

Subscriptions from AL Members keep pace with inflation as they are based on a proportion of a day's pay. NAL Members however pay a fixed sum depending on substantive rank. In 1980 under 40% of Members are from the Active List but they subscribe 62% of the total subscriptions or conversely over 60% of Members who are not on the Active List subscribe only 38% of the total subscriptions. In 1976 the subscriptions came to 50% from each category.

At the 1980 AGM the Council recommended an increase in all subscriptions except for AL Members. The recommended annual rates were based on a planned three year stability, 1981, '82 and '83. The increases represented a maximum of 15% per annum and were based on General List Majors and QM Lieut Colonels paying £12·00 per annum, the forecast cost of publications in 1982. Ranks senior to this would pay more and junior less. The rate for Associate Members, who only receive the Journal, was adjusted to 1982 forecast costs.

The AGM supported the Council recommendation that with effect from 1 January 1981 the new rates for NAL and Associate Members will be:

General List Commissions	
Major Generals and above	£16·00
Brigadiers	£15·00
Colonels	£14·00
Lieut Colonels	£13·00
Majors	£12·00
Captains	£10·00
Subalterns	£ 8·00
Quartermaster Commissions	
Lieut Colonels	£12·00
Majors	£10·00
Captains	£ 8·00
Others	
Associate Members	£ 5·00 (receive Journal only)

Council and the AGM were very conscious that a number of NAL Members, who no longer have second incomes, might find the new rates too high and might be forced to resign from the Institution which would be regrettable. The AGM therefore agreed with Council that Members over seventy years of age could continue membership at their present rates if they so requested.

To implement these decisions the following action is required:

(1) *Active List Members*

(a) If you pay through "Day's Pay Scheme"—None.

(b) If you do not pay through "Day's Pay Scheme"—None. You will be informed of your new rate, based on 0·67 day's pay as at present.

(2) *Non Active List Members and Associate Members*

(a) If you pay direct to Institution by Bankers Order (BO)—A new BO will be sent to you in September, showing your new rate, for signature and return to Institution.

(b) If you pay direct to Institution by cheque or cash—Please note your new rate and pay accordingly. You will be reminded of your new rate in November.

(c) If you pay by CBO through Treasurer Corps Funds—Assuming Corps Treasurer has been authorised by you to increase your CBO unilaterally and inform your bank accordingly, action will be taken to adjust your CBO to include new rate unless he hears to the contrary by 1 November 1980. —If Corps Treasurer does not hold authority to vary your CBO a new CBO will be sent to you in September, showing the new rate, for signature and return to Corps Funds.

(3) *Over-70 Rate Members*

(a) If you are already an over-70 rate Member—None.

(b) If you decide to opt for over-70 rate membership—Please write to the Secretary who will arrange accordingly.

(4) *Publications Only Subscribers*

Publications only subscribers will be invoiced at their new rates each November as at present. The 1981 rates are listed below.

You will have noticed that Covenants have not been mentioned so far. The tax relief on Covenants provides much of the money available to keep all the non-publishing activities of the Institution functioning, to pay the overheads and, hopefully, to increase investments and hence investment income.

Most Members do Covenant and such Covenants remain valid at their current value. When these time expire they will be sent for renewal at the new rates. Members who do not Covenant are asked to do so—we can ill-afford to ignore this legitimate income which costs the Members nothing.

* * * * *

1981 Rates for Publications Only Subscribers

CONSEQUENT on the decisions taken at the 1980 AGM the 1981 Publications Only rates will be:

RE Journal (4 issues)	£6·35; widows £4·00
Supplement to Journal (12 issues)	£3·00; widows £2·00
RE List (annual)	£2·25; widows £1·75

Postage and packing will be charged in addition to these rates *except* for widows, serving and former members of the Corps. The surface mail rates will be:

Journal	UK	£0·66;	Overseas	£1·44
Supplement		£1·20		£1·74
List		£0·21		£0·36

Publications Only Subscribers will be invoiced at their new rates by November 1980.

1980 Corps Annual General Meeting

At the Annual General Meeting of the Corps, held on 25 June 1980, the Engineer-in-Chief, Major General C P Campbell CBE, spoke on Corps Affairs. An account of the Report follows:

My Annual Report this year has a flavour of valedictory comment about it as it will be the last time that I shall speak to this Meeting as E-in-C. But let me begin with the customary yet brief survey of Corps activities during the past year.

A Review of the Year

ABROAD

Our major contribution abroad was to *Op Agila* in Rhodesia (Zimbabwe) where Colonel Francis Sugden and some seventy Sappers of all ranks and drawn from many units jointed the United Kingdom contingent of the Commonwealth Monitoring Force under General John Acland and what a splendid job they did. I am sure you would wish me to take this opportunity to applaud them all for their courage, sang froid and sheer professionalism. Still in Africa, 32 Field Squadron completed the important Gucha Bridge project as part of an overseas development exercise. In the Persian Gulf area we made a timely move by re-introducing a temporary Sapper presence into the Oman in the shape of 20 Field Squadron who carried out valuable work on water supply and electrical distribution systems for the local people. This was a successful venture and one that will be repeated during the coming year. Further round the corner in Saudi Arabia our resident team under the ebullient direction of Brigadier Bob Wheatley continued to play its role as "honest broker" in the major construction engineering projects for the National Guard.

We maintain a continuing presence in Cyprus where the resident squadron is a key part of the garrison and plays host to visiting UK units who come to train and to work on the UN patrol track. Across the world Dominica has claimed our attention where 8 Field Squadron was deployed to deal with post-hurricane repair work. In Belize, UK squadrons continue to deploy on six months tours as reinforcement for the garrison and make a useful contribution to the works programme, eg 48 Squadron built eight married quarters thus enabling some of the longer tour people to be accompanied. Further north in Canada the bridge at Petawawa was completed by 51 Squadron thus bringing to a conclusion a project which had been staged over three seasons and had not been without its hazards. Lest I forget them, the Queen's Gurkha Engineers have had a busy and eventful life in Hong Kong and the New Territories in anti-illegal immigrant operations.

There have been a variety of training exercises overseas with units from Germany going to Suffield (Canada) and those from UK going to Germany (ADR, Harrier and TA), Norway, Italy, Jamaica and Australia. In return Australian and Italian Sappers have visited UK.

Management and specialist teams have been busy in many foreign parts including St Helena and the island of Funafuti. Individuals and small groups have undertaken liaison and advisory visits; for example Colonel Robin Jukes-Hughes went to Malaysia to advise on expansion and reorganisation of the Malaysian Engineer Corps and training school; Brigadier Jeremy Rougier visited Canada and as a result of his talks there the Corps can shortly expect a loan of five young Canadian Sapper Officers for two years to a number of our squadrons in Germany and UK; I went to Italy last October thereby repaying a visit made earlier by the Italian E-in-C. The exchange was cordial and we have established a useful relationship. Finally as a postscript to overseas news we have very recently sent a Sapper element to support the Royal Marines in the New Hebrides.

HOME

On the home front, Northern Ireland continues to be the No 1 priority for the Corps. Over the past year we have maintained squadrons from Germany and UK in

the engineer role with particular emphasis on two major projects at Forkill and Crossmaglen. The infantry role commitment is moderating and 2 Armoured Division Engineer Regiment were hopefully the last BAOR Sapper regiment to be deployed as an infantry battalion. Our future commitment will probably be a squadron in a mixed arms group. In addition to our construction and infantry tasks we are very much in evidence in the search field although this seldom catches the headlines. Before leaving Northern Ireland I would like to pay a particular tribute to the resident Sappers, the CRE and his staff, the DCRE (Works), the Survey, Postal and Courier detachments, 33 Field Squadron, and 325 Engineer Park. It's all too easy to forget our permanent presence in the whirl of units passing through the Province on short tours. In particular I applaud 325 Engineer Park who provide an absolutely first class resources service to so many customers.

Earlier this year we resumed our annual demonstration to the Staff College at Hawley after a suspension of two years forced on us by emergency commitments to civil ministries. In March we staged a comprehensive symposium at the RSME on Battlefield Protection which was attended by Arms and Policy directors from MOD together with field force commanders from BAOR and UKLF.

Postal and Courier units have had a full year and, as ever, their services have been widely appreciated throughout the Armed Forces. Their most important commitment being to support the Commonwealth Monitoring Force in Zimbabwe/Rhodesia. Survey too have had a comprehensively busy time at home and abroad with operations in Norway, Kenya and Northern Ireland. They have also been involved in the production of charts for use in Harrier, Tornado, and Jaguar aircraft, and 512 STRE have continued their satellite tracking activities world-wide. Finally we are now on the eve of an important Corps occasion with a visit by HM The Queen, our Colonel-in-Chief, to Hermitage on Friday where she will open the new School buildings.

The Territorial Army, as they are once again called, have had a customary busy year especially the specialist teams who have done invaluable work in Germany, Cyprus and Gibraltar.

CORPS AFFAIRS

The two tier system for running Corps affairs is now a well established machinery with benefit in many directions. The continuing high priority is the improvement of communications in-house and the projection of our views and achievements in a wide range of influential Army and civilian circles. With regard to our own communications I am very encouraged by the constructive views put forward in the *RE Journal* during the past year and the high standard of material in the *Sapper*. I very much hope that we can continue to build on this solid achievement. The Staff College demonstration and the Battlefield Symposium were two important strands in the strategy of keeping the Corps in the "Army Public Eye" and another will be a presentation we are planning to stage for an influential audience in the City of London in December this year. In furtherance of the aim of stimulating thought and discussion in the field of military engineering, CE BAOR has held further successful Institution Meetings in Germany on the pattern of those launched last year. Many of you will also know of the very recent Joint Meeting of our own Institution with the Civils at Arromanches when *Mulberry* was revisited.

In sum, our units have had as always a full and busy year acquitting themselves with distinction. CGS after a visit to Crossmaglen and Forkill where he saw our soldiers working in the most atrocious weather conditions wrote—"Sappers are really quite remarkable people." A phrase admirably summing up the Corps and our track record.

VALEDICTION

I daresay some of you have come here expecting something of a "haul down" report from me after three years in office. There are those who say that such reports so often represent the views of the originator who has gone beyond the point of being able to

do anything about the matters he raises, or they are viewed by the recipients as something the originator should have done something about during his tour in office and hasn't!! Either way the report all too often is consigned to the waste-paper basket. However having said that I feel I owe it to you to give some account of my stewardship however brief, and also offer some views for the future.

Looking back, the past three years have been characterised in the main by the implementation of the Army Restructuring Programme (ARP), the very heavy burden of over-commitment, the damaging effects of Premature Voluntary Release (PVR), the change of government and the turning of the tide on pay. I have referred to all these matters at different times either at previous AGMs or at my Annual Conferences, but they have provided the backcloth against which I have operated and I will therefore need to say something about them again in order to get my term of office into perspective.

Early on I decided that I needed to establish a form of machinery to steer the way ahead for the Corps in the context of our commitments, capabilities, manning, training, and equipment. I thus formed what has come to be known as the E-in-C's "COSI" Committee which has been described as the "Chief of Sappers Informal Committee". This small group of a few selected senior advisers has met very regularly, (about every 2–3 months), has guided the Corps through some difficult times and has pointed the way to the future. Its informality has been its strength and its creation has been in my view an important event in my tour. Two other groups were also formed, the first to deal specifically with Officers careers, of which you have heard me speak many times, and the second to deal with tactical doctrine, combat development and equipment requirements.

These groups together with the Chief Royal's Committee and my own Regimental Committee have been the legs on which the Corps has stood squarely and within them the regular exchange of views and ideas across the board has promoted a better understanding of all our affairs within the family of the Corps. I should now like to talk briefly about the main areas of endeavour with which I have been concerned.

COMMITMENTS

The most urgent task was to tackle over-commitment (to some extent caused by the ARP) because this had a direct and damaging effect on our ability to keep our ranks filled and also on the quality of our training. We have achieved some success. There are now annual periods which are set aside for regimental commanders to get on with their own unit training undisturbed and as you heard earlier there is some relief in sight from our infantry role in Northern Ireland. But we have to continue to strive to improve the balance which allows sufficient time for training for our priority role and keeps separation within reasonable bounds.

MANNING

Next manning. With a shortfall of some 470 against our manpower target, getting and keeping our ranks filled has been, and continues to be, a very high priority. There has been a perceptible change for the better in recent times. Recruiting for officers and soldiers has risen encouragingly and, most important, wastage is declining and we look forward to being within 100 of our target by the end of 1981. This is much better news than the grim days which I recall in 1977 and 1978 and part of 1979 when there was a flood of PVR especially amongst middle piece Officers. The "black hole" created by this loss will be with us for many years, but I take encouragement from the large number of young men that Colonel John Wilks has in his Potential Officer entry books.

The restoration of pay comparability helped enormously to arrest the outflow of both officers and men and quite suddenly we were able to look them in the eye in the knowledge that they had received their due. Pay will always be a sensitive issue and we deceive ourselves if we think otherwise, but the cause for dissatisfaction is past and we should no longer be pre-occupied with it however justified this was a couple of years ago.

Good recruiting is good news, but so also is a satisfactory level of retention of

trained soliders, senior NCOs and Officers. There are many aspects of this equation such as confidence in the future, job satisfaction, and the attitude of wives. Confidence has to do with stability and commitments of which I spoke earlier. Job satisfaction is to do with good equipment and time to train, and the attitude of wives stems from all of this. In the Corps we have always been fortunate compared with many other arms in the opportunities presented to us to take on worthwhile and challenging jobs in interesting places. This has certainly been true in my time and I see no reason why it should not continue for the future. It is this variety, interest and travel which helps to abate the negative features of modern quality of life.

Talking of quality of life, the cuts in civilian manpower is a matter of considerable concern and while the final details have still to be resolved there are bound to be repercussions for the soldier in terms of his work load and the standards under which he lives.

Finally under the manning head I will now repeat some comments on women that I made at my last Conference. I am certain that we do not make enough use of the WRAC, and while it may go against the grain of the male chauvinists in the Corps, there are not, I suggest, all that number of jobs, outside those in direct combat or requiring great physical strength, which the intelligent well-adjusted female cannot do as well as the intelligent well-adjusted male! Anyhow the Regimental Colonel has his eye very firmly on some female engineering undergraduates who we are going to take when they have graduated and been commissioned into the WRAC.

TRAINING

Next is training. The inter-related problems of over-commitment and undermanning were significant in 1977 for their effects on the seriously declining standard of our Sapper training for priority roles. Some put it as strongly as reaching a nadir. It has been a major pre-occupation to get back into the game and I believe we have achieved a great deal although we are not altogether home and dry. Nevertheless the introduction of periods of two months or so of dedicated unit training has done much to turn the tide. Coupled with the implementation of the new career structure, and part of that has been the establishment of the in-theatre combat engineer training centre at Hameln, we are much better set for the future. I am totally confident that standards will rise. Things are not perfect, nor I doubt will they ever be, but a substantial inroad has been made into the debilitating effects of turbulence and we are achieving the stability needed to attain professional competence.

Training is a vast subject and time precludes me from doing justice to it. But I will make two more points. The first is to do with leadership training. We have taken an important step in setting up courses for NCOs in which leadership instruction based on the functional approach is separated from training in trade skills. The results so far are very impressive especially at the junior NCO level. The YOs also undergo a similar leadership pattern. The second point is one of caution. With fewer exercises on the ground and with operational experience slipping out of sight, (other than in Northern Ireland which is rather specialised), fewer people who are responsible for training really have a sufficient knowledge and experience of tactics or know how to train in a way which is realistic and stimulating for those under training so that they in turn fully understand what they would have to do in battle. There is some danger here and we have to watch it.

CAPABILITY

The final section of my talk is to do with combat capability. There are two strands here—equipments and organisations. In 1978, in my AGM Address, I talked in the "short warning scenario" of the crucial importance of countering very large mechanised forces equipped with sophisticated weapon systems. This has been central to the numerous discussions and studies there have been in the ensuing two years. I can't go into all the details now, but I can tell you that we have evolved a concept for battlefield engineering which will strengthen our hand and enhance our capabilities in the area of counter-mobility and mobility, especially it will aim to reduce time and manpower overheads in all areas of our operations. Working with the research

establishments and procurement staffs we are setting requirements far ahead for new generations of mines, including scatterable mines, rapid demoliton devices, explosive digging aids, improvement of battlefield protection, future bridging, enhancements of armoured engineers, a greater emphasis on mechanised power, and not only for earthmoving, and improvements to RAF support especially ADR. It's going to be a very big programme and we are already into some parts of it. The central drive is given by my Operational Policy Committee. Achieving the programme within the constraints of money and other resources will call for some absolutely ruthless decisions about priorities.

The incorporation of equipments into the Order of Battle has been very much in mind in the studies addressed in *Project Mercury* which I have referred to in other talks. Restructuring was designed for a very tight budget, and for a range of commitments, which has not materialised as forecast. It has produced some benefits more noticeable perhaps in UK than elsewhere, but there are also some now well known operational and command weaknesses in the present organisation. *Mercury* was a long study and the conclusion in the end was that what was required was a "blueprint" or long term plan which set out the desired organisation to meet our operational commitments in Europe in the short warning time. The concept of the "blueprint" recognises that, given the constraints imposed by money, manpower, barracks and exchange costs, there will almost certainly always have to be as at present a balance of the ideal force retained in the UK or provided by reserves. What the balance will be and how the "blueprint" will generally be achieved at any moment of time will be the job of a MOD committee with its rolling programme. This will look ahead in detail for a year and more generally up to ten years ahead, reviewing the "blueprint" and recommending improvements and enhancements which could be achieved as resources become available.

How do we fit into this overall scheme? At my Conference last November I explained how we were building up the RE "blueprint" or long term plan and the gist of what I had to say then was reported in the *RE Journal* this month. Briefly our plan is based on certain principles. Engineer support is to be provided at every level of command; the field squadron is to be the basic organisational brick and is to be found at brigade level in close support, and at division and corps level in a more general support role.

Our RE "blueprint" has now reached the point where VCGS has been able to give it his approval in principle in the knowledge that all arms commanders, especially in Germany, have informally endorsed it. The next stage is to put forward detailed proposals for the staffing through the MOD committee and then to the Army Board for approval. At this point, therefore, I would wish to give only the broad features. In Germany we see brigade field squadrons being operationally independent although in peace living co-located with other divisional squadrons. At divisional level regiments will be smaller than now although in war they will be reinforced. A field engineer regiment is required at Corps level to give depth and flexibility to an area left shallow under ARP. The number of armoured engineers will depend on the number of armoured regiments. Our plan recommends an armoured engineer squadron per division, but this will need to increase if the number of armoured regiments also increases. Bridging engineers will be required on the basis of one squadron per division of the FEBA. All these are regular units and the sum of this long term requirement calls for something of the order of at least two more field squadrons to be added to our ORBAT for BAOR.

The TA provides an essential part of our BAOR ORBAT and I am seeking approval to raise one extra regiment in our long term plan.

In UKLF the picture is much more complicated and the requirements in some areas are not yet totally identified. Nevertheless thus far we foresee a need to raise extra field engineer squadrons for Home Defence, the manpower for which will probably come from reservists. Support for the RAF will be a growing commitment especially for ADR in UK where I have put down the marker for several new TA

units together with regular cadres. In meeting our commitment to RAF (Germany) there will be some adjustments to the roles of 38 Engineer Regiment, and the squadrons required for ADR on the clutch airfields will, if possible, be brought together as one regiment. As part of the long term plan there is a possibility that all RE units in UK concerned with RAF support will be grouped together under the hand of one RE commander—probably at one star level. This idea has some attractions and advantages in terms of centralising control of training, planning, equipment procurement and R and D and perhaps most important, in providing someone to deal with the RAF at the right level.

Well, there it is. Critics might say we don't stand an earthly chance of getting the extras we have asked for. But *Project Mercury* was all about stating what we believed we wanted for the long term. This we have done. We may not get very much in the immediate future, but it would have been quite wrong of us to have marked our card down and allowed ourselves to be deflected from a long term objective by present difficulties. In all the circumstances I believe that our plan is realistic.

FINALE

I have now come to the end of my talk. What then are my final thoughts? I have had three very full and fascinating years. It has been a stimulating experience especially working closely with many long established friends to prosper the Corps. Together I believe we have achieved much, and I am enormously grateful for the help I have had in all our endeavours. We have covered a great deal of ground—stimulating recruiting, improving training, prospering the careers of officers and men, debating tactics, doctrines, concepts, organisations, equipments, fostering the Corps family spirit, and promoting Royal Engineer achievements to the world at large. But of course our work is never done and not for one instance must we lose momentum. Much more remains to be achieved.

The Corps has been through difficult days in the past three years, it has bottomed out and now it is in a period where one can feel renewed confidence all around. No matter how tough the future may be I believe we have a sound structure on which to build further. It will be a matter of keeping our nerve and holding firmly to long term objectives.

I have said on many occasions that the future of the Corps will rest in the hands of our Officers of tomorrow. We have to go on attracting the right quality. Having got them, we have to prosper their careers to the utmost, with those of outstanding talent being allowed the best possible chance to reach the top in the Army. I am greatly encouraged by the very high quality of Officers that we have now amongst our squadron and regimental commanders. I am absolutely certain that we shall return to the big time in the league of generals. All the indications are there—with some high grade men moving into one star command appointments.

I hand over in a few days to General Gus Sinclair and I wish him well. I know the Corps will give him the same loyal and unstinting support that I have enjoyed. I have had enormous satisfaction in this my last appointment and I shall be sad to leave it and the Army.

Torpedoed!

LIEUT COLONEL J A COOMBS RE (Retd)

DRAFT RGYWZ assembled at The RE Depot, Halifax, in October 1943. My father had always said that Hull, Hell and Halifax were all equally terrible: so far, I very much prefer Hull.

After about two weeks of semi-organized chaos, during which, amongst other things, we were issued with our tropical kit, which included Wolsley pattern tropical

helmets (reminiscent of the Kipling era), and "droopy-drawer" type "shorts", which had the "longs" buttoned up, (which could be lowered at dusk as protection against mosquito bites), we and our tin trunks and bedding rolls were loaded into a troop train. The Country was very security minded during the War: hence, although our train left Halifax at about 1430 hrs, the blackout blinds were tightly drawn, and the carriage lights were on. The length of our journey, and the local knowledge of the Scottish members of draft RGYWZ, however, made it clear that we detrained on the Clyde.

We embarked on a troopship, called *The Marnix van Sint Aldegonde*. Before the War she had been on the Holland–Dutch East Indies run, and had been used to take Dutch Government servants, well-to-do planters, business men and so on and their families to and from the Dutch Far Eastern Colonies (now Indonesia). By wartime standards—and indeed by those of pre-war—she was a luxury ship.

Draft RGYWZ consisted of some fifty Soldiers, with a normal NCO structure, and four Officers, of whom I was the junior, having been commissioned for some six weeks. The Officers shared a cabin (two double-tiered bunks) on D deck, and the Soldiers were on F troop deck, which was below the water line.

Soon after we had embarked, OC Troops (a Lieut Colonel) broadcast over the Tannoy giving us details of emergency and boat drills. Practice emergency drills were initiated by the alarm bells ringing intermittently: for "real", the bells rang continuously. We were to join our draft on their troop deck when the alarm bells rang, and were subsequently ordered to our boat stations—should this be necessary—over the Tannoy (I believe the circuits for this could be operated by either the ship's main or emergency power systems). RGYWZ's boat station was on C deck. Before we sailed (and at least daily thereafter) we had emergency and boat drills. During the first boat drill, the Captain of *The Marnix* visited each boat station "Vun torpedo, she not sink. Two torpedos, she not sink" was the gist of his talk. He had sufficient confidence in his ship to go up to seven torpedoes!

We sailed in convoy, with a destroyer and corvette escort, on about 21 October 1943, and our route took us to the North of Ireland, and after making a wide sweep out into the Atlantic, so as to avoid U-Boats, our first sight of land since leaving England was the SW tip of Portugal and the dazzlingly white lighthouse, surrounded by the greenery of Cap St Vincent, where Nelson's Battle of that name had been fought. We continued round the coast of Spain, and eventually sighted the Rock of Gibraltar as dusk fell on Friday, 3 November. We were going to be the second convoy through the Mediterranean since the Cape Route was abandoned after the defeat of The Afrika Korps!

The food on *The Marnix* was wonderful after war-time rationing in England. The Officers sat at circular tables for ten; each Officer was waited on by an individual Indonesian steward. Because of the war-time crowding, we ate in two sittings—and I was in the second.

On Saturday, 4 November, the sun shone with autumn brilliance in the Mediterranean, and the sea was fairly calm. At about 1800 hrs "darken ship" was ordered, and I went to have a bath before dinner. I was lying soaking, when the alarm bells went. "What a time to have a practice", I thought, remembering that there was roast chicken for dinner "I wonder how long I shall have to wait for it". I suppose this thought flashed through my mind for about a second, at the end of which I realised that the alarm bell was ringing continuously so I was out of the bath, roughly dried, and into a shirt, SD slacks, (my trousers held up by a Sam Browne belt), and wearing shoes and socks, and on my way down to join RGYWZ on F deck within a minute or so. F deck had many mess tables, bolted to the deck across the width of the ship, with a passageway down the middle; at the ends of the passageway were companionways leading to the decks below and above. I was sitting at the passage end of one of the mess tables.

At about 1915 hrs there was a tremendous explosion, all the lights went out, and *The Marnix* listed alarmingly—I don't know how far, but I found myself lying on the

side of the ship, and was painfully aware of an ammunition boot in my groin. My first reaction was to tell the unknown owner of the boot to remove it—which thankfully he did! Apart from some confused shouting initially, there was little or no panic on F deck, and when the Major in command of our section of F deck ordered everyone to be quiet, he was quickly obeyed. Slowly *The Marnix* started to recover from her initial list, and we began to pick ourselves up in the darkness. When we reached a list of 10° to 15° to port, this recovery stopped, and very soon the emergency lights came on. The OC Troop Deck told OIC RGYWZ to detail an Officer to guard the companionway between E & F decks, and to stop anyone going to their boat stations until orders were given that this was to be done; I was the Officer detailed for this duty.

Over the Tannoy we were told that an (aerial) torpedo had hit the engine room, but that the majority of watertight doors were intact, and that *The Marnix* was not in immediate danger. We would be called to our boat stations by decks, but that the few civilians on board (which included an ENSA party), and also the few service women, would be called to their boat stations on A deck first. There was a delay—to those "below stairs" inexplicable—after the A deck parties had been called up to their boat stations. Suddenly *The Marnix* gave a slight lurch to port, and there was confused shouting below the F to G decks companionway, followed by a panic stricken rush of Soldiers and Airmen up the companionway. I shouted to them to stop, but they could not, or would not hear me. I had my hands on the companionway handrails, and was standing half way up. The leader of those rushing up from below was pulling himself up the stairway two steps at a time, using his hands on the handrails to assist him. He was closely followed by many others.

I shall never know whether my reaction was instinctive (self preservation?) or was something automatically remembered from my reading of "*Aid to The Civil Power*" when at the RE OCTU at Newark some three months before. This specified that in a riot, one should determine who was the ring leader, and put him out of action first. Whatever the reason, supporting myself on my arms, I swung myself forward and kicked the ring leader as hard as I could in the stomach. The result was very effective, even if the method was not entirely in accordance with the normal military relationship between Officer and Soldier! The ring leader collapsed back onto those behind him, and the panic stopped. OIC RGYWZ joined me, and we persuaded them to return to G deck to await call forward. We later discovered that H troop deck was partially awash, and that the panic probably started when *The Marnix* gave a further lurch to port. Soon after we were all called up to our boat stations, RGYWZ going as planned to C deck.

Shortly afterwards a lifeboat, which among others contained the ENSA party, was lowered away from A deck, and stopped at C deck to fill up. One of the ENSA girls, a tall redhead, who had been very standoffish (and refined!) to all those officers with less than a crown on their shoulders, entreated anyone who would listen, using the language of the Gorbals to get the boat into the water! The boat soon departed downwards, followed by roars of laughter. When all the lifeboats (at least, those on our port side of the ship) had been launched and cast off, the Carley floats, followed by scrambling nets, were released from their lashings, and RGYWZ climbed down the nets and on to the floats. Some of us (myself included) did not have to swim, but we soon got soaked by spray, and were very cold. Sometime later we were picked up by a boat from an American destroyer; I remember that two of the crew were called Don and Eddie—but I never saw them!

We were taken to *The Willhelm Ruys*, a sister ship of *The Marnix*, which had gallantly hove-to waiting for us to be picked up. We were fed and bedded down in the saloon, and all of us, I think, slept immediately, while *The Ruys* steamed towards Phillipeville, in Algeria, some 100 miles from the Tunisian border. Before we reached Phillipeville, our OC Troops told us that *The Marnix* had sunk while under tow that morning. There were few casualties; all RGYWZ were saved.

From the sea, Phillipeville looked clean, white and sparkling, but first appearances

were deceptive. Reality proved the town to be smelly and filthy, except in the French shopping and residential quarter—and even there I saw what I have never seen since, a beggar in rags, crawling along leaving a trail of slime behind him! From Phillipeville the officers were taken to the Guards Training Camp between Bone and Constantine, where we were made very welcome. The Soldiers went to a nearby camp, whence a party from RGYWZ came to see us next day to thank us for looking after them. This made us feel very humble; we did not see them as a draft again.

A week or so later I was carted off unconscious with dysentry to a tented hospital, so it was six weeks or so later that I joined another troopship which eventually landed me in India, where I was privileged to join The Royal Bombay Sappers & Miners, with whom I had the honour to serve until December 1947.

I think that the lesson I learnt from this experience is that if an Officer, albeit a very junior one, has the responsibility of looking after his men in an emergency, he does not have much time to be frightened himself.

Back in St Helena with 512 STRE

CAPTAIN A H BAYLISS RE, BA

Having completed two years at Welbeck College the Author went to Sandhurst in September 1973 where he did SMC 4 and RCC 4. After his YO Course he was a Tp Comd in 5 Fd Sqn in Iserlohn for 6 months before going to Cambridge. His degree course was followed by a 13 month tour with 512 STRE. Capt Bayliss is now a Tp Comd with 64 Amph Engr Sqn.

In March 1979 512 Specialist Team Royal Engineers (STRE) found itself once again sending a section to the Island of St Helena in the South Atlantic. This was the sixth time in six years that a section had been to the island so the experience was not altogether new. It had been my job to close the station down in September 1978 and I was more than pleased to be tasked with re-opening it. The other two members of the section were Sergeant J Griffin RE (Field Survey Technician) and Chief Petty Officer A M Roberts RN (Survey Recorder), the section's electronics technician, both of whom were visiting the island for the first time. Sergeant Griffin and I had worked together before in the Azores and also in Arizona. Since then he had been working on a separate task in Brunei with CPO Roberts while I had been working in the Bahamas.

For thirteen years 512 STRE has worked in close liaison with the United States Defence Mapping Agency (DMA) and has its Headquarters in Washington DC. It was formed to assist the DMA geodetic survey programme which now utilises the US Navy navigation satellites for determining the precise positions of survey stations around the world, to an accuracy of ± 1·5 metres, on an earth-centred reference system. The field work for this work is done by the three Doppler Sections of the

Back in St Helena with 512 STRE
Captain A H Bayliss RE BA

Unit. Each of these sections consists of an officer for administration and control, an electronics technician to take care of the tracking equipment and two more Senior NCOs who are well qualified surveyors.

At any one location the section must complete two basic requirements. The satellite tracking involvement calls for the results of forty satellite passes. The antenna is erected over a trigonometrical survey marker (sometimes establishing new ones where there are none in existence). The Geoceiver then receives a fixed frequency signal from one of the available satellites and measures the Doppler effect (remember your "O" Level physics?) as the satellite moves from horizon to horizon. A second frequency is also used and the comparison made allows a refraction correction to be made. Once the timing is corrected to the nearest micro-second the system gives extremely accurate results. The information gathered is recorded on telegraphic punch tape by the Geoceiver and is then ready to be telexed back to Washington to be fed into the computer. For this information to be useful the station must also be tied in to existing trigonometrical stations by conventional means.

The principal object of this Doppler survey work is to enable the many different survey reference systems throughout the world to be linked into a world reference system. This is of prime interest to the defence community (for obvious reasons) and also to the scientific community in understanding more fully the physical properties of the earth and its behaviour. With an accuracy of about 1 metre from the results of the Doppler fixes, the relative positions of the earth's landmasses can be more accurately determined than was previously possible. With the Doppler reference system being 3-dimensional, the height value obtained can be used to evaluate the shape of the earth, defined as the geoid, which is "the figure of the earth's mean sea-level surface assumed to be continued across the land". It is from this surface, the geoid, that all topographical heights are measured.

During its years in operation the Unit has completed many of these surveying tasks in all areas of the world and the results obtained have helped to improve our knowledge of the earth's true shape, size and mass. The most recent of these jobs

Photo 1. The author using the equipment during a satellite pass. Taken in the Azores but shows the major components of the equipment except for the antenna

Back in St Helena with 512 STRE (1)

were in the West Indies, the Middle East and Malaysia although there are very few areas of the world which have not been visited.

In recent years 512 STRE has also been tasked with providing three of the twenty or so teams required for static satellite tracking. The static work is not for survey, but to closely monitor low-altitude satellites from known positions to obtain dense observational data to support atmospheric model studies. These in turn are used to support scientific space operations. These teams are spread around the world to achieve the best possible global coverage and are located as far apart as Alaska and Antarctica, Honolulu and Cyprus. It was this type of tracking which took us back to St Helena.

Having flown from Washington to Johannesburg and then driven to Cape Town with the equipment, I met CPO Roberts and Sgt Evans when they flew in from UK. We left Cape Town three days later on the RMS *St Helena*, the island's own ship and the only one regularly calling at the island as it sails between Avonmouth and Cape Town. After five days at sea we reached the island which was to be our home for five months.

St Helena is 1000 miles west of Angola. The closest land is the still smaller Ascension Island which is 700 miles away. Although it is smaller Ascension Island does have an airfield which St Helena lacks. It was built for the US Air Force in the Second World War and is still used by them as a crew resting place on their Johannesburg flights and also to resupply the NASA tracking station in The Devil's Ashpit, Ascension Island. The BBC World Service and Cable and Wireless Ltd use Ascension for radio relay stations so that many St Helenians move there to find employment which St Helena lacks.

The 3000 tons RMS *St Helena* also calls at Ascension Island and takes fifty hours to travel between the islands. Theoretically, then, it should be possible to get to and from St Helena in three days. Unfortunately one needs government sponsorship to fly with the USAF to Ascension Island and inevitably it is necessary to spend a few days on the island waiting for the ship. I have never completed the journey between Washington and St Helena in less than nine days and it usually took two weeks.

St Helena itself is ten miles long and six miles wide. Its origins are basically volcanic

Photo 2. Jamestown, the only urban area on the island, huddled on the valley bottom

Back in St Helena with 512 STRE (2)

Photo 3. Jamestown and James Bay where visiting ships anchor

and it has a very rough terrain as a result. There is a central ridge of about 3000 feet from which a series of ridges and valleys run towards the sea. Early reports of the island talk of luxurious vegetation but wild goats (landed by the Portuguese to provide their mariners with a permanent source of fresh meat) completely denuded the island and much of the land has not recovered since.

Much to the chagrin of the St Helenians their island is usually only remembered as the second, and last, island prison of Napoleon. When it was discovered by the Portuguese in 1502 it was uninhabited but as trade with the Far East grew it became an important re-victualling point for the sailing ships on their way around the Cape of Good Hope. Its population grew out of the mariners, Chinese coolies and black slaves who have each played their part in the island's history. After changing hands a number of times the island was governed from 1659 by the Honourable East India Company who wanted it for their trading ships. The British Government took over its administration on Napoleon's arrival. Since then the Governor and his staff have always been posted by the Foreign and Commonwealth Office (FCO) in London.

The island also receives a certain amount of technical assistance from the FCO. At present (January 1980) an RE Management Team, *Project Bonaparte*, is assisting in the building of a swimming pool, the erection of a rock crushing plant and the improvement of the island's water supply. Major Glyn Berry RE and his team are on St Helena for approximately eighteen months and work in close conjunction with Major Peter Clements (RE Retd) who heads the Public Works Department as the island's Civil Engineer. The initial recce for *Project Bonaparte* was done by a member of 512 STRE, Captain A R M Wilson RE, who spent four months on the island some years ago. Other team members have also given local assistance by doing small surveying jobs and by teaching islanders the rudiments of field survey.

Today the island, one of the few British colonies left, has a population of 5000. Unfortunately the last major industry, rope making from locally grown flax, died with the introduction of man-made fibres. Many families eke out a living from the sadly impoverished soil while fishing provides not only jobs for some but cheap food for others. It is not surprising that the standard of living is generally lower than in Europe since manual workers earn about eighty-five pounds per month and secretaries about seventy pounds each month.

Back in St Helena with 512 STRE (3)

There is only one town of perhaps 1500 people. Jamestown is the capital, sea port and focal point of the island. Two roads lead into the town which lies in the bottom of a long valley. The valley is so narrow that most of the town is only one street wide. There is a back lane parallel to Main Street in the broader valley bottom towards the sea. In the town there are a dozen small stores of the British corner shop variety and a supermarket. They all sell a limited range of goods which inevitably become scarce from time to time. An hotel, two pubs, a post office and the general hospital complete the town, not to mention the island's bureaucracy which is housed in the Castle.

Above the town stands Ladder Hill Barracks, part of which is still called the RE Yard, having been built by the Sappers during the last century. The barracks now house a secondary school and the RE Yard contains the telephone exchange. On the slope between Jamestown and the barracks there is a continuous stairway of 699 steps. It was built by the Sappers in 1871 (what a troop task that must have been!) and is known as Jacob's Ladder.

No account of St Helena would be complete without a mention of Napoleon. Our bungalow (rented from Cable and Wireless Ltd) stands next to Napoleon's first St Helenian home at The Briars. He later moved to Longwood House where he spent most of his six years in exile, before being buried in the valley bottom of The Devil's Punchbowl. In 1840 at the persistent request of the French Government he was exhumed by Captain Alexander RE. His body was shipped back to France where he was given a state funeral nineteen years after his death and buried in Les Invalides, Paris. All the properties in St Helena which are connected with Napoleon are still the property of the French Government and are in the care of the French Consul. The present Consul is M Gilbert Martineau, an eminent historian who has written countless books on Bonaparte and the Napoleonic era.

Our place of work in St Helena was a disused fort called High Knoll. We used a stone hut on top of the Keep to house the equipment and erected the antenna over a trigonometrical survey marker also on top of the Keep. The tracking simply required one of us to be on site at precisely-computed times to operate the equipment. Weather observations were entered into the Geoceiver to improve the accuracy and every twenty-four hours we telexed the recorded satellite passes to Washington via Cable and Wireless Limited.

After five months on the island, receiving mail about once each month and being totally isolated, I think we were all ready to get home. That is not to say that we did not enjoy our stay on the island. The St Helenians are so hospitable that I would certainly revisit the island given the opportunity and it was with very mixed feelings that we sailed from the island in August 1979.

Madras Engineer Group Bicentenary Celebrations 1980

MAJOR R D FOORD-KELCEY TD, C Eng, MI Mech E

"Jim" Foord-Kelcey, born in Canada on 19 September 1914, was educated at Kings School Canterbury. He was commissioned in 54 East Anglian Div Engrs (TA) in May 1937. In 1942 he was posted to QVO Madras S&M and in June 1942 was appt 2IC of the newly formed 425 Fd Coy. With that Coy he served in 53 Bde of 25 Indian Div in India and the Arakan until posted as OC 325 Fd Pk Coy in the same Div. Demobbed in early 1946 he returned to J I Thornycroft and Co and in 1953 moved to Vauxhall Motors. He retired in 1975. The Author was Tour Leader of the Madras Sapper Officers Association Group which attended the Bicentenary Celebrations.

By the kind invitation of the Colonel Commandant and the Commandant of the Madras Engineering Group and Centre, the United Kingdom Branch of the Madras Sapper Officers Association (MSOA UK) arranged for a group of their members to attend the Madras Sapper Bicentenary Celebrations which took place in Bangalore between 24–27 February 1980.

On the 23 February 1980 this group of twenty-six ex-Officers, mostly with their wives, took about ten hours to fly nonstop, almost entirely overland from London to Bombay. By contrast it had taken fifteen to twenty days, in Troop Ships, for members of the group to return by sea from Bombay to Southampton thirty-five years ago. The Senior Officer of the group was Major General D C T Swan CB, CBE, who joined the Madras Sappers in 1924. The Representative Colonel Commandant RE Lieut General Sir Hugh Cunningham KBE, also an ex-Madras Sapper, and Lady Cunningham joined the group for the Celebrations.

The pictures of India, Bangalore and of the Madras Sappers and Miners which members carried in their memories, had not been updated for the half-lifetime that intervened. Like the "sleeper awakened" they were plunged into a new age of reality and a new generation of people. Less than half of the present population were alive when members last saw India. However, they were to meet many reminders of the past, in places, scenes and people, and above all in the uninhibited spirit of mutual trust, respect and affection which has survived the passing years.

In this age of terrorist activity and political crime, it was understandable that the names and credentials of all members of the party were subjected to security check and clearance by the Indian Government Authorities several months before the departure date. The group were taking with them an engraved silver cup as a gift to their hosts. To avoid paying heavy Customs duty on this, for which they might not have had adequate funds, there had been a lengthy exchange of correspondence between London and Delhi, in an attempt to get written Customs exemption for this gift. Additionally James Leasor's book *The Boarding Party* had been a recent Best Seller in India. This narrated the clandestine activities of twenty middle aged members of two Volunteer Regiments, the Calcutta Light Horse and the Calcutta Scottish, in the 1943 action against enemy ships in Goa. Did some note of caution sound in the mind of some Officer concerned with security? Perhaps when a printed MSOA

Madras Engineers Group Bicentenary Celebrations 1980
Major R D Foord Kelcey TD C Eng MI

circular recorded mistakenly that forty British (Serving) Officers were leaving together for India on 23 February, (hot from unarmed combat courses and with pockets bulging with lethal "James Bond" devices)? Whatever the cause and effect, eight days before the due date of departure the Group Leader received a cabled message, via the British High Commissioner's Office in Delhi and the Regimental Headquarters of the Royal Engineers in Chatham, decreeing that "only twenty-four may travel"!

The group was twenty-six strong together with twenty-one of their wives and daughters, all of whom had paid in advance for the tour and the cost was not refundable. It was good to know that the group was considered to be a party of some military significance and not just one more package tour of foreigners destined for the conveyor belts of the "tourist triangle". However, they experienced a period of nerve-wracking suspense before the order was withdrawn.

On arrival at Bombay Airport at about 1.30am, the group were met by Major Kutty from Bangalore who was to be their Liaison Officer for the period of the Celebrations. He had already discussed the Silver Cup with the Customs Authorities and had also arranged for all the baggage of the whole party to pass quickly through Customs. On close inspection of the engraving on the silver cup it was accepted as being a gift and thereby exempt from duty. The Sapper Liaison Officer had achieved his first objective. After a few hours rest at a hotel the group returned to the Airport for the flight to Bangalore.

On arrival they descended to the tarmac and walked the short distance to the Airport Terminal in scorching heat. Inside the building they were greeted by a broadly smiling Sapper Guard of Honour headed by the Commandant, Colonel B V Ahuja, and several very smart young Officers with their ladies. Coffee, tea and sandwiches were served and this was the first taste of the magnificent hospitality that was to follow.

The first impression of Bangalore was one of complete strangeness. Gone were the large open spaces, the *maidan* and the quiet residential avenues along which spacious walled compounds surrounded modest creeper covered colonial style bungalows set amidst flowering shrubs and plants, all protected by a canopy of shady trees. Macadam-paved city streets, packed with fast moving traffic and lined with multi-storeyed buildings, was the new order of the day. The West End Hotel was the first reminder of the past; a cluster of dignified Victorian buildings laid out on an open plan with outside staircases and balconies leading to spacious lofty ceilinged bed-rooms; old world furniture remained, with large electric *pankhas*, four poster beds for mosquito nets, and modernised *ghusl khanas*. It was here that Lieut General Sir Hugh Cunningham and Lady Cunningham joined the group, having travelled from Delhi where they had been for the past few days. There was only time to check-in and quickly bath and change before the first event of the four day Celebrations was due to begin.

24 February 1980

1700–1900 hrs Fashion Parade and Cultural Show in the Sapper Theatre.
1915–2030 hrs Cocktails at Sapper House.
2100 hrs Informal Dinner at the Officers Mess.

On arrival at the location of the first event the bus stopped for the party to alight. Standing alone on the pavement was an elderly Indian in civilian clothes. He stood to rigid attention and as each Officer alighted, his face lit up with an expression of delight and he gave a faultless parade ground salute. This was not part of the pre-planned programme, it was an unrehearsed and impromptu private greeting by an old soldier who had served with British Officers half a lifetime ago.

The Sapper Theatre had been built by the Engineer Group several years ago for their own private use. It seated a large audience in comfort and was well equipped for film and stage shows. To start the programme, nine beautiful young ladies clad in all kinds of gorgeous *sarees* and with a setting of soft music and lighting, were introduced to the audience one by one: Sunitha, Gita, Anjoo, Maya, Teresa, Nirmala, Pushpa,

Neelima and Manju; not professional models but the wives and daughters of serving Officers. The first half of the show displayed sarees of great variety of colours, patterns and materials and the second showed European style outfits made from the same beautiful, locally made silk and cotton fabrics. The lady commentator and the nine models gave a most graceful and accomplished performance. The last part of the show, after an interval for tea, consisted of traditional Indian dancing to the accompaniment of traditional Indian music. The dancer was Malvika whose father, a retired senior Officer recently deceased, had served as a Lieutenant in Burma from 1943–1945 with one of the Madras Sapper and Miner Field Companies. His widow, a prominent dancing instructress gave the commentary. Malvika, a trained and practicing accountant, gave great charm and expression to a most interesting performance.

After the Show the party moved on to Sapper House where they were the guests of the Commandant for cocktails. Sapper House is still the residence of the Commandant and many members of the group could remember being entertained there as young Officers by former Commandants and their wives. There were many guests besides the UK contingent and the party took place in the beautiful gardens of the house which were illuminated by hundreds of basket lamps. Here members of the group met old acquaintances and serving Officers.

The Officers Mess and its grounds adjoin Sapper House and the party moved to the gardens of the Mess for the informal dinner which concluded the evening's entertainments. The Officers Mess compound with its huge ancient trees, provided a further landmark of the present time which coincided with memories of the distant past.

25 February 1980

1030–1100 hrs March Past by ex-Servicemen.
1100–1200 hrs Meet ex-Servicemen.
1200–1330 hrs *Barakhana* with ex-Servicemen.
1530–1630 hrs Reunion by Regiments/Companies.
1900–2100 hrs Torchlight and Tattoo Display.
2115 hrs Informal Dinner.

This was the day of reunion. Ex-Servicemen of all ages and ranks and from all over India had been invited to Bangalore and were housed and fed by the Madras Engineer Group.

First, the March Past of ex-Servicemen on the magnificent great parade ground of Meanee Lines, familiar to all. A perfect hard red surface about 400 yards wide and 100 yards deep was encompassed by single storey red tiled barrack room blocks. Above the red roofs were large trees, some in fresh green leaf, alternating with huge Jacaranda trees in full bloom, displaying solid masses of sunlit blue petals. Everywhere there were flowering shrubs, bougainvillaea hedges and great banks of potted flowers. The spectators consisted of serving Officers, smart in their jungle green shirts and trousers, brown leather "Sam Browne" belts and with dark blue berets, the ladies in multi-coloured sarees and the retired Officers, including the United Kingdom contingent in civilian clothes. They all sat in comfort on a long tree shaded bank bordering the parade ground. On the far side of the parade ground the band played familiar tunes including "The CRE", "The British Grenadiers" and "Auld Lang Syne". On the parade ground were 366 ex-Servicemen in civilian clothes and formed up into several identical squads. Standing to attention in perfect formation they were smart and proud. Fighter planes flew low overhead and kites hovered in the cloudless sky. The Madras Engineer Group Flag, almost identical to that of the Royal Engineers, even to the motto *Sarvatra* (the Sanskrit word having the same meaning as the Latin word *Ubique*), fluttered in the breeze. The sun was climbing high but the ex-Servicemen ignored the growing heat. Major General Harkirat Singh (Retired), a former Engineer-in-Chief, bearded, wearing civilian clothes and a *pugri*, took his place on the saluting platform. He had joined the Madras Sappers as a Subaltern in 1936 from RMA Woolwich and Cambridge. With him was Honorary Captain

Perumal MBE. The Officer Commanding the Parade marched smartly to the platform, saluted, reported, saluted again and marched back to his men. He gave commands which seemed to conform to those of the British Army.

The Band, together with a squad of men wearing Madras Sapper uniforms back to 1780, took up their position at the head of the Parade and the March Past began. In drill movements of the British Army, the squads moved to the right in threes and keeping perfect formation they marched with confident precision as in the days of their youth. As each squad neared the saluting base they were given the "eyes right" command and the spectators gave them long and enthusiastic applause. After halting at their former positions General Harkirat Singh addressed the Parade in Hindi. Following his speech the Parade was dismissed and the ex-Servicemen marched smartly away. Immediately, from the spectator side of the Parade Ground, the Indian ladies left their seats and, in their varied and multi-coloured sarees, looking like a swarm of pretty butterflies, they fluttered across the Parade Ground to their next engagement, a Sale of Work in aid of the Families Welfare Centre, followed by an informal buffet lunch. For the men, the remainder of the morning and the afternoon were devoted to reunion, a barakhana and photographs by Regimental groups.

British officers met many old acquaintances of all ranks, together with the present day Officers of the units in which they themselves had served. Profuse and heartfelt were the greetings exchanged between ex-Servicemen and their former Officers. Many of the war time Companies (now called Squadrons) had been disbanded in 1946 but on later re-expansion of the Indian Army they were raised again, using the previous designations to give historic continuity with the past. Serving Officers from Squadrons assigned to present day Indian Divisions wore Divisional badges which were identical to those of the 1939–45 war, except that the colours are now black on red.

A huge audience had assembled at the large Malakand Lines parade ground for the Torchlight and Tattoo Display. Darkness arrived with the usual promptness and suddenness of the tropics. The first item was a PT Display by a large body of men who emerged from concealment carrying flaming torches in each hand and performing to the rhythm of a brass band. A great variety of spectacular effects were produced by the marching, countermarching, circling, running and swinging of the arms. As a finale, the rapid moving performers came to a sudden halt, some crouching, some standing and with their torches spelling out, in huge numerals, the number "200".

The main item followed, the *Son et Lumiere* performance, consisting of a succession of set pieces and an excellent commentary in English, aided by two huge screens on which slides were projected. This traced the history of the Indian Army and the Madras Engineer Group, starting with Queen Elizabeth granting to the East India Company a charter to trade with India from the port of Madras. The performance took place over an extensive area and involved elaborately constructed sets, invisible in the darkness until lit-up to play their particular part in the narrative. It excercised the combined techniques of stage, film, television, radio and military engineering. It was a masterpiece of stage management, planning and coordination and gave the audience about 100 minutes of deep interest and excitement, punctuated by touches of humour and light relief.

The entertainment already given would be considered by any other standards as more than enough but the firework display was an added extra. This took place in perfect atmospheric conditions and is impossible to describe. It was breathtaking in beauty and excitement and the bangs of ordinary fireworks were supplemented by terrific detonations which only the Sappers, with access to gelignite sticks and gun cotton slabs, could ever contrive to provide.

The UK group were driven to the Officers Mess for an informal dinner in the Mess gardens before returning to their hotel. They had experienced twelve unforgettable hours of hospitality, comradeship, spectacular events and entertainment. The Officers Mess again, that link with the past, the same trees, but much bigger, the same monkeys (or their great grandchildren!) the same cool verandah. For their benefit

the silver store was left open, but for the iron bar door, and they could see the magnificent collection of trophies and ornamental pieces which had adorned the table on Guest Nights in their day. The collection included the silver Chinese Dragon which symbolised the Battle Honour of 1842.

26 February 1980

1000–1200 hrs Visit Regimental and Religious Institutions of the Centre.
1300–1430 hrs Informal lunch.
1630–1830 hrs Watermanship Regatta.
2000 hrs Dinner hosted by MSOA UK.

During the morning the party visited the new Sapper Museum where accounts and relics of incidents of Madras Sapper history were beautifully displayed. Wreaths were laid at the War Memorial by Major General Swan, by Colonel Cotton (Secretary of the MSOA UK) and by Mrs Cotton.

At the Welfare Centre wives of Other Ranks were learning English, sewing, soap making and various useful arts. At the Kindergarten assorted sizes of small children were learning arithmetic and English and singing English nursery rhymes, and at the Red Cross Home disabled and elderly soldiers were being cared for while younger disabled men were doing light remunerative work. Time was short and it was not possible for everyone to see every Institution but it was sufficient to impress on the visitors that the welfare of children, young parents, the sick, the aged and the disabled was taken very seriously by the Engineer Group and excellent facilities were provided. This was a very moving part of the four day programme.

The party arrived early for the Watermanship Regatta at Ulsoor Lake. In 1946 the lake had dried out completely anj the opportunity had been taken to bring in earthmoving equipment to deepen it, to extend it, to improve the shore line and to relocate certain islands. Thus it was a different and far larger expanse of water than members of the party remembered. Thousands of spectators had assembled along the shore for the show and the official guests were seated on a huge floating platform joined to the shore by a fifty yard long pontoon bridge. A smaller floating platform anchored a few yards from the official guests awaited the arrival of the VIPs. It was a most dignified touch that the VIPs, including the Governor of Karnataka, His Excellency Shri Govind Narain, the Post Master General, Shri K R Murthy and Major General P R Puri, Colonel Commandant of the Madras Engineer Group were carried from the shore to their seats in a slow moving and majestic "Royal" barge. All spectators stood to attention whilst the Indian National Anthem was played. Music came from a scarlet-clad brass band on a three-storey floating Pagoda, moored in the middle of the lake, and from a pipe and drum band on one of the natural islands. After a welcoming speech by Major General P R Puri and a speech by Shri K R Murthy the Governor addressed the assembly. He recalled that the Sappers, in selecting this area for their Cantonment, were largely responsible for the creation of Bangalore which was now one of the finest cities in India. He formally released the special issue 30 *paise* postage stamp to commemorate the Madras Sappers Bicentenary 1780–1980. At the conclusion of the speeches the VIP platform was manoeuvred alongside the main floating auditorium and the occupants stepped aboard to join the other spectators. The former craft then sailed sedately away across the lake.

One and a half hours of watermanship display was then to follow. There was an intermission for tea which was served on an adjoining natural island with shady trees and for the purchase of the new issue stamps and first day covers. The stamps portrayed two Madras Sappers, one in the 1780 and the other in 1980 uniforms. From late afternoon to approaching dusk the Regatta was a show to be seen and not described. No words can provide an adequate substitute for this superb spectacle. The setting was beautiful; a wide expanse of blue-green water with its shoreline and islands cloaked in feathery green trees and dominated by the cloudless blue canopy of sky. On to this great stage came a continuous succession of events. The "Sail Past" at the beginning and the "Tableaux" near the end were a waterborne display on the scale of the Lord Mayor's Show in London. There were Cutter races, Tracked Raft

races, Medley Relay races, Obstacle races and Assault Boat races. These competitive events were exciting to the audience and to the participants alike. The *Thambis* performed with the greatest enthusiasm and vigour and with obvious delight.

The PT and gymnastic display took place on a floating platform the size of a tennis court. The Thambis gave a superb display to International standards and two ingenious clowns gave comic relief. The three-storey Pagoda carrying the brass band sailed by. The four Tableaux, displaying a cavalcade of Madras Sapper history and Battle Honours, were on a grand scale and sailed past to the accompaniment of all the noises of the battlefield and the explosion of depth charges for good measure. The final item was a brilliant water skiing display in which a succession of groups of Thambis, in ones, twos, threes and fours, with some standing on their heads, mounted in acrobatic formations on single surfboards circled the lake at high speed. From the large floating platform moored in the middle of the lake the Governor of Karnataka presented the prizes. In the declining light of approaching darkness the whole assembled company stood silently to attention as the bugle notes of "Beating the Retreat" were carried across the water from a distant island.

It was then the turn for the UK members of the Madras Sapper Officers Association to entertain their hosts to dinner. At 8 o'clock twenty-six members and their ladies assembled at the Ranjit Singh Institute to await their guests. The British United Services Club, to which British Officers in Bangalore had usually belonged, had become a private club (The Bangalore Club) and the Ranjit Singh Institute had taken its place for Indian Officers. The guests, including Lieut General Sharma, the Engineer-in-Chief, Lieut General Loomba, Major General Harkirat Singh, Major General Puri and Colonel Ahuja with their wives and twenty other senior Madras Sapper Officers and their wives were received by Major General Swan. An informal buffet dinner of English food was served (Indian Officers have a preference for buffet meals, rather than sit-down dinners). It was a very pleasant evening giving the guests and their hosts an opportunity to meet in a relatively small group and to get better acquainted.

During the evening Major General Swan formally presented the silver souvenir Cup, which had been made in England specially for the occasion and brought to Bangalore with the group. The Cup was engraved with the crests of the Madras Engineer Group and the former "Queen Victoria's Own Madras Sappers and Miners" from which the present Group had sprung. The inscription on the Cup read as follows:

"1780–1980. Presented to the Madras Engineer Group on their 200th Anniversary by the British Royal Engineer Officers and Other Ranks who had the honour to serve with them."

At the end of the evening Colonel Ahuja presented each of the British ex-Officers with a delightful souvenir gift consisting of a bronze bust of a Thambi mounted on a hardwood plinth on which there was a cast brass bas-relief of the Group Headquarters building (still called the "Monkey House") and a second brass plate with the recipient's rank and name inscribed. The presentation box in which this was packed also contained samples of the various souvenir items which had been available for the occasion and a delightful set of hand embroidered table mats and napkins for the ladies.

27 February 1980

0830 hrs	Ceremonial Parade.
0945–1030 hrs	Tea.
1030 hrs	Group Photographs.
1300–1430 hrs	Lunch. JCOs Mess.
2000 hrs	Dinner.

As is usual in India, the parade was held early in the morning, thus spectators were asked to be in their seats between 0800 and 0810. The hosts had put a bus and two staff cars at the disposal of the UK guests for their entire stay at Bangalore. This was one of the many most helpful contributions to their comfort and convenience for

The Silver Cup presented to the Madras Engineer Group by the British Royal Engineer Officers and Other Ranks.

Madras Engineer Group Bicentenary Celebrations 1980

which they were most grateful. The party left in this transport at about 0745, dressed in smart civilian clothes and wearing "miniatures". The morning was fresh bright and beautiful and left many lasting impressions; the immaculate guard at the gates of Meance Lines; the mass of flowers lining the route, the abundance of flowering shrubs and trees; the smart military police with white belts, sleeves and anklets, with red armbands and with scarlet "cock-combs" on top of their pugris; the red soil below their feet freshly brushed smooth and free of untidy footprints; the Madras Sapper Officers in attendance, wearing uniforms of impeccable smartness, blue berets and with campaign medal ribbons on their chests; the magnificent red surfaced parade ground on which the ex-Servicemen had paraded two days previously. The Commandant was in command of the parade which was lined up on the far side of the parade ground, in six Squadrons of men, each with their respective Commanders out in front, all in jungle green uniform with blue berets and with white anklets, the men with rifles and the Officers with swords, all standing at ease. Every man was perfectly steady on parade and for the thirty minutes or more of waiting there was not a movement to be seen.

The Chief of Army Staff, Lieut General O P Malhotra, arrived at 0830 and received the General Salute. All spectators stood to attention. The Chief of Army Staff then reviewed the parade standing on a silent and slow moving jeep. On return to his saluting base two squads of "Attestees" marched onto the parade ground and took up positions in front of the other troops. These were recruits who had completed their training and were ready for enrolment as trained Sappers. Apart from their blue *dooptas* they wore the same uniforms as the trained men. It was most commendable that after twenty weeks' training they had reached a standard of drill which enabled them to participate with soldiers of long service in the same ceremonial parade. The band took up their position with the parade and the Indian National Flag was carried by an Officer and a small escort of soldiers to the centre of the parade ground. The Indian National Anthem was played whilst the troops presented arms and all spectators stood to attention.

The next ceremony was the Attestation of the recruits, and this was most noteworthy. It is the custom that the recruits "take the salt", the oath of allegiance, which is a religious ritual. For this three "padres", Hindu, Muslim and Christian carrying their holy books, conducted the ceremony with military precision. "Slow marching" together, these three padres, wearing white robes, moved through the ranks past every one of the recruits, whilst symbolically anointing him with salt. The recruits then took their vows, shouting out the responses together loudly and clearly. On completion of this ritual and still marching to perfection, the three padres left the parade ground together in unison and harmony whilst all the troops remained rigidly to attention. In a series of smart movements the recruits joined the ranks of the other troops for the March Past. A superb display of ceremonial drill then took place, each Squadron saluting the Chief of Army Staff as they approached his base. Having circumnavigated the whole parade ground the Squadrons halted at their former positions. From there they Advanced in Review Order towards the saluting base. At this point the Chief of Army Staff addressed the Parade.

The standard of ceremonial drill was magnificent throughout, every Officer and every man putting every ounce of his available effort into his actions and remaining as steady as a rock meanwhile. It would be flattering for a Guards Regiment to be told that their drill was as good as that of the Madras Engineers. After the speech the Attestees marched forward off the parade ground, in single file and in slow time under a ceremonial arch of swords and through the rows of spectators. They received round after round of applause as they passed by.

The UK group had lunch at the JCOs Mess. "Junior Commissioned Officer" is the designation now given to the former Viceroy Commissioned Officers. Ex-service JCOs and VCOs of all ages were present, as well as currently serving JCOs. This was a further occasion that brought old friends together. A great many happy reunions took place and members of the UK group took away numerous messages for delivery

to absent friends.

The final event was Dinner in the Officers Mess gardens which had been decorated even more beautifully with illuminated emblems of the Battle Honours mounted high up in the trees and a fairyland of lights at lower level. On a central dais was a huge birthday cake seven foot long by four foot wide with 200 burning candles. This was cut by the Chief of Army Staff with the Prendergast Sword and distributed to the guests. On the same dais the Silver Cup presented by the UK group was on display together with gifts from other Indian Engineer Groups and from Mrs Indra Kumar, the widow of Colonel Kumar. Several speeches were made including one by Sir Hugh Cunningham. He delivered the following message from the Chief Royal Engineer and all ranks of the Corps of Royal Engineers:

"Greetings on the 200th Anniversary of the raising of the Madras Sappers. This is an historic occasion when we can all celebrate two centuries of distinguished service by Madras Sappers. The close relationship between the Corps of Royal Engineers and the Madras Engineer Group remains as ever of great importance to all Sappers and we look forward to its continuance far into the future."

General Cunningham congratulated the Madras Engineers on the magnificent displays which they had produced and, in particular, on the Ceremonial Parade. He would, he said, report back to the Chief Royal Engineer that the standards of the Madras Engineer Group were higher than they had ever been. He congratulated General Malhotra and General Sharma upon having such men under their command.

A most fascinating feature of the evening was the arrival of the food. From some place of hiding, there suddenly appeared a full size locomotive hauling a train of trucks. With a chef sitting astride the boiler of the locomotive, wearing a tall white hat, and blowing a whistle, the train steamed along a length of railway line and came to a halt amidst the guests. The flat topped trucks serving as the buffet table were laden with decorative dishes of delicious food. It was a memorable evening from which the UK group were most reluctant to leave, as it meant saying a final farewell to the many friends they had made during the last few days.

The party was due to split into two groups, both flying out of Bangalore the following morning; one flying north for a tour of the Delhi, Agra, Jaipur area and the other south for Coimbatore, Ootacamund and the Malabar coast. It was difficult for them to realise that the Bicentenary Celebrations were over, that they were leaving Bangalore and that they were unlikely ever to return. It was four days so packed with interest, activity and spectacular events that it had passed in a flash and was over. Memories of those days will remain vivid in the minds of those forty-seven people who had been so fortunate as to participate.

Early Days

MLC

In 1880 the *RE Journal* was much concerned with the Afghan War, in the same way as the Zulu War had been the dominant theme in 1879. During the course of both campaigns there had been a resounding defeat for British Arms—Isandlwana in Zululand and Maiwand in Afghanistan. On both occasions one of the central figures had been an RE Officer—Colonel Durnford at Isandlwana and Lieutenant Henn at Maiwand. Poor—or unlucky—generalship had exposed a British force to attack by overwhelming numbers, and both Officers had been cut down in a hopeless last stand.

Both of the Afghan Wars (1838–42 and 1878–80) had the object of countering Russian influence and of installing a Government in Afghanistan favourable to British interests. In 1879 there were arguments, reported in the Journal, that if the old frontier was to be crossed at all, the only worthwhile object should have been complete annexation. However, Lord Northbrook forcibly pointed out in the House

of Lords, that if we put ourselves in direct contact with the Russian frontier "the indiscretion of some Officer, or the caprice of some Asiatic Chief, may produce a situation in which one of two high spirited nations may have to submit to what may appear an humiliation—or resort to arms. . . ." Lord Northbrook furthermore stressed that the purely patriotic Afghans "whose one wish was to be rid of us" had kept aloof, as they did not wholly believe in the sincerity of the British wish to withdraw. Others would not come forward for fear of being abandoned, if all did not go as planned after the withdrawal. "The British presence was a constant irritation, and while the Government waited for an orderly regime to evolve from the chaos of intrigue and turbulence, the cost of the occupation itself was all but intolerable."

It was, in fact, not long before the British did withdraw. The succeeding power vacuum was, fortunately, filled by Abdur Raham, a ruler of tough and independent mind, who, with the help of a strong Army, largely paid by British subsidies, managed to exercise a central control over the whole country. The Ruler allowed neither Russian nor British influence to dominate. Long after the campaign, in 1907, an Anglo-Russian Convention was signed. Great Britain disclaimed any intention of altering the political status of the Country, and Russia recognised Afghanistan as being outside her sphere of influence.

The Sapper contribution to the campaign was considerable and vital. Survey was of especial concern, and the extensive area of turbulent and dangerous country mapped was remarkable. Telegraphs, water supply, roads and tracks played an important part. Much was done in a country where labour was plentiful. Indeed, much was needed in a campaign where the force deployed was large, and where the baggage trains and camp followers seemed to have reached huge proportions. At Jalalabad a three-span trestle bridge, with a total length of 572 feet was constructed over the River Kabul. Many fortified positions were built, and many Afghan forts and towers were blown up. While engaged in this latter task, Captain J Dundas VC and Lieutenant C Nugent were killed by a premature explosion when destroying a watch tower. It seems that so few fuses had been sent up from India that many of those used were of local manufacture. Such a fuse "had flared up like a train of powder".

The disastrous action at Maiwand took place on 27 July 1880. A full account appeared in the December 1880 Journal. Maiwand is about forty-five miles north west of Kandahar. A force of about 1,500 British and Indian infantry, 500 cavalry, twelve guns and thirty Sappers and Miners under Lieutenant Henn, had been sent to block the advance of a very much larger "rebel" Afghan force, with orders to stop the advance and to disperse the enemy troops if possible. The latter, consisting of about 4,000 cavalry, 4,500 infantry, thirty guns, some 2,000 deserters from "loyal" Afghan troops and an unknown number of irregulars, had been much underestimated.

In the ensuing action, which was not well conducted—"if General Burrows had been a Subaltern instead of a Commander he would have won the VC twenty times", the British force was routed. The Officers were mostly killed, and the survivors fled as best they could. The small band of Sappers and the British Infantry element (the 66th, later to become The Royal Berkshire Regiment) did their utmost to prevent the position being overrun and to cover the retreat of the remainder. This resistance together with "the conduct of the Horse Artillery which was most admirable" was to no avail. The enemy attacks, lack of water throughout a blistering day, and the collapse of any order amongst the various contingents, led to a retreat to Kandahar and the subsequent investment of that city. In fairness to General Burrows he had, in fact, been given an impossible task. However, he failed to extricate his force before it was too late.

The subsequent advance of General Roberts from Kabul to the relief of Kandahar, forms one of the better known episodes in the history of the British Army. After all, it was the defeat at Isandlwana that led directly to the stirring epic of Rorkes Drift. Significantly, two groups of windows in Rochester Cathedral, built in exactly similar style were subsequently respectively dedicated to the memory of those killed in the two wars.

Major General Sir W F D Jervois, late RE, Governor of South Australia, when addressing an audience in Adelaide, and as recorded in the Journal, chided the Australian and New Zealand Colonies for priding themselves as being part of the "greatest maritime nation in the world. They held fast to the faith that the glorious British Empire should be defended and maintained, but they did not wish to contribute materially to their own defence either in ships or men". England was expected to bear the burden and the expense. Indeed the reality of this burden had been well illustrated by recent events in Afghanistan and in South Africa. Jervois had been very much concerned both with the design and construction of the forts, recently constructed in Britain for the defence of the Naval Dockyards, and also in the Channel Islands. He had subsequently reported extensively on the fortifications throughout the Empire. As Governor of South Australia he had been closely involved with schemes for the defence of the Colony. As indicated above he had been forthright in his opinions that the Colonies, depending on the Royal Navy, were prepared to do little for their own protection. When later made Governor of New Zealand, his first care had been to place the main ports in a state of defence. Jervois, an FRS, was another notable example of a Royal Engineer Officer who had made his name as a Military Engineer, a Surveyor, and as a distinguished Colonial Administrator.

"We have at Woolwich a thoroughly sound and reliable fleet of five balloons . . . and a few trained officers and men . . . who are competent to undertake the management of balloons in both free and captive ascents." So ran the introductory paragraph in the January Journal, describing details of the construction and handling of balloons in flight. We are reminded that in free flight the ballast must be so secured that when the "car bumps the ground and, as not infrequently happens, turns turtle, none of the ballast shall be lost"! The author strongly recommends that, "if captive work is assumed to be the proper role of the military aeronaut, the possibility of a captive ascent being converted, by accident, into a free trip was sufficiently likely to make free flight training an essential"! There follows an account of such a flight from the Arsenal in a strong wind from the NNE. "Before we could part ballast, we were driven into the gasholders." One member of the crew was left spreadeagled on one of the girders, and the other, senseless under one of the gondola seats, was carried on to Sevenoaks where he managed to jettison ballast and land safely. "Since then we have been more careful to have sufficient ascendant force to avoid uncompromising objects to leeward"! It seems that on every flight there was the hard choice of jettisoning ballast, which was always short, or taking a bump on the ground. Another report reads "after lowering his grapnel he observed that it was about to catch in some telegraph wires. Rather than damage PMG property, he cut the cable—an exhibition of presence of mind, which procured for himself and passengers an even severer shaking than must normally be expected on landing." "Concorde" seems to be more than a hundred years away!

A matter of "utmost importance to the well being of the nation" was also featured in the January Journal. This was a condemnation of the apprentice system. The Master, we are told, once understood his trade and taught his apprentices. Now he was a mere employer of labour and exploited his apprentices, "never troubling himself to teach or to get them taught. . . ." This was in contrast to France and Germany. It seems that in 1880 the City Companies had recently devoted £15,000 annually to the promotion of technical education. "The Country had yet to appreciate the value of an instructed, intelligent workman, and that the reign of 'rule of thumb' should cease." Sadly, "sitting by Nelly" is still too evident today and we have been slow to heed lessons which were evident enough even a hundred years ago.

"Distress in Ireland" was the title of a long article in the October Journal, on the part played by several Officers of the Corps in implementing measures for the relief of the agricultural poor in Ireland. This distress (unfortunately not for the first time that century) was the result of poor harvests and the inability of the Irish peasant to withstand bad times because of the land holding system. "Holdings were too often small, ill drained and badly cultivated. The difference between a bad and good year

is, for many, simply that between bare existence and absolute want." The Irish peasant was too prone to bear the hardest lot with a light heart, and rather than improving his land, trusted to Providence that all would be sufficiently well. The combination of bad harvests in Ireland and England (where large numbers of Irish workers were normally able to earn some sufficiency by harvest work) could, and did, spell ruin. The relief measures then being discussed were mostly concerned with improving lands, maintaining roads and other public works. Royal Engineer Officers were very much fitted to administer such works, both by their training, outlook, and, one suspects, their integrity. For many years the Chairman of the Board of Public Works in Ireland was an RE Officer. In a letter to *The Times* (in 1880) General Gordon stated that it seemed to him that the condition of the people in the West of Ireland was worse than that of the Chinese, Indians or Anatolians. He was of the opinion that the Government should "buy up the eleven counties at the cost of £80m, and that the State should own and manage the holdings—such was the present gap between landlord and tenants." Not, as we all know too well, a good augury for the future.

The 1880 AGM was much taken up (as in 1879) with the affairs of the RE Widows Society. The points at issue were the raising of the pension from £55 to £60 per year and whether, in the case of orphans, a pension should be paid which would otherwise have been paid to the widow, had she survived. This latter point was agreed (three families were concerned). Raising the pension by £5 per year was not agreed, after it had been pointed out that the reason for the then surplus (and hence the demand for the increase of pension) was that there had been a substantial increase in the number of Officers joining the Society. However, this very welcome increase would give rise to more widows in about twenty years time and there could be a deficit in about 1906 were the increase in pension to be paid. Happy were the days when even such relatively small pensions could be confidently forecast for thirty or so years ahead!

Another long debate at the AGM concerned the Annual Gold Medal Prize Essay Competition. This had been launched by the RE Institute shortly after its foundation in 1870. It was designed to encourage young Officers in the study of their profession. The Meeting agreed that it had failed in this purpose. Entries for the prize had been few and the standard not high. There was unanimous agreement that it be discontinued.

One wonders what the Corps thought of the Journal in 1880. Each issue certainly contained more pages than in previous years. Long travelogues or semi-travelogues (*Overland to India*, *A Trip to the Hills in Cyprus*, *Diary of a Brigade Major with the Quetta Column*) could reflect Editorial policy—the more pages the better! Seemingly endless (in very small print!) extracts from foreign military journals (*Militär Wochenblatt* etc), descriptions of foreign fortifications and accounts of siege operations (in this case the Russo-Turkish War, Plevna for example) could have added to an Officers professional background, although judging by the success of the Gold Medal Essay this does not seem to have been the case! The Journal, to be fair, had to be judged in conjunction with the annual volume of *Professional Papers* which contained the type of article, if rather laborious and lengthy, to be found in today's Journal. One feels, however, that the *Professional Papers*, a generous coverage (in the Journal) of "Supplement" type items, plus the material in the Journal itself, could have all seemed a bit much. It could be that if printing and postage had been more costly, some reductions would have been made with advantage, especially when it is remembered that the Journal itself was issued monthly.

One item of information published in the November Journal, might even now be a welcome practice for the impecunious Officer. The English Army, we are told, is the only European force in which an Officer, desirous of marrying, is allowed to do so whether he can afford it or not. In other European countries the bride must deposit with the authorities a certain sum, as a guarantee that she can properly contribute towards the expenses of a new household. A Captain's bride would have had to produce a deposit of about £2,000, and that at 1880 prices too!

The Use of Concrete by the Royal Engineers in the 19th Century

BRIGADIER J R E HAMILTON-BAILLIE MC, MA, C Eng, MICE

Brigadier J R E Hamilton-Baillie MC, MA, C Eng, MICE, was commissioned into the Royal Engineers in January 1939. He first used concrete building fortifications in France during the winter 1939–40, but spent the rest of the war as a prisoner in Germany (including Colditz!). After the war he read Mechanical Sciences at Cambridge and attended the Staff College at Camberley. He served in India, Aden and Germany as well as the United Kingdom. In 1965 he was responsible for the design of the concrete pavement of Crown Airfield in Thailand. He retired in 1974, his last posting being Director of Engineer Services (Army) in the Ministry of Defence. Since then he has been, as a Civil Servant, a Lecturer in Civil Engineering at the Royal Military College of Science, Shrivenham. He has been Vice President of the Institution of Royal Engineers, Chairman of the Fortress Study Group and a member of the Historic Concrete Working Party of the Concrete Society.

This article is an edited version of a paper presented by the author to a Joint Professional Meeting of the Concrete Society, The Newcomen Society and the Institution of Royal Engineers held at the Institution of Civil Engineers on 5 March 1980. The main points of the discussion engendered are included. By mutual agreement a full version of the paper will appear in "*Concrete*", their co-operation is appreciated.

DURING the 19th Century Cement and Concrete was the subject of at least nineteen papers published in the *Professional Papers of the Royal Engineers*. They span the period during which concrete gradually gained acceptance as a major constructional material, starting before Aspdin's first patent for Portland Cement and ending with a description of reinforced concrete—they called it Ferro-concrete—much as we know it now. With additional reference to the Minutes of a few meetings of the Institution of Civil Engineers, at most of which Sapper Officers took part, the whole history of concrete during this period can be traced.

The first four articles are in the first "quarto" volume of the *Professional Papers*, of 1834–35. The first (1a) is called *Notes on Concrete*, by Lieutenant Denison RE. His concrete was made with lime, usually slightly hydraulic Dorking lime, not cement, and the most usual aggregate was Thames ballast. He realised that the proportion of sand to coarse aggregate was important, and suggested not less than two parts sand to one of lime, and two parts stone to one of sand, but this was to be checked by experiment in every case. The minimum of water was to be used to make a satisfactory mixture and the mixing was to be done by hand, first dry and then wet, or in a pugmill. Much that seems reasonable to us was thus already normal practice.

The main use of concrete was for foundations, but Denison seems to have been considering extensions to its use. A footnote by Lieut Colonel Reid RE describing the walls of Ciudad Rodrigo in Spain (near the Portuguese frontier) as being built of

The use of Concrete by the RE in the 19th Century
Brigadier J R E Hamilton-Baillie

concrete with the board marks clearly showing. I wonder if anything of these walls remains. They must I think have been made of a natural pozzolanic cement in the Roman style, rather than with lime.

The second article (1b) is also by Lieutenant Denison. It describes the successful underpinning of a storehouse in Chatham Dockyard by Mr Taylor, "a civil engineer and architect", using lime concrete, one lime to six ballast compressed between new footings and the base of the walls with a screw-press device. The concrete was mixed with boiling water, according to a Mr Ranger's patent.

A third article (1c), this time by Lieut Colonel Harding, CRE Woolwich District, describes an interesting experiment of more military interest. A concrete arch representing part of a magazine or casemate was built on the artillery ranges at Woolwich and fired on with 13 inch mortars and 24 pounder guns. The concrete seems to have been much as before, 1:2½:4½ using Dorking lime with boiling water. The arch suffered from inadequate foundations on the marshy ground but stood up quite well to the bombardment, especially as in the middle the concrete was not yet "dry" as they put it. This lime concrete, though apparently very quick setting, was of course very slow in hardening. They seem to have understood that hydrated lime hardened by reacting with carbon-dioxide in the air. There is another reference to Moorish concrete walls in Spain.

The fourth article (1d) is about a sea-wall at Brighton of similar lime concrete on quite a large scale. It does not sound very successful, though the article includes a good description of littoral drift and the effect of groynes.

Denison appears in print again (3) in 1838, this time primarily to discuss the concrete river walls at Woolwich and Chatham that had been built with Mr Ranger's patent lime concrete made with boiling water. Most of these walls were built with precast blocks, moulded under pressure and meant to be made with Aberthaw, an hydraulic lime. Despite this, the results were poor, most of the blocks spalling badly from the effects of frost, and when struck by berthing ships. Denison noticed that some blocks survived well and suspected that the failure was due to a less hydraulic lime than the Aberthaw being used for many blocks. However, this failure gave concrete a bad name from which it took many years to recover. Denison also reported an experiment over which he had consulted Sir Michael Faraday (no scientific specialities in those days) which showed that if excess lime was washed out of a block of Aberthaw lime concrete no further reaction with water took place. He also gave the results of flexural tests on concrete blocks made by Colonel Pasley which imply a modulus of rupture of 0·4N/mm² (why does he quote "the constant S", given as $\frac{wl}{4bd^2}$ ie $\frac{f_b}{6}$?)

Mention of Colonel (later Major General) Pasley brings me to the next publication, a whole book on cements with a very long title: *Limes, Calcareous Cements, Mortars, Stuccos, and Concrete, and on Puzzolanas, Natural and Artificial; together with Rules Deduced from Numerous Experiments for making an Artificial Water Cement, Equal in Efficiency to the Best Natural Cements of England, Improperly Termed Roman Cements; and an Abstract of the Opinions of Former Authors on The Same Subject.* It was usually referred to as *Pasley on Cements*. This was first published in 1838, (2) and a second edition came out in 1847, (5). Pasley was the Director of the Royal Engineer Establishment at Chatham, a post now called Commandant of the Royal School of Military Engineering. He held it from 1812 to 1841, rising in rank meanwhile from Major to Major General. He was a keen experimenter and writer, a friend of such men as Rennie and Brunel and became a Fellow of the Royal Society.

Pasley gives a good summary of the history of cement up to his time, attributing to Smeaton the fundamental discovery that only limestone (or chalk) that contained a proportion of clay would burn to an hydraulic lime, ie one that would set in wet conditions. He distinguished pure lime that sets only very slowly, weakly and strongly hydraulic limes, and cement. By the latter he meant primarily the so called Roman

cement, invented by Mr Parker made by burning naturally occurring "cement stones", calcareous nodules containing a proportion of clay. These set with water without first slaking, unlike the hydraulic limes, and gave higher strengths. Pasley set himself to discover a way of making "artificial cement" ie a cement made from easily obtainable material rather than the comparatively rare "cement stones". This he achieved by burning mixtures of chalk and Medway clay getting the best results from a proportion of 4 parts by weight of chalk to 5·5 parts of blue clay, high in silica even for a Roman cement. His firing temperatures were no doubt too low for making true Portland Cement. His earlier experiments on a small scale in crucibles may have come closer to Portland cement than his later trials fired in kilns. In these he used 5 parts by volume of chalk to 2 of blue clay; much nearer the correct value. He had not heard of Joseph Aspdin's patent, but at this time Joseph's product was also not raised to a high enough temperature, and was not true Portland Cement (24). By the time the second edition of Pasley's book came out in 1847, true Portland Cement, though of very poor quality by modern standards, was being made by Joseph's son, William, at Northfleet not far from Chatham. Pasley only heard of this when he met William Aspdin at the Great Exhibition of 1851 (18). Surprisingly Pasley did not approve the use of cement in making concrete, recommending instead hydraulic lime. This seems to have been based on two reasons. One, that as concrete was made with quick lime, the heat generated by slaking speeded up the set, as presumably did Mr Ranger's boiling water. Pasley admitted that the long term strength was not increased by this heat, but thought that the adhesion of the lime to the gravel was permanently improved by it. The second was that his experiments showed that the adhesion of cement mortar was reduced by a greater amount by the inclusion of sand than was lime mortar. As a result of these views he considered only lime concrete, and despite the various experiments and works described in the *Professional Papers*, he condemned this except for foundations and some special circumstances. For casemates he recommended brickwork in cement mortar and stuccoed with cement, rather than lime concrete.

Pasley did not test cement concrete but his flexural tests on very small specimens of a neat cement give a modulus of rupture of 1·9N/mm^2 at 14 days for the best of his own products. Had he tested cement concrete he might have overcome his prejudice against this material. As it was, his condemnation was for many years a serious setback to its acceptance, not only among military but also among Civil Engineers.

Other interesting experiments described by Pasley are those on the reinforcement with hoop iron of brickwork laid in cement mortar. The most dramatic was the double cantilever "semi-arches" built by Brunel at the Thames Tunnel site, one side 60ft long and the other 37ft with a load of 28 tons at the end. The top twelve horizontal joints in the brickwork were reinforced with from 2 to 6 pieces of hoop iron. Then there was a beam built by Messrs Francis to advertise their (Roman) cement made at Vauxhall. This spanned 21ft 4in, was 4ft 9in deep with five pieces of hoop iron reinforcement distributed in the lower half. It broke under a central load of 22 tons 8 cwts. Finally Pasley built his own reinforced brick beams and loaded them to destruction, carefully recording loads and deflections, and also the ultimate tensile strength of his hoop iron. A beam of 10ft clear span, of bricks in cement mortar with hoop iron in the joints, 12in deep and 18¾in wide failed under a central load of 4523lbs. Pasley found that cement mortar gave adequate bond strength, but that with lime mortar the iron pulled out. He also noted that the cement mortar gave good protection to the iron against corrosion.

Evidently Pasley and his contemporaries came very near to inventing reinforced concrete some sixty years before the use of this material was generally accepted. But for the prejudice against cement rather than lime in concrete, it seems likely that test beams would have been made and that reinforcement would then have been included as for the brick beams.

Pasley's comprehensive book seems to have discouraged further publication on the subjects that he covered for some years. In 1845 a sensible little paper appeared

in the *Professional Papers* (4) on the bulking of sand and gravel so that volume batching could be adjusted to give the correct weights of materials. This was however still in the context of lime concrete.

In May 1851, the year of the Great Exhibition, George Frederick White presented a paper to the Civils (6). He pointed out that Portland Cement was a new material introduced since Pasley wrote his book. In direct tensile tests on neat cement a strength of 0·7N/mm² had been obtained after 7 days and 2·8N/mm² after 3 months. These tensile tests were evidently considered the standard, but compressive strength on cement mortar blocks in the range 8 to 15N/mm² were quoted. Surprisingly however, cement was still recommended for mortar for brickwork (but not masonry) and for precast blocks, but not for mass concrete. Lime concrete was still accepted for foundations. An attempt had been made to repeat Messrs Francis's reinforced brick beam experiment at the Great Exhibition, but by error the hoop iron had been wrongly placed bringing some of it above the neutral axis. Pasley spoke at the meeting and mentioned Messrs Robins and Aspdin as makers of cement.

No further progress is recorded in the military or civilian papers for some years. Then a new name appears, Captain H R D Scott RE, who for some time was to be an influential figure in the story. In 1857 he published in the *Professional Papers* (7) an account of his invention of a new cement that he had patented. This was made by burning sulphur in the kilns in which lime was burnt. The result must have been a gypsum plaster and is compared by Scott with Parian or Keene's Cement, rather than with Portland or other similar cement. The primary uses for which he recommended it were for internal and external plastering, but he also suggested it for mortar and concrete as a substitute for hydraulic lime.

Scott wrote again in much more detail in 1861 (8) on his cement, which he called Scott's cement, or Selenitic cement, perhaps because his wife's name was Selena. This time he gave much more attention to its use in mortar or concrete. He described Scott's plaster and Scott's cement separately. For the latter the sulphur process was applied to naturally hydraulic lime or the treated lime was made hydraulic by the addition of puzzolana or "artificial puzzolana", ie burnt and ground clay.

In the following year, 1862, Scott published two further and more important papers. General Pasley had died the previous year, and evidently it was only then that anyone dared to improve on his book. Scott's first paper (9a) set out to do this in a very long and thorough account of limes and cements. The differences between the various products are clearly set out and for the first time a reasonable description of the chemistry is given, together with emphasis on the importance of the temperature of firing. The whole article is in the context of mortars and no mention is made of concrete. He shows that the effect of sand in weakening cement more than lime no longer applied to the cements such as Portland and his own—Scott's—which were new since Pasley's date. Indeed a very large part of the article is taken up with a discussion of sand in mortar. He uses flexural tests on 2in × 2in × 3in long beams, following Pasley, but also crushing tests on 1in cubes, as well as tensile tests on mortar joints. Some typical results from his numerous tests are, for 1 to 2 cement-sand mortars:

Flexural strength at 30 days { Scott's Cement: 1·3N/mm² ; Portland Cement: 2·1N/mm² }

Roman cement mortar was always much weaker and lime mortars weaker still. At some ages and mixes Scott's cement came closer to Portland than the results quoted, but was never as good. In cube tests Scott got an average of 11N/mm² for his own cement neat at 9 months. Later in the same volume Scott published another paper entitled *On Concrete as a Substitute for Brick and Stone Masonry in Works of Fortification* (9b). It was a strong plea that such a substitution would be both effective and economic. He mentioned an official paper by Captain Fowke RE circulated in the Corps by the Inspector General of Fortifications, but Scott's paper seems to be the first published advocacy of the making of cement concrete and its use on a large scale other than in foundations. Because of the dominant influence of Pasley, Scott

evidently considered he had a difficult task, so he started with the Romans and worked through to the various lime concrete works already mentioned. Among these the Brighton sea-wall was still standing up fairly well. His case is however really made by a single table of strengths of concrete, based on the usual flexural tests on 3in × 2in × 2in beams. This gives:

Best hydraulic lime concrete 1 to 4·5 at 15 months	0·5N/mm²
"Roman" cement 1 to 4 at 13 months	0·4N/mm²
Scott's cement 1 to 5 at 13 months	1·6N/mm²
Portland cement 1 to 4 at 13 months	3·3N/mm²
Portland (best samples) at 13 months	more than 5·0N/mm²

Strength had thus increased dramatically since Pasley's experiments from which the first two results were quoted. Pasley's conclusions were thus no longer valid and cement concrete could be an effective construction material in its own right.

The next paper to appear was in the Proceedings of the Civils for 1865/66 (10). John Grant, who had used Portland Cement extensively for mortar in the London Southern Main Drainage Works, spoke on his experiments on the strength of cement. He described the direct tensile test on a 1¼in × 1¼in neck in neat cement or cement mortar bricks that was to be the standard for a long time. he gave details of the moulds for making the "bricks" and various modifications intended to ensure a true axial load. He published a very large number of results on Portland and Roman cements (but not Scott's) with various proportions of sand. From these results he plotted strength against age curves. The acceptance strengths for neat cement in tension at 7 days had been increased from 1·24 to 1·54 and finally to 1·72N/mm² during the course of his work on the sewers. He appeared to realise the importance of curing, though he did not use this term. He considered salt water as good or better than fresh for making mortar. In all this he said very little about concrete and still recommended it for use in foundations only.

By the time this meeting at the Civils took place the Sappers must have been well on the way to completing what may have been the first really large scale use of concrete above foundation level. This was in the construction of Newhaven Fort, reported on by Lieutenant Ardagh RE in the *Professional Papers* in 1866 (11). Almost all the revetment of the ditches of this Fort were in mass concrete totalling some 20,000m³ (see Figure 1). Surprisingly Scott's cement was used, not Portland cement, despite Scott's own paper (9a) having shown the latter to be considerably stronger. However, no doubt Scott's cement was cheaper, and its strength evidently adequate as the revetments stand to this day (Figure 2). The strength specified for the cement, tested in tension as recommended by Grant, for 1 cement to 2 sand at 7 days,

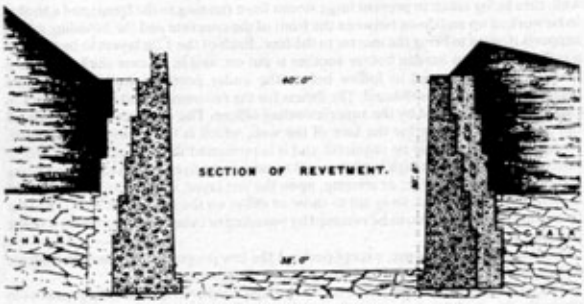

Figure 1. Section through Ditch of Newhaven Fort 1866

The use of concrete by the RE in the 19th Century (1)

Figure 2. Scarp Wall of Newhaven Fort 1978

cured dry, was 0·2N/mm^2, but the mean figure obtained was 0·34. This is higher than Grant got with a similar mix of Portland cement at 7 days. For a tensile test of the concrete on a briquette with a 3in × 6in neck Ardagh got 0·83N/mm^2, though unfortunately he does not give the age.

The concrete was hand mixed from Scott's cement, clean sharp sand and beach shingle in proportions 1 to 1 to 6. The shingle was raised by a steam driven hoist from the beach below the Fort. Part of the specification was as follows:

"The revetments are to be of concrete, composed of one part of Scott's cement, one part of coarse, clean, sharp sand, and six parts of ballast shingle or flint, mixed properly dry; a sufficient quantity of water to be added just before, and as it is required for the works: to be laid in courses 1ft high, and rammed as laid to form the wall, care being taken to prevent large stones from running to the front; and a shovel to be worked up and down between the front of the concrete and the boarding which supports it, so as to bring the mortar to the face. Each of the 12in layers to be allowed a sufficient time to harden before another is put on, and in no case shall more than three layers be allowed to follow before the under portions shall have become perfectly hard and consolidated. The fitness for the recommencement of the work in each case to be decided by the superintending officer. The contractor to provide all the necessary boarding for the face of the wall, which is to be fixed to such lines, slopes, or batter, as may be required; and it is presumed that sufficient boarding to raise the wall three feet high is all that will require to be fixed at one time, care being taken that the lower edge, or starting, upon the last layer, shall, in all cases, be well secured and neatly fixed, so as not to show an offset on the face of the wall. The rear face of the concrete is also to be retained by boarding or other filling, to retain it to the required section."

All this seems good sense, except perhaps the low proportion of sand, though we do not know how much sand was in the beach shingle used.

The only trouble discussed in detail by Ardagh was in vertical shrinkage cracks in the walls. By careful measurement he convinced himself that these were due entirely

The use of concrete by the RE in the 19th Century (2)

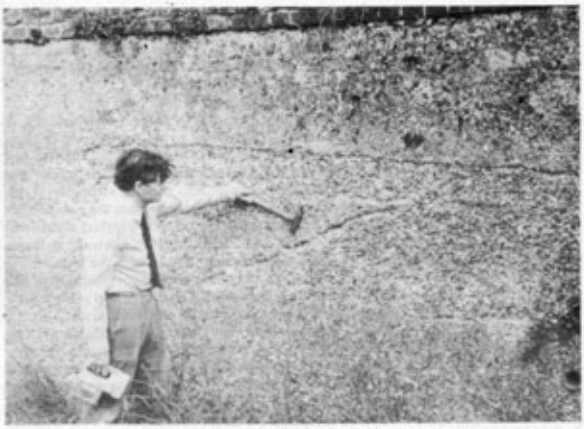

Figure 3. Concrete at Newhaven Fort showing Lifts and Unsupported Stop End

to thermal movement. No doubt shrinkage was also to blame and the fact that the cracks were worst where exposed to the sun was aggravated by the lack of curing. He also mentioned the difficulty of getting the "ramming well done", this being "a chronic source of annoyance". Unfortunately much of the ditch has recently been filled by a speculator who dozed the ramparts into it. Enough however is still visible to get a good idea of its condition, which could be described as still serviceable (Figure 3). The cracks have spalled and widened somewhat especially in the outer (counterscarp) wall (Figure 4), and some honeycombing is visible, probably because the mix was so low in sand.

In 1978 eight 6in cores were cut from the concrete by the Materials Laboratory of 62 CRE (Construction) in cooperation with the Royal Military College of Science.

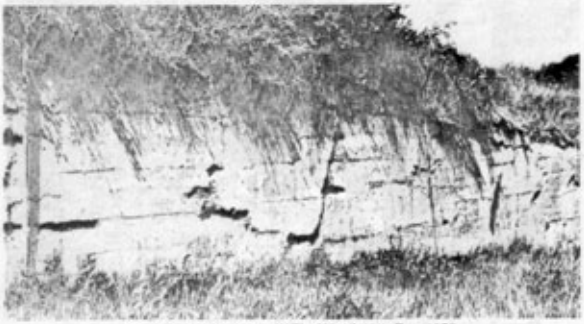

Figure 4. Counterscarp Wall of Newhaven Fort 1978

The use of concrete by the RE in the 19th Century (3 & 4)

Five came from the scarp (inner) wall and three from the counterscarp (outer) wall of the North ditch. The matrix is visibly different in the two walls, being very white in the outer wall and of a more normal cement colour in the inner. This difference is supported by the equivalent cube strengths obtained on crushing some of the cores:

Scarp : 18·1, 26·5, 18·5, 14·3; average 19N/mm^2
Counterscarp: 9·6, 7·3; average 8·5N/mm^2

Chemical analysis carried out by the Materials Research Department of the C & CA confirms that the cements differ. Neither is Portland as no anhydrous calcium silicates were detected. Both contain calcium carbonate as calcite and vaterite and some calcium aluminate hydrate. This confirms that an eminently hydraulic lime was used in Scott's manufacturing process. Both samples also contain ettringite, a calcium alumino-sulphate hydrate, no doubt formed in some way from the compounds produced by the sulphur burning process. Ettringite is a reaction product also found in modern super sulphated cement, and would have given Scott's cement its extra strength over that of hydrated lime. The counterscarp sample with the pale matrix contained considerable calcium hydroxide, a testimony to the impermeability of this concrete. The analysis and the paler colour indicate that this cement was made from a less hydraulic lime. Possibly it was more in the nature of the product known as Scott's plaster rather than Scott's cement. it is surprising that Lieutenant Ardagh makes no mention of the change in cement, of which he must have known, especially as every batch was tested. Possibly the fact that the counterscarp was in a weaker material (it was built first) was a military secret. The compaction of the concrete was good near the surface, but became very poor in the interior, probably due to Ardagh's "source of annoyance" but at the same time compliance with the instruction to work a shovel against the shuttering. An interesting detail is shown in Figure 5. Writers, in those days before the use of reinforcement, recommended broken brick aggregate where concrete was in tension. The illustration shows this in the broken cantilever steps.

Despite the success of the construction of Newhaven Fort there was now another lull in the publication of papers. The next to mention concrete in the *RE Professional Papers* appeared in 1870 (12). This discussed various materials for backing armour plate on forts and for use in the gaps between spaced armour (not a modern invention as is often thought). For filling the spaces, a curious mixture of iron borings,

Figure 5. Steps at Newhaven showing Brick Aggregate for Concrete in Tension

The use of concrete by the RE in the 19th Century (5)

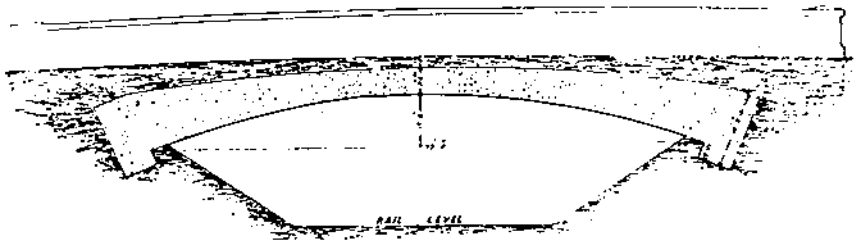

Figure 6. Longitudinal Section through Bridge over the District Railway 1868. The main dimensions (which are now unreadable because of size reduction) were: clear span 75ft, rise of arch 7ft 6in, depth of slab at crown 3ft 6in, fill at crown 1ft 6in, depth of slab at abutment 10ft 9in

"asphaltic stone", bitumen and pitch, called iron concrete was used, but for general backing Portland cement concrete came out better than this or other materials tried. Unfortunately no details of this concrete are given.

We must now return to the Civils where in April 1871 Mr Grant spoke again on his further experiments (13). Most of his tests were tensile tests of the same type as before, though a variety of minor modifications of mould shape were tried. The quality of Portland Cement had increased considerably since his earlier experiments and now, for neat cement at 7 days, averaged 2·47N/mm^2 compared with 1·86 five years previously. Grant now favoured testing at 30 days, when he got 3·17N/mm^2 from the same cement. The main change was that he now recognised concrete as a suitable construction material, both as precast bricks or blocks and in the mass. He had constructed sewers in mass concrete both with and without brick linings. He foresaw its widespread use in building and civil engineering and quoted its use with granite aggregate in a 6in slab for road pavements in Inverness, Edinburgh and London. As well as many crushing tests on concrete bricks, he carried out compression tests on concrete cubes. He tried 12in and 6in cubes, 6, 8 and 10 to 1 mixes, several different aggregates, compressed or not in the moulds and set and kept in air or in water, always for one year, so there is a great variety of results. His best strength was for 6in cubes, 6 to 1 mix, compressed, air cured, with crushed Portland stone aggregate which gave 17·4N/mm^2. Granite gives a lower value and "ballast" only half. Surprisingly in most cases the air cured results were higher than those kept in water.

Scott spoke in the subsequent discussion, warning against using Portland Cement mortar stronger than the bricks it was to join, and getting in a plug for his own plaster. Lieutenant Innes RE also spoke at some length describing his own experiments on fineness and grading of sand in mortars, on the difficulties of density measurement of cement and on the importance of fineness of grinding in cement.

The next reference to concrete in the *Professional Papers* is also in 1871 (14) and describes not a military work, but a mass Portland cement concrete bridge over the District Railway between Gloucester Road and Earls Court Stations (see Figure 6). It is based on descriptions given by T Marr Johnson, described as Engineer of the Metropolitan District Railway. It must have been one of the earliest substantial civil engineering structures in this material. The span was 75ft and the rise 7ft 6in. The concrete arch was 3ft 6in thick at the centre. A central width of 12ft was built first, about 136m^3 of concrete, in a single pour. The concrete was hand mixed in 1:7 of Portland cement to screened gravel, apparently with no sand. A test load was calculated to give a maximum compressive stress of only 1·6N/mm^2 and caused no signs of distress. London Transport records describe a widening of this bridge in 1869, probably the addition of the outer sections each side of the central 12ft width first built. That initial construction must therefore have been between 1865 and 1869 probably 1868. The bridge was near the site of the present West London Air Terminal. No record has been found of its demolition, but no trace now remains.

Lime concrete was used elsewhere in the construction of the railway and this bridge, which was an unimportant one, must have been used as a test of Portland cement concrete. Either T Marr Johnson or Sir John Fowler, who was the Engineer for the construction of the railway, must have been responsible.

In 1873 Innes, who had spoken at Grant's second lecture to the Civils and was now a Captain, published in the *Professional Papers* a paper on the supply, storage and testing of cement (15). He quoted Grant, emphasising the importance of fineness of grinding and used the tensile test. He added many sensible practical details, but only on the testing of cement, not concrete. However he clearly visualised the main use for the cement being in concrete. He quoted cement specifications used by Grant, by Sir John Cooke on various civilian marine works and by the Sappers for Portland Breakwater Fort and for the defences of Cork Harbour. The latter was probably the first large scale use by the Royal Engineers of Portland Cement Concrete. No details of concrete work are however given by Innes.

Concrete work is however very fully described by Major Maquay RE in the *Professional Papers* of 1874 (16). He quoted Grant and Innes but added much more on the use of mass concrete. He recommended volume-mix proportions of 1 to 8 mixed aggregate of which one third should be sand, ie 1:2⅔:5⅓, and understood that the finer material must fill the voids in the coarser. Only the minimum of water was to be used. He described hand and mechanical mixing and illustrates two steam-driven plants, one that had been used at Cork Harbour including a stone-crusher feeding direct to the paddle type mixer (figure 7). He illustrated a mobile staging for casting concrete revetments, a predecessor perhaps of slip forming (figure 8). He also described how complete concrete huts could be cast, preferably using iron shuttering. For damp situations he recommended cavity wall construction. Some details on the making of precast concrete window dressings for brick buildings show that cavity wall construction was already in use in military brick buildings at this date.

The next paper appears in 1876 (17) and is by Lieutenant E Wood RE who was concerned in the building of new barracks at Guildford "where Portland Cement Concrete is used throughout instead of stone, for floors and steps, and also for lintels,

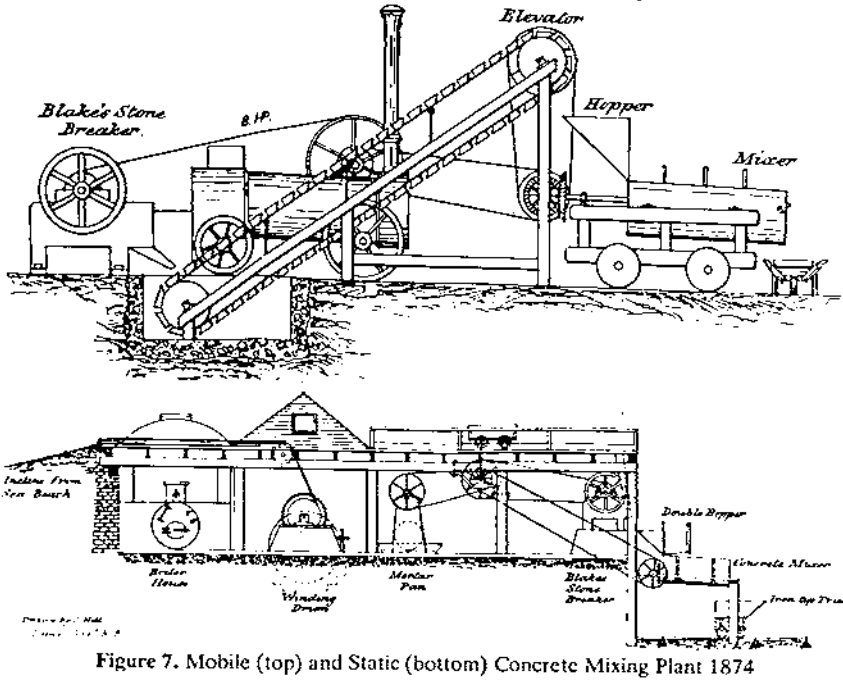

Figure 7. Mobile (top) and Static (bottom) Concrete Mixing Plant 1874

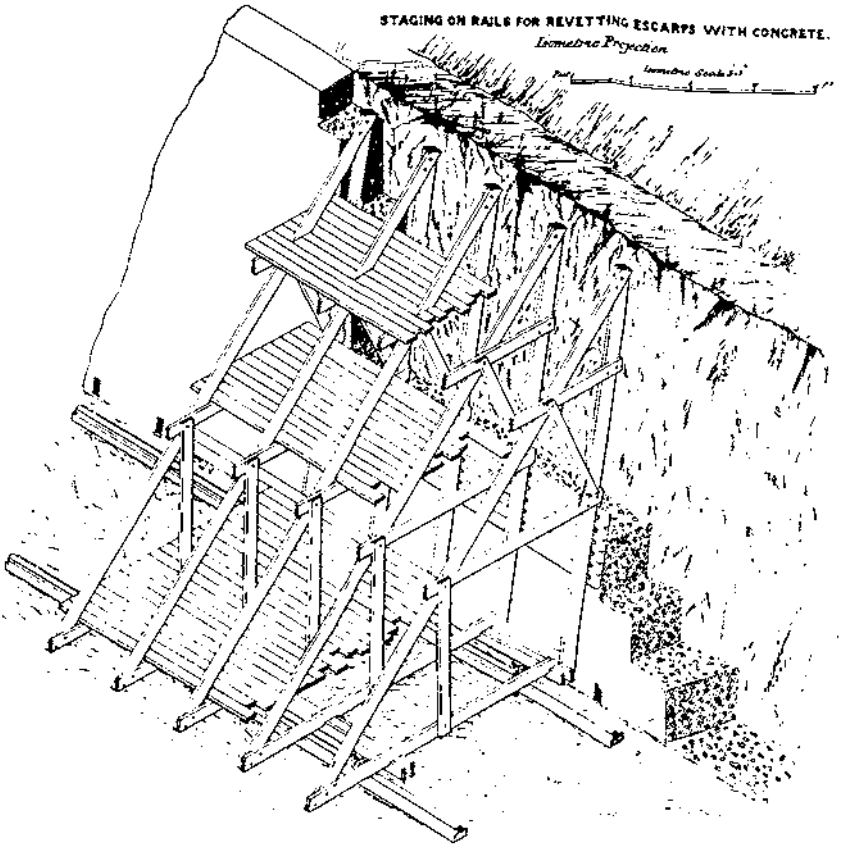

Figure 8. Movable Shuttering 1874

sills, string courses, copings, chimney dressings, etc when it is worked up to imitate stone". He ran a series of tests to determine the strength of encastré concrete beams, but he had trouble with the rigidity of his abutments, and his theoretical approach is confused. His results are unsatisfactory, but assuming he did achieve fixity they imply a flexural strength of $1{\cdot}7N/mm^2$, the true figure probably being higher.

We must now return to Scott, whom we last heard of as a Lieut Colonel, speaking at the Civils on Grant's second paper. In 1861 he had been seconded to an appointment as Secretary to the Commissioners of the Great Exhibition at South Kensington, and the next year he took over responsibility for the completion of the design and for the construction of the Royal Albert Hall from Captain Fowke RE who had died suddenly. The Albert Hall is a remarkable monument to Scott's architectural and engineering ability, especially when one realises how little experience on major structures he had had previously. He used his own "Selenitic" lime in the plasterwork.

In 1871 he was promoted Brevet-Colonel but shortly afterwards retired from the service with the honorary rank of Major General, to continue his employment at South Kensington as a civilian (19). At about this time he formed a company to make his patent cement that had until then been made under licence. The company continued in business until the expiry of the patent, though the process was changed from burning sulphur with lime to form calcium sulphate to adding this material as ground plaster-of-Paris to Portland cement. His principle has in some measure survived in the gypsum added to the Portland cement clinker in modern processes.

Scott also floated a company to exploit the manufacture of cement combined with the lime treatment of sewage by a method he had patented. While lime treatment remained in vogue this was economic and successful but was never as widely introduced as its advocates hoped. It came to an end when other methods of dealing with sewage were introduced.

Scott's architectural assistant on the Albert Hall was G R Redgrave, who was also associated with him in his "Selenitic" cement and sewage cement operations. Redgrave was later to publish an important book on Cement (23). In 1880 Scott and Redgrave presented a joint paper to the Civils on *The Manufacture and Testing of Portland Cement*, and were awarded a Telford Prize for it (18a). The paper starts with an excellent brief history of Portland Cement, correctly stating that Joseph Aspdin had not, at least at first, made the true product, but that William Aspdin had done so (24). Mr Grant was credited with encouraging the acceptance of Portland Cement as a reliable material and the Germans with the best scientific description of the chemical processes involved. Their careful standardisation of testing procedures including the use of standard sand for test briquettes was also praised and its imitation, with conversion to English units, advocated. The bulk of the paper is on technical improvements in the method of manufacture, still of course in bottle kilns, mostly concerned with more economical ways of drying the "slip", the clay and chalk slurry, before burning. They reluctantly accepted that the vital proportioning of chalk to clay from the variable raw materials should be left to the guesswork of an experienced workman!

At the same meeting of the Civils, E A Bernays spoke of his recent experience in the use of concrete, chiefly in the Royal Dockyard at Chatham. He points out that concrete was at last being recognised as a material in its own right, despite the Admiralty specifications for work at Chatham as late as 1867 making no mention of Portland Cement, but specifying lime concrete for work even there in the middle of the main centre of the Portland Cement industry! He had managed to introduce the use of Portland Cement by showing that even reducing the mix proportions to 1 to 12 so that the Portland Cement concrete cost no more than the lime, the result was better.

Grant also introduced an immensely thorough paper on the testing of cement. Specific gravity, fineness and strength tests were all gone into in great detail, the German systems discussed and their standard sand used. Tensile tests, mostly on mortars of 1 cement to 3 standard sand, were used and a great variety of sizes and shapes of briquettes discussed. "Selenitic" cement was included in the tests and came out well. Setting and hardening times were examined in detail. The importance of fine grinding or sifting was emphasised. Among a mass of variable results, typical tensile strength values were now 3·4N/mm^2 for neat cement and 1·4N/mm^2 for 1 to 3 of standard sand, both tested at 28 days. The acceptance value suggested by Scott and Redgrave for 1 to 3 mortar at 28 days was 0·77N/mm^2, but in the following discussion this was criticised as low and it was pointed out that the Germans specified 0·98 and some of their makers guaranteed 1·57N/mm^2. The discussion and correspondence on the paper were both lengthy and there was clearly a feeling that, after a head start, the British were now being left behind by the Germans in the manufacturing and testing of cement.

We have wandered rather from the subject of concrete and the Royal Engineers, but before we return to it it is worth completing the life story of General Scott. Only two years after he had delivered his paper to the Civils, and when working on the Victoria and Albert Museum, his post was suddenly abolished without warning or compensation as a Treasury economy measure. Worry about his family of fifteen children on top of many years of overwork broke his health and he died in 1883 at the age of 61, with a CB and as a Fellow of the Royal Society, but with little financial reward from all his work (19).

The next contribution in the *Professional Papers* does not appear until 1887 (20) when Major H Pilkington RE published a short but good paper on the proportion of

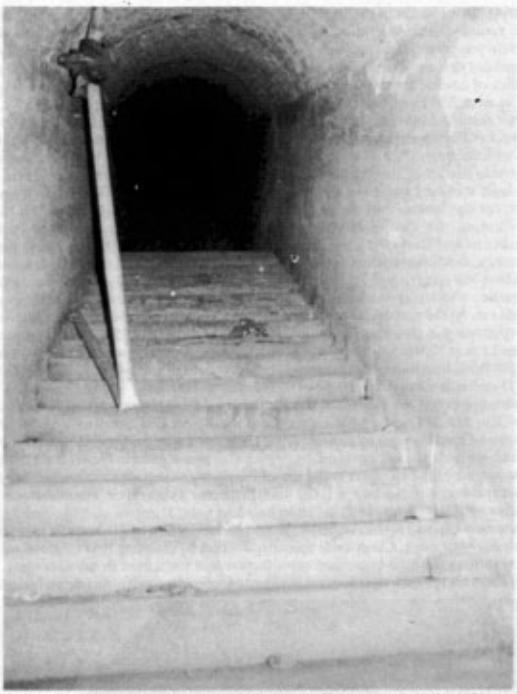

Figure 9. Underground Works at Fort Borstal, Chatham, built in the 1870's

sand in concrete. Before this time the proportion of sand used was often much too low as we found in the sample from Newhaven Fort. The proportion was often left to chance by the use of all-in aggregate, sometimes with good results because of the good natural grading of Thames Ballast. Pilkington compared 1 to 8 mixes with no sand with 1:2:6 and 1:1:3 mixes with six different aggregates. As expected he got rapidly increasing strength. Unlike earlier writers he considered ballast the best aggregate, probably because he screened out the sand, and replaced it in a measured volume. An interesting feature of his paper is that he used all three types of strength tests, a flexural test on 6in × 12in beams at 4ft 6in span, a tensile test on specimens with a 12in × 6in neck and crushing tests on 6in cubes. For the first time in any paper he considered the latter the most reliable test. His average compressive strength at four months for the 1:8, 1:2:6 and 1:1:3 mixes were 2·4, 5·2 and 9·3N/mm^2. The last in particular seems low, though he did get 15N/mm^2 from his best cube. The ratio of tensile, flexure and compressive strength attained was 1:2·4:13·9 which is reasonable.

No more papers appeared for some time but a number of surviving military works

The use of concrete by the RE in the 19th Century (9)

illustrate the progress in the use of concrete. Work started on the landward ring
Forts round Chatham in the late 1870's, but made slow progress. At this tim
concrete was often used for floors and walls but roofs were still vaulted in brickwo
in Portland cement mortar, as recommended long ago by General Pasley. Despit
this lack of confidence the surviving concrete such as the steps in the picture (Figu
9) is in excellent condition. Work stopped for some years in the early 1880's, bu
when it restarted two redoubts were built with their casemates entirely in concret
The earlier Forts were completed about the end of this decade and concrete was no
used with confidence for all structures. The counterscarp galleries that were intende
to provide fire along the ditches were complicated structures in mass concrete of
very high standard and have lasted very well (Figure 10). In the 1890's a line
structures was built to the south and east of London which, though called "Mobilis
tion Centres" for the Volunteers who were to defend the Capital, were built
redoubts to add strength to the positions. Concrete was used for the walls, shelt
casemates, ditch revetments etc. Though unreinforced in the modern sense, mo
chambers had steel troughing or close spaced "I" beams (usually old railway rails)
permanent shuttering in the roofs. Steel I-beams or rails were also built in ov
portals etc. At the end of the century most coast defence positions were modernise
with concrete gun pits, many of which remained in use until 1956. That illustrated
Figure 11 is at Newhaven Fort, and uses quartzite aggregate which must have bee
brought from a considerable distance. The overhead protection was added in Worl
War II and is in comparatively poor condition!

There are two more articles in the *Professional Papers* to mention. In 1898 A
Carey Esq MICE (modern FICE) spoke to the Royal Engineers on *The Selectio
Testing and Employment of Cement* (21). He started with an historical survey, mo
of which we have already covered, but which also gives credit to General Sir Andre
Clarke as one of the pioneers in the use of Portland cement when this was struggli
for acceptance. Sir Andrew Clarke was Inspector General of Fortifications an
Director of Works from 1882 to 1886 and had been Director of Engineering an
Architectural Works at the Admiralty from 1864 to 1873 when Bernays was carryi
out his harbour work. Carey ends this introduction by claiming that England was b
then regaining the lead in cement manufacture lost for a time to the Germans.

His main acceptance tests for cement are now specific gravity, fineness of grindin

Figure 10. Counterscarp Galleries at Fort Borstal, built in the 1880's

The use of concrete by the RE in the 19th Century (10)

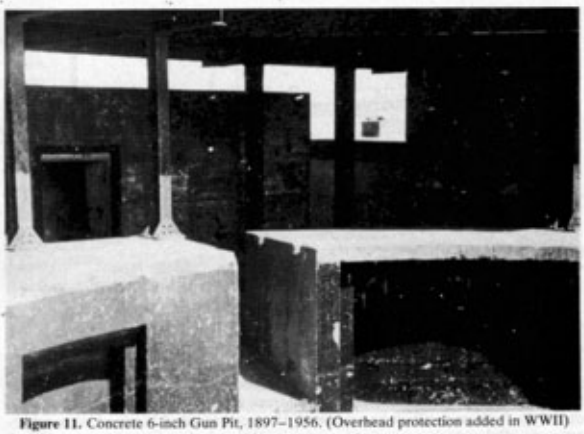

Figure 11. Concrete 6-inch Gun Pit, 1897–1956. (Overhead protection added in WWII)

and tensile strength of a one square inch cross-section, the 1 ½in × 1 ½in section being by then quite out of date. The briquettes were to be made in neat cement and in 1:3 mortar of normal sand giving:

Neat cement : 1·24N/mm² at 3 days
2·76N/mm² at 7 days
1:3 Cement Mortar: 0·90N/mm² at 7 days

Most interesting however is that his paper, rather as an afterthought, gives the first description of reinforced concrete. He describes the Austrian official tests of the Monier system of reinforcement with iron ties embedded in the concrete, and mentions bridges built on this system on the Continent up to 40m span. Carey accepted sea water for mixing but one hopes he did not use it in reinforced work!

Our last paper comes just into the present century but really marks the transition to modern ideas, at least up to the introduction of prestressing. Once again a Civil Engineer addressed the Officers of the Corps on the latest techniques. He was E P

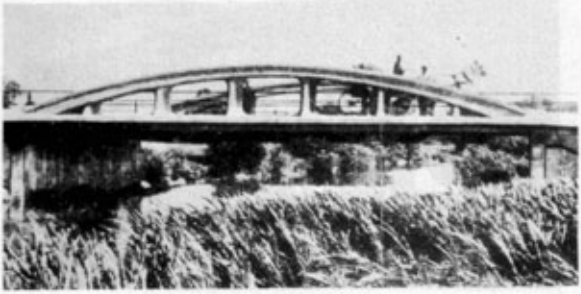

Figure 12. Bridge at Strassburg

The use of concrete by the RE in the 19th Century (11 & 12)

Figure 13. Footbridge at Rotterdam

Wells Esq and he spoke on *Concrete and Ferro-Concrete in Arches Etc* (22). He accuses British Engineers (presumably including Civil as well as Military in this category) of extreme conservatism, and unwillingness to use concrete except in unimportant situations. He supports this accusation well by examples from all over the Continent. As well as the use of reinforced concrete, the Germans had introduced the 3-pin arch which he explained. He recommended Portland stone aggregates, weigh-batching, and machine mixing. He quoted compressive strengths of 23N/mm^2 and one, from concrete for a bridge at Geneva, of 32N/mm^2. The illustrations (Figures 12, 13 & 14) show examples of the bridges he discussed from Germany, Holland and Spain. I would not expect bridges looking like this in this country to date from the turn of the century, so I think they make this point. The bridges were built on the Hennebique system. Mr Wells knew Mons L G Mouchel, their London representative.

In conclusion, the main landmarks in the acceptance of concrete in which the Royal Engineers were concerned were Pasley's book of 1838 (republished in 1847); Scott's updating of this work and advocacy of the structural use of mass concrete in 1862; the building of Newhaven Fort in 1865, Cork and Portland in the early 1870's

Figure 14. Bridge near Bilbao

The use of concrete by the RE in the 19th Century (13 & 14)

and numerous works including the Chatham ring forts in the following ten years. Thereafter the leadership in this field slipped not only from the Sappers but from the Civil Engineers of this country, perhaps never to be regained.

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DISCUSSION

Over a hundred members of the three learned societies enjoyed an excellent presentation by the author which held their attention throughout. The talk was illustrated by drawings from the *Professional Papers of the Royal Engineers* and photographs taken by the author.

In the discussion which followed a number of speakers commented on the time taken to advance from reinforced brickwork to reinforced concrete, nearly eighty years. There were a number of causes but the two major ones were probably Pasley's prejudice against cement in concrete and the collapse of the reinforced brickwork beam at the Great Exhibition in 1851.

When asked about Martello Towers the author explained that they were built early in the 19th century and were built in brick and lime mortar which was not truly a cement. Given time such lime mortar becomes very strong. Admixtures were often used about this time including tallow, coal and linseed oil; Pasley himself used many admixtures in his experiments to improve specific characteristics of mortar.

Some surprise was expressed that Wilkinson's work in the concrete field was not mentioned in the Professional Papers.

The Meeting was chaired by Mr S R Arnold and the vote of thanks to the speaker was proposed by Mr W T F Austin both of the Concrete Society and both Members of the Institution of Royal Engineers.

Sappers in Fort Monagh

LIEUT COLONEL G B FAWCUS RE, MA

Commissioned from Sandhurst 1958, the author spent 15 months in Cyprus before attending a degree course at Kings College Cambridge. Immediately after that, in 1963, he was posted to Osnabruck for the first of three tours in the left-hand side of Roberts Barracks—then as a troop commander in 39 Fd Sqn, 10 years later to command that Squadron and now as CO 2 Armd Div Engr Regt. In between these tours he has attended Staff College, returned there later as a DS and has held a number of other staff posts, including one in AG7. This article describes his second tour in Northern Ireland, his first also being in the infantry role, in East Belfast in 1973 when commanding 39 Fd Sqn.

On 2 October 1979, 2 Armoured Division Engineer Regiment took command of the Fort Monagh area of Republican South West Belfast for a four month *Op Banner* tour. The Regiment was the twenty-third unit to operate from Fort Monagh since the Fort was built in 1972, and unknown to the Regiment at the time, was destined to be the last. During the tour force reductions were planned; the Regiment was not replaced and on its return to BAOR, Fort Monagh was demolished.

The Regiment therefore retains the unique distinction of being the only Sapper Regiment ever to operate in the Fort Monagh tactical area of operation (TAOR) which, during this tour, encompassed the Andersonstown, Riverdale, Ladybrook, Lenadoon, Suffolk, Twinbrook and part of Dunmurry areas of South West Belfast. For those who do not know the area, it is predominantly RC except for a small and diminishing Protestant population enclave in Suffolk opposite Woodbourne Camp. The housing is all comparatively new, ranging from the Old Andersonstown houses in the north of the area built in the 1930s, through many good estates built since the war, to some ambitious schemes just commencing. The whole area is potentially a good residential area and does not contain any of the mean slums that can be found elsewhere in the City.

To look after this area, the Regiment was deployed as follows. Tac HQ was based in Fort Monagh which, rather surprisingly, but hallowed by tradition, was actually outside our area, just inside the Springfield Road Battalion area and therefore shared with and guarded by a company of that battalion. Echelon in the grounds of Musgrave Park Hotel was also outside the Regimental area across the M1 Motorway in 10 UDR area, but guarded by ourselves. The patch itself was a two-company patch with 16 and 39 Field Squadrons, both with four troops twenty-six strong based at Glassmullin and Woodbourne Camps respectively. The Regimental ORBAT was completed by the Close Observation Troop, also based at Glassmullin. There was actually a further troop which had been destined for Woodbourne, but at twenty-four hours notice it was permanently detached on arrival to the North Howard Street Company of the Springfield Road Battalion to offset lack of manpower against the greater threat up there.

Aim

The purpose of this article is to describe some of the problems encountered during

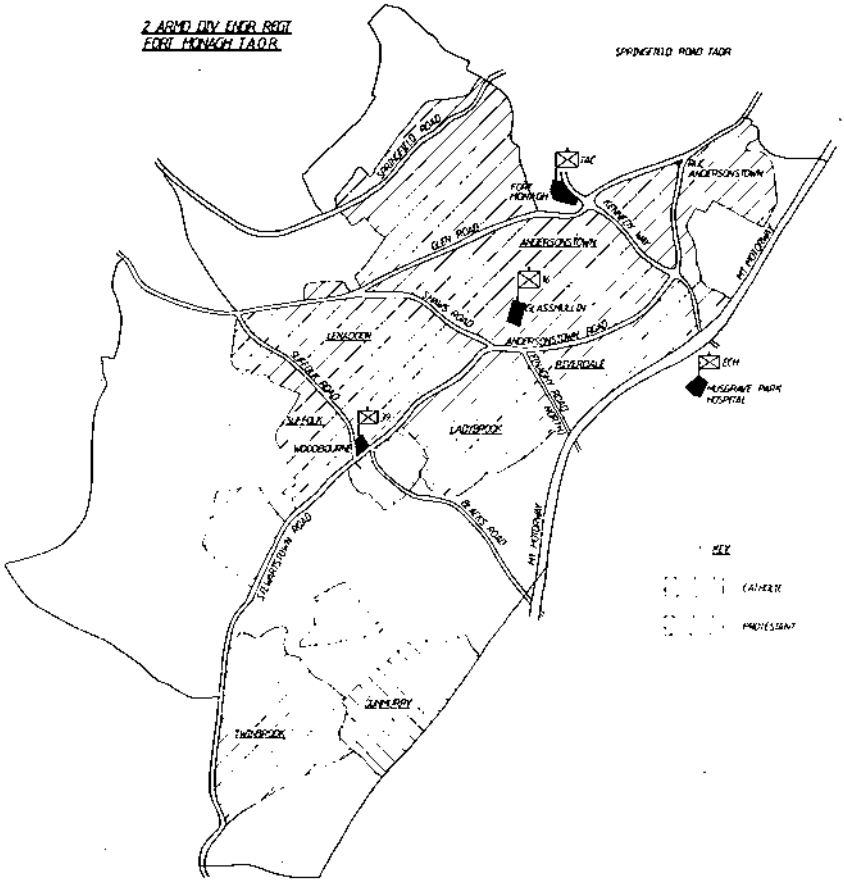
Sappers in Fort Monagh (5)
Lieut Colonel G B Fawcus RE MA

preparation for and on the tour itself, whether peculiar to Sappers operating in this unnatural but increasingly familiar role, or of more general concern, in the hope that others, particularly those from non-infantry units, may find their description useful or at least interesting.

The Numbers Game

In BAOR in normal times the Regiment consists of four squadrons—12, 16 and 39 Field Squadrons and 43 Field Support Squadron—and of course its Regimental REME Workshop. Together these make up an establishment of 895 all ranks, and the Regiment was required to go to Northern Ireland at a strength of some 450. This would appear to pose little or no problem, but a number of factors conspired together to make this seemingly easy target anything but simple to achieve.

BAOR Sapper policy is that the divisional engineer regiments shall provide for Northern Ireland in their turn both a regiment in the infantry role (an *Op Banner* Regiment) and a field squadron in the engineer role (an *Op Descant* Squadron) not at the same time but consecutively, and continue throughout to maintain engineer support to the division in BAOR. 12 Field Squadron did the *Op Descant* tour first; to support the BAOR division effectively on their return, in the absence of the Regiment on *Op Banner*, the Squadron needed a fair slice of resources support (bridging, plant, etc) as well as the normal administrative barrack support, all of which represented a significant manpower bill. 12 Field Squadron actually returned from the



Op Descant tour after the Regiment had started its *Op Banner* training, and during this period before 12 Squadron was operational in BAOR the Regiment was required to send two separate troops, each some forty strong, to train with battle groups at the Suffield Training Area in Canada. To round off the manpower problem the Regiment was one hundred under strength some six months before the tour started, and although this was more or less made up it was not completed until well after training had started. All this taken together meant that the Regiment started training considerably under strength, although in the end went to Northern Ireland at about the strength required.

The only way to produce the *Op Banner* Regiment was to cannibalise 43 Field Support Squadron, which thereby ceased to exist, and to break up, throughout the Regiment, established squadron and troop organisations in order to regroup individuals to achieve the new organisation. On return from Northern Ireland the process had, to a great extent, to be repeated in reverse and we have lost the long term continuity of groups of men that is such an important factor in morale and "the will to win".

The loss of BAOR skills, largely compensated for by the excellent leadership training, attendant upon a Sapper *Op Banner* tour is well understood now. What may not be apparent is the continuing adverse effect of the staggered *Op Banner/Descant* cycle. For the last fifteen months one part of the Regiment has been training for or taking part in a Northern Ireland tour. In eight months time the cycle starts again. 12 Field Squadron is out of phase with the rest of the Regiment and as long as Northern Ireland continues is likely to remain so—it cannot be changed without sending a squadron back unacceptably soon after its last tour. The Regiment therefore spends the majority of its time split into two parts doing different things. This is satisfactory neither from the point of view of operations nor Regimental morale.

Training

GENERAL

Training for *Op Banner* is nowadays well understood. There is much detailed official documentation, extremely professional advice and assistance from the Northern Ireland Training and Advisory Team (NITAT) and, in the case of a non-infantry unit, the further assistance of an infantry officer and some NCOs attached for the period of training. There is no need for me to go into all aspects of training and I shall deal only with those aspects of particular interest or concern to us as Sappers. It should be remembered that we are Sappers and not infantrymen and therefore there are certain required skills, second nature to an infantryman, which we have to practise hard to master.

LEVEL OF ACTIVITY

Perhaps one of the most difficult aspects of training is to put over to the soldier the "feel" of, and the level of activity in the area. This must be so, but even though both NITAT and the unit stress the difference between the operational and the training level of activity it is difficult for a soldier who has not been there to visualise what it will be like, and those who have been there before merely visualise it as it was then, which could be totally different from the present. For instance, the Fort Monagh area has been wild and rough in the past but during our tour was quiet and returning fast to normality; the attitude required in each case is totally different and if misunderstood could lead to unnecessary problems. Three things could help to remedy this; the NITAT team could include in their excellent presentation a briefing on the specific area to which the unit is going; the unit in the particular patch could make for its successors a videotape "Down Your Way" type programme including interviews with local councillors etc as well as geographical shots—better still, the brigade could perhaps get a professional company to make the programme; and lastly, the unit currently in Northern Ireland could send a couple of troop and/or "brick" commanders to its successors' NITAT training to give a first-hand account of the current feel and level of activity.

"CHATTING-UP"

Related to this is the problem of teaching soldiers to talk to the local population when out on patrol—"chatting-up" as it is called. The importance of this was fully realised and given priority in training but was still not right when the Regiment got to Belfast, although it improved rapidly once there. Some soldiers are naturally good at it and some are very poor but all improve with practice. Chatting-up other soldiers, or their wives, even if from other units, is somewhat artificial and is not the complete answer because soldiers do not react like civilians in Belfast, and in Germany you cannot send soldiers out into the town on chatting-up projects because of the language problem, although this is recommended as a successful method in the United Kingdom. The Regiment made a video film on the right and wrong ways to

Photo 1a & b. Sappers "gaining the goodwill of the local population." "Chatting-up" is a difficult skill to practise in training

Sappers in Fort Monagh 1a,1b

deal with and chat-up the locals, but an amateur film does not come over well. There is room for a professional film; it would not be difficult to make.

The real problem is giving soldiers practice in this unfamiliar skill. In the end the soldiers had received little practice but had all been well versed in the theory of chatting-up. They had been taught how to approach an individual, the attitude to adopt, the effects of the right and the wrong attitudes upon the local population, and they had been given instruction and ideas on what is possibly the most difficult aspect—that of knowing how to start up the conversation with the locals. This produced an acceptable minimum standard on arrival in Belfast, and by then putting a great emphasis on this aspect, the soldiers quickly acquired practice on the real thing and in a matter of days became really quite good. Practice is definitely the key, but is difficult to provide in training in Germany. Nevertheless our experience was that as long as the soldiers are absolutely clear on what is required—and this entails much instruction and demonstration—they very quickly become competent on the streets of Belfast by being forced into doing it.

THE LAW

Having got the soldier into contact with the local population he needs to be pretty sure of his legal powers. The average man in Belfast is very clear on his rights, or thinks he is, and to give the soldier the confidence he needs he, too, should be master of such things as what questions the civilian has to answer, what he may or may not do in searching a car or a person and so on. The soldiers were, of course, given the normal instruction on such matters during training, but this did not always cover in sufficient detail the problems that the soldiers sometimes encountered with awkward customers on the ground. A soldier in trouble can always ask for advice on the radio but this is not the most satisfactory answer, and detailed practical knowledge of the law on the sort of incidents he is likely to encounter is much better. During the tour a number of advertisements were published in the Republican press giving detailed advice on civilians' rights in such matters. They were normally wrong, but the soldiers when confronted with action based on these would not know the answer. It would be most useful to have copies of such advertisements in training so that the soldiers can be instructed in their detail.

ORDERS

Operationally there are a number of things that Sappers need particular practice at. Sappers are not good at giving clear detailed orders, particularly not for the sort of multiple patrol operation which was the staple diet of the troops. Patrol commanders do not get enough practice at it purely by giving orders for training patrols, and must be given much extra practice. This is very simply done as a Tactical Exercise Without Troops (TEWT), getting them to give orders using the actual TAOR maps exactly as they will do on operations. They cannot have too much of this, but of course these orders must be carefully monitored for operational viability and method of delivery.

THE MULTIPLE PATROL

The technique of the multiple patrol itself, about which most of the practice orders will be given, is not one familiar to Sappers and must be practised constantly on the ground. It is a major defence against the gunman and the control procedures must become second nature to patrol and "brick" (half section) commanders, so that patrols can proceed without constant chat on the radio net. At the same time ordinary brick members must be quite clear on how to achieve all-round defence within the brick as well as their responsibilities for defence of the rest of the multiple patrol. Before any multiple patrol exercise there must be proper, full orders and after the patrol there must be a debrief for all the patrol, and the "gunman" must be present and join in. He can tell the patrol how vulnerable he found them and allow them to pinpoint and put right any weakness. The big problem with multiple patrolling exercises is finding suitable areas; the home barracks very soon becomes too small and well known, and there is no question of training in the local town. The use of neighbouring barracks helps, and the extension of NITAT training facilities will be of great benefit, although patrolling techniques ideally should be perfected

before the NITAT package which takes place at the end of the training period. The Regiment's techniques stood the test; initially in Belfast there was too much unnecessary control talk on the radio, but this disappeared as confidence grew.

ACTION ON "CONTACT"

Having learned to patrol, soldiers must be taught how to react on a "contact"—a terrorist shoot at a patrol—something that is certainly not second nature to Sappers. After a shoot there is not time for orders, and brick commanders must make an instant appreciation and then act decisively. To do this the brick commander needs to know his brick's position relative to the other bricks in the multiple (good initial patrol orders should provide this information) and he needs to get from the "contact report" the sender's callsign, the location of the fire point (if known) and the impact area. Armed with this he can and must make an instant decision on how best he can act to deal with the gunman, and then implement it fast. This instant appreciation is a difficult and unpractised skill for a young Sapper brick commander, and all patrol exercises should practise them at it and their reaction should be discussed at the debrief with the aid of a blackboard.

In the event the Regiment had no "contacts" during the tour and the training was therefore never tested. How much of training for this difficult and unfamiliar skill would have been remembered in the split seconds requiring action, had there been a contact late in the tour after weeks of nothing, is a matter for speculation. I believe (and hope!) that with the extremely thorough training, together with constant reminders during the tour, the contact procedures would have been remembered and carried out effectively.

THE OPERATIONS ROOM

To control all this activity the squadron operations room must be trained to a pitch much higher than is necessary for the control of a normal Sapper operation. They need to grip the radio net, emanate confidence and competence, show sympathy to bricks on the ground, instil urgency and give direction to those bricks, and learn which decisions are best made in the operations room and which are best left to the commander on the ground. They can and will get good practice during the NITAT package, but one cannot rely on leaving the training that late. Simple telephone battles need to be run beforehand, using the actual TAOR maps during which all likely scenarios (shootings, bombings, riots etc) can be practised.

MENTAL VISION

Finally there is the need to develop in the soldier what may be termed mental

Photo 2. Sappers support the RUC on the streets of Belfast

Sappers in Fort Monagh (2)

vision. All ranks need to look ahead, anticipate problems and out-think the terrorist, for by so doing they will reduce the risk to themselves and considerably lessen the chances of being set-up by the terrorist. The Sapper JNCO is already taught to look ahead on a normal Sapper task in order to make the plan, order the resources and so on, but this does not add up to the sort of mental vision that is needed to outwit the terrorist. To a certain extent the training on "contact" procedure described above develops this mental vision, but one is trying to achieve more than this; one is aiming to cultivate a permanent attitude of mind so that the soldier develops such a level of awareness and insight that ideally he never allows himself to get into a potential "contact" situation in the first place.

This attitude may be encouraged by holding two-sided games on models of the TAOR. Each of the Fort Monagh squadron bases had a model of its squadron TAOR and these were traditionally sent to the succeeding unit during its training period. These were ideal for the game, although failing the TAOR models, any model of a similar area would do. One side in the game (a soldier or group of soldiers) plans one, or maybe more shoots in detail including the escape details. Meanwhile the other side plans a multiple patrol. Neither side tells the other their plans. Then the "patrol" starts, using some means to indicate its positions as it moves along. The gun team decide if and when it can realistically execute a shoot on the patrol and if it can, it does so. The patrol then carries out its immediate "contact" action and having done this the gun team then show its escape plan; one can then see if the patrol might have caught the gunmen. The great value of the game is that it gets both sides thinking hard about what the other might be doing throughout the patrol, and it pits the wits of one man (or group) against another in just the way that may happen in Northern Ireland. It makes both sides more aware, better able to anticipate the problem and gives at least a little bit of practice in how to out-think the terrorist. It is a worthwhile method of developing this essential mental vision.

Operations

SITUATION

And so to the operational problems encountered on the tour. A few words first on the situation as we found it. The area had been comparatively quiet for some months although terrorists lived in the area, moved through it, probably operated from it and almost certainly hid weapons in it. Nevertheless, as far as the normal civilian population was concerned it was returning to normal. There were still a few areas where the Royal Ulster Constabulary (RUC) did not patrol; one of our tasks was to help them extend their patrolling presence as much as possible. On our arrival and for some three weeks afterwards, there was a spate of shootings at Security Forces in uniform and plain clothes, most of them in the Springfield Road TAOR to our north but a couple just inside our border. Incidentally, although we were not to know it on arrival, and therefore it could not colour our appreciation, we had no further shooting or bombing incidents directly involving the Security Forces, and no Security Forces were killed or seriously injured in our area. We did have our share of murders, knee-cappings, robberies, one bombing and hoaxes, but compared with wilder, earlier times these were not great in number. Incidentally an alert brick did catch two armed bank robbers, after an exciting vehicle chase, and returned £32,500 to a grateful bank manager.

CONCEPT OF OPERATIONS

But back to our arrival. The first thing to do was to decide how best to operate. We were quite clear that we were there in support of the RUC and that they should take the lead and be seen to be doing so. B Division of the RUC with whom we worked are good and this too was their aim. The Squadron TAORs were huge and there was no question of maintaining a large patrol presence throughout the TAOR, nor of dominating the whole TAOR by troops on the ground. Indeed, it was some time before a soldier had patrolled everywhere in his TAOR, let alone got to know it well, when one remembers that of the four troops in a squadron, two per day were on

guard duties, one was the reaction force and only one was on patrol duties. We therefore could not hope to know the patterns of the whole area so well, and keep such an eye on it, that we could spot for certain the indications of terrorist activity. We therefore patrolled basically for three reasons; firstly to provide cover to the RUC to allow them to carry out their tasks; secondly to deter the terrorist from having a go at us or the RUC, and finally to win the support and the goodwill of the local population.

COVER FOR THE RUC

Providing cover to the RUC was a comparatively simple matter affected by three factors. The first was the method of cover. In the long term the aim is for the police to patrol on foot in pairs without military cover and do normal "neighbourhood police" tasks. The situation at present does not allow this and the RUC would be at extreme risk if they attempted it in some areas. However, it seemed to us that we should help them towards this end by superimposing our cover upon the area of their patrol but allowing them to patrol to all intents and purposes on their own, instead of closely escorting them as was the normal practice. We therefore patrolled an area with one or more multiple patrols, whilst the two RUC constables walked the beat, albeit with a radio on our net, but with no further co-ordination other than that they remained within the delineated area. Our presence in the general area gave them all the protection they needed. Although the local population was aware of the military presence, what they saw was policemen going about their business unescorted and on foot in a normal manner. It was interesting how the local population, with notable exceptions, quickly welcomed this show of normal law and order and how swiftly the confidence of the police and indeed their safety grew as they got to know and became personally known and accepted by the locals. There is a long way to go yet but as this confidence and acceptance grows and as the situation allows, so the military presence can be gradually reduced, whilst the RUC continue to patrol as before, until in the end perhaps the military presence can be completely withdrawn and the support to the neighbourhood police be provided by a mobile police reaction force somewhere in the vicinity. This is some way off yet, and must not be rushed. It requires more police, which are being recruited, and it could be set back forcefully at any time, although there is a snowball effect and as the police get to know their "neighbourhood", so they become accepted and respected, the community get to know them

Photo 3. A "brick" as part of a multiple patrol—"a major defence against the gunman"

Sappers in Fort Monagh (3)

personally, look after them and keep them from harm. Maybe this situation will never come about but our experience in South West Belfast made us optimistic.

The second factor concerning cover to the police was an essential part in building their confidence. If cover for an RUC patrol is promised it must be provided without fail throughout the duration of the patrol. This sounds so obvious as to warrant no mention, but neighbourhood police morale had been severely dented more than once before our arrival by units who had used a reaction force to provide RUC cover, and then removed this cover without warning when an incident took place, leaving two RUC constables on their own in the middle of a perhaps hostile area feeling distinctly naked.

Finally, it is essential that there is very close full time liaison at squadron level to ensure that military cover for routine RUC patrols and RUC presence on other routine military operations is tied up to best effect. This, too, sounds obvious but clearly does not always happen, with the result that the two branches of the Security Forces tend to work separately and the vital need at this time for the military to work in support of the RUC and for the local population to see the RUC taking the lead, is not satisfied.

DETERRING THE TERRORIST

Operating to deter the terrorist was an attempt to out-think him, to get him guessing and to keep him permanently unsure of what we would do next. It was aimed at breaking our routine and posing to him too much of a threat for any operation he might consider mounting. Incidentally, he never did have a go at us or the RUC within our area, although we learned after the events that on at least two or three occasions he did try. Perhaps, like NATO, we were more successful than we realised. Deterrent measures involved the following simple activities:

(a) Checking during a patrol by knocking at the door and talking to the occupants of the houses overlooking our base camp, RUC stations and the "white" roads (the main roads through our area), all of which are favourite terrorist hijack houses, with the aim, not of catching a gunman but of letting him see us do this and thus deterring him.

(b) Flooding an area with up to eighteen bricks—instead of the routine four to six—so that the potential gunman never could be sure how many bricks we would or did have on the ground. This we did either with reinforcements from the resident battalion; or getting both squadrons to patrol simultaneously either side of the inter-squadron boundary; or giving one squadron responsibility for reaction to all incidents in the Regimental TAOR except for one particular area into which the

Photo 4. Lighter moments in Belfast; Sally Nicholson, the Regimental pin-up, pays a welcome visit

Sappers in Fort Monagh (4)

other squadron could therefore deploy its patrol and reaction troops together with any other available bricks; or a combination of these. We rarely deployed bricks from one squadron into the other squadron's area because the size of the TAORs was such that the troops needed all their time to get to know their own areas, and did not therefore know each others' well.

(c) Nominating one or two days each week, called "Pig days", when only armoured vehicles were used within the TAOR. This broke up the pattern of the vehicle movement and gave less regularity to soft vehicle targets moving in and out of bases, and allowed us to change our vehicle pattern without the terrorist realising it.

(d) Ensuring a conscious effort by everyone to avoid setting any sort of pattern in anything, particularly in patrol movements, vehicle routes and timings, and entry and exit into bases—this latter being by far the most difficult.

(e) Requiring everyone to fire his rifle once a week on the pipe range in the squadron base. The locals could hear this considerable use of the range and were therefore aware that continuation shooting training was being taken seriously.

WINNING THE SUPPORT OF THE PEOPLE

Although we were anxious to get the RUC leading as much as possible, our soldiers still had constant daily dealings with the local people. The relationship they struck up was vital in gaining the goodwill of the locals, thus lessening support for the terrorists and directly enhancing our own safety. Much is made of this in advice for training and of the need for the right attitude on the streets, one that is "firm, fair and friendly". We placed great emphasis on this in training, and continued to stress it on arrival, together with emphasis on the related matter of "chatting-up" already discussed above. This paid handsome dividends and undoubtedly led to a lessening of tension and put the population to a great extent on our side. We went out of our way to inconvenience people as little as possible, and where inconvenience was necessary the soldiers were apologetic, explained what they had to do and why, and in all things tried to show that what they were doing was for the benefit of the people and not from a desire to harass them.

Soldiers were instructed to take an interest in people they had to deal with or talk to, and to treat them as decent citizens who they, the soldiers, were keen to help. Sometimes the approach drew mere abuse, but in general worked wonders. The situation in the area in rough times in the past has not always allowed this approach but the situation was ripe for it on our tour and was welcomed and appreciated. To a certain extent the Regiment was well placed to adopt such an attitude not having been to the area before and having few men in the Regiment with much experience of attitudes in hard areas in very different times. The soldiers therefore started with no preconceived notions and were able to adopt their attitudes perhaps more easily than, say, an infantry battalion that knows that or similar areas well and has been battle-hardened in darker days.

Of course active terrorists and hooligans were treated a deal more "firmly" and nor did we believe that because we were being nice to people and they to us, that nothing was going on under the surface. The area is most certainly not yet free of terrorist activity, but anything that can make the local population better inclined to the Security Forces detracts from the power of the terrorist. Proper multiple patrolling is probably the best defence against the gunman, and this always assumed a high priority on our training and during the tour but we also believe that the right attitude to the locals positively enhanced our safety in great measure.

MAINTAINING ALERTNESS

The last operational problem worth mentioning is that of keeping the soldier on his toes, and also of convincing him of the need to continue patrolling, when the area is quiet. When incidents are few and operations fairly routine, the soldier's level of alertness is likely to drop. Alertness is one of his greatest defences and one that has led to the lack of incidents in the first place, and so it is vital to maintain this alertness. Every patrol must have a specific task or tasks; there must be no patrolling just for the sake of patrolling. Moreover, commanders must be able to communicate fear. The

Photo 5. The H Block March on 1 Jan—the Commanding Officer and Commander RUC B Division co-located for joint control of Army/Police action

threat was there alright; the soldier had to be made to realise it, and sometimes a bit of embroidering of the situation to ensure that the message had got through proved useful.

Imagination is also required to ensure that operations do not become so routine and dull that soldiers become bored, see no reason for what they are doing, and switch off. Anything that can be done to vary routine operations or present them in a different light, helps to make the soldiers think and remain alert. Regimental operations (as opposed to the routine squadron operations), projects undertaken by troops to monitor and analyse the movement and associations of certain people, and general variety helped to avoid this problem.

Conclusions

We had problems in producing the numbers required for Northern Ireland. Everybody does, but we were more fortunate than some in that we finally arrived with the right number—too many possibly as one troop was immediately taken away from us! To achieve this, and retain a capability in BAOR, the squadron and troop structure within the Regiment had to be broken up, and then go through further turmoil to reverse the process at the end of the tour. Soldiers definitely suffered with this turbulence.

Some of the matters that we knew needed emphasis in training we found difficult to provide because of a lack of facilities. But overall the training was sound and the content correct, due in large measure to the excellent machine which has been refined over the last ten years to direct and advise the training of a unit.

Operationally, we arrived in an area where the situation was ripe for the RUC to take the lead and to be seen to do so. From top to bottom we found B Division of he RUC a professional force keen to take this lead. We supported them and extended considerably their neighbourhood patrolling presence and the confidence that went with it. The area was far too large for us to dominate it militarily or maintain a continuous presence throughout the area, so we operated to protect the police, deter terrorist operations and to win the support of the people. We like to think that our methods led directly to the fact that no police or army were killed or seriously injured by terrorists in our area, that tensions lessened and that the RUC increased their

Sappers in Fort Monagh (5)

presence. We did not escape all terrorist activity however and had our share of murders, knee-cappings, robberies and hoaxes to remind us that the area had not yet returned to proper normality.

All TAORs are different, geographically, demographically, criminally, economically and politically. The aims, techniques and methods of operation that are right for one cannot be applied automatically to another. We are only too aware, for instance, that in the Springfield Road TAOR immediately to the north the techniques applied had to be different in a much denser area. Since our departure the two TAORs have been combined and we can only but wish good fortune to the Commanding Officers who have to direct operations across this huge and varying urban area, particularly as we learn that the terrorists have recently resumed action against the Security Forces in our old area.

The object of this paper has not been to tell others how it should be done but to put forward some of the problems we met and how we overcame them, if indeed we were able to do so. If someone destined for the Province in the future finds anything of use within, or indeed if anyone has read this far through pure interest, the article will have succeeded in its purpose.

Charles Gordon
Major General, Royal Engineers
1833–1885

MAJOR GENERAL A E YOUNGER DSO, OBE

The Author was commissioned into the Corps in 1939 and served during WW2 in the Dunkirk Evacuation, the Normandy Landings and in Holland and Germany. Later he served in Burma, Malaya, Korea and Kenya. After being Chief of Staff at HQ AFNORTH in Norway 1970–72 he became Chief of the Directing Staff at the Royal College of Defence Studies and retired in 1975.

This article owes much to *Charley Gordon*, an excellent biography by Charles Chevenix Trench recently published by Allen Lane, London.

The death of General Gordon, two days before his fifty second birthday, was an event that shook the society of his day to an extent that is too easily forgotten now. Although less than a hundred years have passed since that fateful day in Khartoum, Gordon's whole career illustrates graphically the amazing changes that have taken place.

Charles Gordon, Maj Gen RE, 1833-1885
Major General AE Younger DSO OBE

His father, who rose to be a Lieutenant General, sent three of his sons to the Royal Military Academy, Woolwich. Charles, the youngest, entered aged sixteen and was commissioned aged nineteen in June 1852, having lost six months seniority for hitting a junior on the head with a hairbrush, an early example of his hot temper.

In those days the Royal Engineers was a Corps of Officers only, which was rapidly becoming a *corps d'elite* because of their all-round military competence. The Rank-and-File were the Corps of Sappers and Miners and were thought of as "very fine, intelligent fellows", the envy of other regiments. Battles still tended to be mass attacks in which it was difficult for any individual to distinguish himself. Engineer Officers had many more opportunities since they were responsible for such tasks as placing ladders against walls for storming parties, exploding powder bags against gates of forts and staying behind with a rearguard to demolish bridges. In times of peace, these same Officers spread over many of the lesser known parts of the globe exploring and surveying mountain passes, rivers and jungles, building roads and railways where none existed and, of course, constructing forts in remote outposts. Perhaps because of this wide experience of the world it seems that they were selected frequently to command native irregulars, a task that was to fall to Gordon early in his career.

After nineteen months of technical training, this young Subaltern was sent to Pembroke where fortifications were being constructed by the Corps. The six months that he spent there were unremarkable, except that he was introduced to religion by a fellow Officer and thus started his lifelong interest in and study of the Bible.

It was the Crimean War that cut short his first posting. Casualties had been heavy in the great battles of Alma, Balaclava and Inkerman, but even these were being eclipsed by inroads made by the Russian winter on hopelessly unprepared troops as they attempted to lay siege to Sebastopol. However the horrors of so-called hospitals, filled with men lying in their own ordure as they died from cholera and dysentery, were not apparent to the robust young Gordon as he moved up the line. He was immediately involved in basic Sapper tasks like digging drainage ditches, clearing snow from trenches and blasting battery positions out of solid rock, but it was in field sketching that he made a reputation. His ability to record what he saw with a pencil is still clear from the detailed sketches left in his letters and journals, and he quickly demonstrated his fearless nature by exposing himself for considerable periods to enemy fire whilst he recorded Russian fortification in detail.

He made some lifelong friends in the harsh environment that he found himself in, including Gerald Graham, the Sapper who won a VC at Sebastopol and Garnet Wolseley who was to become a Field Marshal. His technical proficiency was extended when he helped French Engineers to demolish the docks with explosives after the capture of the port and also after the Peace of Paris when he was posted for three years to survey the new Russian-Turkish boundary in Bessarabia and Armenia.

By the end of this time he had had his fill of the Taurus mountains and was pleased to be posted back to Chatham as Adjutant of the Depot in May 1859. However the delights of home service were not for him and after a year in the job he applied for a posting to China where a promising little war was developing. His views on his time at Chatham are summed up by the heavy irony in his warning to his successor that "you will need at least eighteen pairs of spurs as you require them on all occasions. Sleeping in them is a nuisance at first, but you soon get used to them".

It is surprising to realise that only just over a century ago Britain went to war with China to allow the import of English manufactured goods and Indian opium, which was stronger than the locally produced variety and therefore preferred by addicts. Assisted by the French, the British expeditionary force seized the forts at the mouth of the river leading to Peking and then marched on the capital. Gordon arrived just in time to join the march and the subsequent pillage and destruction ordered by Lord Elgin, Her Majesty's Government representative, to teach the "Son of Heaven" a lesson. Gordon thoroughly disapproved of the vandalism that ensued, but he did secure "part of the throne out of the Summer Palace, beautifully carved" for the RE

Mess at Chatham and "a curious cup" which he sent to his brother Henry with the comment "I am afraid to say how much gin has been drunk out of it".

When things quietened down Gordon was involved in building quarters for the troops and his lifelong concern for the poor showed itself. On his initiative money was collected and he invited the local mandarins to select suitable recipients from the Chinese population. However, they flatly refused to be involved in such a preposterous scheme, so Gordon invited the needy to attend a public distribution of cash; for the event some three thousand people arrived and in the ensuing scramble eight were trampled to death.

The course of history then took one of those unexpected twists that crop up not infrequently. A Christian inspired movement started in Taiping with an all-embracing doctrine that "The Heavenly Father sits on the Throne above. The Heavenly Brother, Christ, is the most honourable, sitting on the right of the Father, excelled by no man. By the grace of the Father and the Brother we sit on the left. United as one we reign. Disobey the Heavenly Will and you will be ground to pieces with a pestle". This sect, known as the *Wangs*, were initially very successful and over-ran the great cities of Nanking, the Southern capital, Soochow and Hangchow and the rich provinces of Kiangsu and Chekiang. They then moved on Shanghai, the main port for foreign trade and the richest prize of all. The wealthy merchants there saw the threat to their livelihood and privately raised a force with the optimistic title of the Ever Victorious Army (EVA). Two American soldiers of fortune were commissioned to command the force, but one was soon killed and the other was drunk so frequently that he proved useless. The threat to Shanghai increased until the British government sent a force to protect it, in which the Sapper detachment was commanded by Gordon. The rebels were in the stronghold of Tsingpu, thirty miles to the west and Gordon promptly distinguished himself by sketching the defensive layout under fire and by directing the crossing of the creek that defended the city and the scaling of its wall. After this successful operation the British troops withdrew, but the problem of quelling the rebellion remained. The Governor of Kiangsu Province asked the British to provide a joint commander for the EVA to expel the Wangs and Gordon was chosen for the job, together with a tactful nonentity, Li Adong, who contented himself with administration.

Gordon's professionalism as a commander became evident at once. First he mapped the waterways that criss-crossed the area and then by a series of unexpected amphibious moves he brought his artillery close to the forts of his opponents, smashed gaps in the walls and led his troops to success after success. The troops that he first commanded were little more than a rabble and it speaks highly for Gordon's personality that, speaking little or no Chinese, he was able to lead them so successfully. His casualities were considerable but he was able to convert prisoners taken to his own use and in that way maintain his strength at the expense of his opponents.

Honours showered on him, including the title of *titu*, the highest in the Chinese Army, the Yellow Jacket granted to the top fifty mandarins in China, and from his own government a CB and a brevet Lieutenant Colonel rank. Also his name hit the headlines of the British press for the first time.

Gordon was entitled to twenty-two months leave when he returned home from China in 1865, but this proved too much for his restless spirit. After seven months he applied to return to duty. Not for the last time the Corps showed scant appreciation for the capabilities of one of their most gifted and experienced members and sent him to Gravesend to command the Sappers building forts in the Thames estuary. Since his military responsibilities were so slight, he turned with almost frenzied zeal to attacking the poverty he found all round him. He opened the gardens of his official residence as allotments, helped needy families from his pay and was a constant visitor at the Workhouse Infirmary, with tobacco to be given to men there and tea for the women. But it was the youth of the neighbourhood that he really worked for, setting up a school at his own expense in his house, providing the pupils with clothing and food and finally obtaining jobs for them, often in the Army.

It is this period of his life that some authors have used to show that he had homosexual tendencies. Needless to say, there is no direct evidence one way or the other. Certainly he never married, but he did cut himself off from his own social class by persistently refusing invitations to dinner. His energy was directed increasingly into religious channels. He churned out a succession of tracts, which he had printed at his own expense and then he distributed them personally in the streets to passers-by, much to the amazement of his Subalterns.

During this period he volunteered unsuccessfully for service in the Abyssinian and Ashantee wars, and finally accepted without noticeable enthusiasm the post of British Commissioner on the international commission set up after the Crimean War to regulate navigation in the lower reaches of the Danube. For two years he served in this remote military back-water until, by chance, he met the Egyptian Prime Minister on a visit to Constantinople. The latter was looking for someone to replace Sir Samual Baker as Governor of the Equatorial Province of the Sudan and, no doubt swayed by Gordon's undoubted charm of manner, asked the British Government for his services.

Gordon's problems on his first appointment in the Sudan could hardly have been more difficult. What the upper reaches of the Nile lacked in amenities it provided in diseases and discomfort. Once there, Gordon was totally cut off from his superiors in Cairo other than by Nile river steamers. His Headquarters at Gondokoro, more than a thousand miles up-stream from Khartoum, was filled with disgruntled Egyptian troops who had been sent there in punishment for serious crimes committed in the comparatively luxurious provinces of Lower Egypt. When short of food these troops would sally forth and fill their needs from local villages, whose inhabitants naturally hated them. Apart from some ivory, the main export was slaves to satisfy the seemingly inexhaustible demands of Egypt and other Middle Eastern countries.

Spurning advice from Cairo, which he considered to be an indolent and infinitely corrupt city, and cutting down his own salary from the £10,000 a year of his predecessor to £2,000, he flung himself into the task of setting up new stations up and down the river. The rich slave traders at first circumvented the new posts by bribery, but gradually Gordon's measures took effect. The vociferous Anti-Slavery lobby in England were delighted, but the practical Gordon noted that the slavers now drove their charges over great areas of desert that he was quite unable to patrol. For the slaves a comparatively safe and speedy trip northwards by boat had been exchanged for an endless march during which many died.

In the enforced loneliness of Gondokoro Gordon became more and more solitary, sometimes shutting himself off for days on end with his Bible, a supply of brandy and endless cigarettes. His temper showed increasingly in furious outbursts at anything he considered to be slipshod or careless, but in spite of threats of dire punishment he would soon cool down and forgive the offender. He certainly inspired fear, but he could also compel love, and those bright blue eyes in his sunburnt face could "charm the birds out of a tree."

Returning home on leave in 1876, he was persuaded by his Sapper friend Gerald Graham VC, to undertake the job of Governor General for the whole of the Sudan, with a prime objective of sealing off the desert slave routes, which could not be controlled from his old posts. From 1877 to 1880 he set about this task, together with the countless other responsibilities of government. His great camel journeys across the desert to visit outposts became a legend for their speed. He continually questioned all sorts of people about their religious faith and developed a strong respect for Islam "I find the Musselman quite as good a Christian as any Christian," he said, "He is not ashamed of his God; his life is a fairly pure one; certainly he gives himself a good margin in the wife line, but at any rate he never poaches on others."

Largely by the expedient of encouraging non-slaving tribes to harry slaving tribes, he cut down this unpleasant trade very considerably. But Gordon knew well that it would never cease until the demand for slaves from Cairo and other populous areas dried up.

Whilst this hectic period in Gordon's life was running its course, on an island 200 miles up the White Nile from Khartoum a lonely ascetic was fasting and studying the Koran. In 1881 he was to declare himself the Successor of the Prophet of God, the *Mahdi*, who would purge the Moslem world of unbelievers.

In 1879 Gordon left the Sudan, returned to London and, after refusing an invitation to dine with the Prince of Wales, went to Ireland to find out for himself why there was so much trouble there. Horrified by what he saw, this Colonel of the Royal Engineers wrote to the Prime Minister, Lord Northbrook at the Admiralty and to a Sapper friend for transmission to *The Times*.

"I believe these people are patient beyond belief, loyal, but at the same time broken spirited and desperate, living on the verge of starvation in places in which we would not keep our cattle. The Bulgarians, Anatolians, Chinese and Indians are better off than many of them are. . . . I am not well off, but I would offer Lord Lansdowne or his agent £1,000 if either of them would live for a week in one of these poor devils' places, and feed as these people do." In these days of inflation we must remember that his offer would be worth nearer £100,000 today, but needless to say it was not taken up.

In May 1881 a fellow Sapper Colonel gave up a posting to Mauritius and Gordon took this. He found the social life there hateful and spent most of his time in proving to his own satisfaction that the Bible clearly indicates that the Garden of Eden was in the Seychelles.

In March 1882 he was promoted to Major General and sent to Cape Colony, but resigned his job there after a flaming row with Government representatives in Cape Town, who rejected Gordon's recommendations on the handling of the Basuto tribe. After a trip to Palestine, during which he studied the accepted maps of Biblical times and decided they were all wrong, he returned to England in December 1883.

By then the Sudan was in a ferment, with the Mahdi's newly formed army having success after success against tribal and Egyptian Government forces. A Colonel Hicks, of the Indian Army, was sent to Khartoum and led an army of 10,000 men against the Mahdi, only to have the army annihilated, whilst he himself and all his staff were killed. Gladstone's Government in London were most reluctant to undertake the expensive task of launching an expeditionary force to attack the Mahdi and when the newspapers clamoured for Gordon to be sent there, accepted this cheap alternative. After all, Gordon was believed to be popular amongst many of the tribes there and he certainly knew the country better than probably any Westerner.

By the time Gordon reached Khartoum, the Government had decided that the only short term solution was to evacuate all non-Sudanese from Khartoum, amounting to about 15,000 people, whilst some means of bringing the Mahdi to heel was being worked out, and Gordon was instructed to do this. Unfortunately Gordon's solution to the longer term handling of the Mahdi was to bring an old enemy of his, called Zebeyn Pasha, to be installed as Governor General after Gordon. Zebeyn held enormous influence with the northern Sudanese tribes, and was by far the strongest person to take on the job, but he was also well known as the leader of the slave trade. What appeared to be the sensible solution in Khartoum and Cairo was quite unacceptable to Gladstone, whose political sense warned him that the Anti-Slavery lobby would bring down the Government if Zebeyn was installed.

The arguments swayed backwards and forwards with Gordon sending enormous and sometimes contradictory telegrams to Sir Evelyn Baring, the Agent-General in Cairo, whom he disliked but who usually supported his requests and ideas, while the Government in London either refused any help or employed the bureaucratic device of delay to avoid awkward decision making.

To cut a long story short, on 10 March 1884 the telegraph lines from Khartoum were cut and the siege began. Gordon made effective use of artillery pieces mounted in various ships that he had and also prepared a wire obstacle between the Blue and White Nile, the easiest way into the city. Always the Sapper, Gordon supplemented the wire with mines activated by a match if trodden on, and these were greatly feared

by the attackers. Stores in the city were considerable and just over 2,000 people were evacuated before the siege began, but naturally stocks of food steadily diminished. Gordon's leadership was amply demonstrated by the amazing fortitude shown by the defence in hanging on for ten months against overwhelming odds. Finally the Government in Westminster, after endless delays, decided to send a relief force. The lack of urgency demonstrated was almost unbelievable, presumably because those responsible hoped that something unexpected would turn up to make the expedition unnecessary. Gradually, as month followed month, Gordon's position grew more desperate, whilst new instructions added to the delays of the relieving force. Finally food ran out and Gordon realised that he could not be saved. A flood occurred rendering his land mines innocuous and leaving a 500 yard gap between the end of his defences and the White Nile. Early on the morning of 26 January 1885 the Mahdi's forces surged in. Gordon, revolver in hand, made his enemies pay dearly for his life, but there could be no escape for him.

Victorian England, which had marvelled at his resolution under siege, was outraged at the circumstances of Gordon's death. By a spontaneous wish, money was contributed by people up and down the country for a memorial to his memory. This took the unusual form of the creation of the "Gordon Boys' Home" at Woking, which was felt to be particularly appropriate because of Gordon's known interest in education.

In 1946 the "Home", originally organised to teach trades and music (for Army Bands) was converted to be the "Gordon Boys' School". It is now a boarding school with a semi-military tradition, integrated into the national educational system and organised on public school lines. Boys with a special need are given first priority by the Governors. The School has become increasingly popular with Service-men. Its traditions appeal to them, and it meets the needs of their sons who might otherwise suffer academically from frequent changes of school. The present composition of parents is 67% from the Army (of which the RE account for 6%) and the remainder from the Royal Navy and Marines, the RAF and civilian families.

As the School is the national memorial to General Gordon its Foundation Committee has invariably attracted strong Sapper support. The present Chairman is General Sir Charles Richardson, who took over from General Sir Charles Jones in 1977. Plans are now being made to celebrate the School's Centenary, one hundred years after the death of Gordon at Khartoum in 1885.

Correspondence

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PUBLIC RELATIONS (PR) FOR THE CORPS

"If I tell you I am handsome and exciting, that is advertising. If somebody else tells you I am handsome and exciting, that is sales promotion. If you come and tell me you have heard I am handsome and exciting, that is public relations."

Sir—I would like to take the opportunity through the Journal of suggesting ways in which we could more usefully utilize Army PR resources to our advantage. A well planned PR policy would be of considerable benefit to our recruiting as well as providing a service to the public by informing them of our achievements throughout the world.

It may help if I was to first outline the PR organisation in the Army and how it can advise and assist us in telling the public of our activities. In the Ministry of Defence

there is a tri-service PR Staff under the Chief of Public Relations, who is a senior Civil Servant. Army PR is under the direction of the Director of Public Relations (Army), who is a Brigadier. He has a staff of regular Officers and Civil Servants in the Information Service who are either experienced ex-journalists, or retired Officers with a considerable PR background. There is PR staff representation at all major Headquarters in this country and overseas consisting of a balanced military and civilian staff of the Information Service similarly qualified to those in the Ministry of Defence. The Corps also has RE staff in the majority of these Headquarters and it is here that we should establish a close working liaison to gain maximum publicity. The PR staff will advise and assist in getting material of the right quality to the media. Units should also establish a close working relationship with the PR staff, as it is from the unit that the material will originate and where pre-planning with the PR staff begins. PR staff can advise the unit on how to plan its PR coverage together with advice on what the media will publish. The RE staff at the appropriate Headquarters should be kept informed of what PR coverage is planned so that they can assist the unit in its liaison with the PR staff.

In the UK, the Corps is well placed for overall PR coverage as it has a major unit either regular or TA in every District as well as units and schools in the training organisation. We are therefore in a position to cover the entire country, and I would suggest that the UK based units and RE staff are in a position to assist overseas based units in getting their material processed through the various District PR staffs. In order to establish this liaison effectively, it should be mandatory for each unit to have a properly trained Unit Press Officer (UPO). G PR Branch at Headquarters UKLF run three UPO courses each year. Vacancies are available for regular and TA units. These courses are of a high standard, with a number of lectures given by outside professional journalists. Students are taught the rudiments of Army PR and how to present material for publication. Students have been praiseworthy in their course comments and many write after their tour as UPOs saying how valuable the course was to them in carrying out their duties successfully.

Another useful method of gaining good unit PR coverage is through the "Editors Abroad Scheme". The scheme is controlled by the staff of the Director of Public Relations. Through the scheme sponsorship at public expense is available for editors and journalists to visit units overseas. Arrangements for such visits should be made through District/Division PR staffs who will organise the necessary details and movement through the Ministry of Defence. A well planned visit coinciding with a major unit activity will invariably provide excellent PR coverage.

The value of KAPE (Keeping the Army in the Public Eye) tours can be considerably enhanced by a coordinated PR campaign in advance of the tour. PR staff at the District Headquarters concerned should be asked to assist in giving the tour maximum publicity. They will also advise the unit on the timing and type of material needed to gain this advance publicity, and assist with the publication of material through the media during the tour.

"Local Boy" stories are generally well publicised throughout the UK by stories either produced by the four UK-based PR Mobile Teams, or the unit. Local Boy stories, however, are generally confined to Soldiers and not Officers. Perhaps Officers are not considered to fall into the category of a local boy! I believe we should encourage units to produce stories about Officers. Not only would such stories encourage local boys to join the Army, and hopefully the Corps, but they could also be sent to the Officer's School to assist CCF recruiting. In schools where no CCF exists, the stories could be sent for favour of publication or display, where I am sure the pupils would be interested in reading about the exploits of old boys. Again, the PR staffs at District are available to advise and assist units in getting these stories published.

I have perhaps banged on long enough, and in many reader's view must be well into "injury time". In conclusion however, I would just add that our Corps offers unique opportunities to young men. In no other Arm or Service in the Army does one

have the opportunity to serve in a Parachute, Commando, Armoured, Gurkha, Amphibious, Survey, Construction or straight Field or Support unit. Add to this the variety of tasks required of us in peace and war throughout the world, and we have a platform for PR which we would be foolish and irresponsible to ignore. We should make a sustained effort to harness the Army PR resources available to us.

I am aware of the intensity of unit training programmes and commitments. Planning for unit major events, exercises, and projects should include PR coverage as Standing Order Procedure. Staff planning for such events is usually carried out well in advance, and PR planning along with other preparations should not only ensure good publicity, but will allow the unit time to think ahead without too much disruption to current commitments.

A vigorous PR campaign by the Corps would not only give a service to the public, whose money we spend, but enhance our image immeasurably, and produce the favourable climate so necessary for successful recruiting.—Yours faithfully, Robin Jordan

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FOOD FOR THOUGHT .....?

Sir—I was delighted to have provoked two such totally different responses to my article on the potential of unit computers. The enthusiasm shown by Captain Stalker is probably typical of a considerable number of officers and others who could get such a system "off the ground". Colonel Cook's letter requires answering in rather more detail.

Professional Engineer Trained Officers of the Corps do not necessarily hold formal Army ADP qualification. However, for some ten years they have been trained in the use of programmable calculators and, more recently, in the use of mini and micro-computers. It is on the basis of this experience that the article was written.

The National Working Party on Computer Standards and Specifications have recently quoted the following cost brackets for micro-computers:

(a) Simple microprocessor with keyboard £200–£1000
(b) Microprocessor with keyboard and disc memory £2000–£3000
(c) Printer according to speed and quality £250–£1800

These prices are still falling in real terms and such equipment would provide very useful computing power, though one can easily imagine that users will often wish they had more power to their elbow.

Colonel Cook must be correct in pointing out that there are pitfalls to be avoided in our search for the correct equipment for unit use. However, I believe he is wrong in believing that the power of a micro-computer in the above price bracket to be trivial compared with the needs within a unit. It seems that while the RAPC, RAOC and REME are way ahead of us in the use of main frame computers and the R Sigs are ahead in the use of larger mini-computers they have not yet given serious thought to the use of their micro cousins except as training aids. The RAPC, for instance, are more interested in providing communication between unit pay staff and their centralised computers than in any "in house" computing capacity for unit use. No doubt there is a place for such systems on the RE net as well, but the article was not directed at the provision of centralised data.

The example of the AB 397 was deliberately chosen because the running of accounts is one of many extra duties necessarily undertaken by unit officers. We all acquire some expertise in such routine duties but it is a duty that could be simplified. Every decade brings a new range of equipment to be learned about and trained in. The micro-computer brings similar problems but if it can dispose of some of the

traditional chores, such as learning the mechanics of accounting, it will contribute to reducing the "overstretch" suffered particularly by incumbents of certain key posts.

One significant point I would concede to Colonel Cook; that is that some form of data storage better than cassette tapes will be required by all users. Floppy discs are likely to be superceded by plug-in solid state memory packs, but in the meantime "ruggedness" sufficient to allow vehicle mounting of micro-computers could only be obtained inexpensively by temporarily dispensing with the disc backing stores.

The greatest problem in the introduction of unit computers is one of trust—either too much or too little! Programs can and will be written by enthusiasts to the benefit of all, but they must be proved thoroughly before they are used by those who are too trusting. Conversely the cautious squadron commander, anxious to preserve his name, may prefer to avoid the risk of trouble altogether—to his everlasting shame.

Now is not too early to introduce micro-computers on limited issue. We can ignore portability for the time being. There are other limitations in the current range of equipment but it is quite adequate for a number of uses. It is possible for units to acquire micro-computers now through their CO's Public Fund and no doubt some will do so. However, this is not recommended without some central control to ensure that programs are interchangeable and to ensure that when enthusiasts are posted they do not leave an unused white elephant behind them. The RE Computer & Microform Steering Committee can undoubtedly give advice on this subject. We could get off to a good start with a little organisation and the enthusiasm of the likes of Captain Stalker. Or, we could create a shambles!—Yours faithfully, J A Jennings-Bramly

Captain W J Heminsley RE, B Sc
73 Engineer Regiment (V)
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DISTINGUISHING MARKS

Sir—I must agree with Captain McCabe's views on dress, especially barrack dress, expressed in the March issue of the Journal. I am just finishing the Junior Division of the Staff College Course at Warminster. During the past ten weeks I have viewed virtually the complete range of pullover and shirtsleeve order of the Army.

Members of the same Infantry and Cavalry Regiments wore the same order of dress. Did we?—oh dear, no. Our berets with barrack dress were speckled with Weser mud and the variety of shirts was—well—different. Didn't we do badly! Most Sappers here looked like obvious members of "a Corps", but which one? While I accept issue green trousers as a permanent fixture why cannot we wear our stable belts on the outside of our pullovers again?

We must be instantly recognisable as Sappers when in barrack dress—but most of all cannot we all try and dress alike?—Yours sincerely, W. J. Heminsley.

Lieut Colonel J R V Thompson
Tapley
Petham
Canterbury
Kent

VIVIAN THOMPSON (1880–1917)

Sir—In Mr Keith Atkinson's recent lecture to the Royal Geographical Society on the life of Vivian Thompson, mention was made of the unusual circumstance of his Command of an Infantry Battalion. I believe that other RE Officers have taken

similar Commands, but whether in emergency or as postings is uncertain. In Vivian Thompson's case he completed eight months as a Brigade Major in the Irish Division, followed by a short Staff appointment, and from this he was posted to command the 9th Battalion The Essex Regt. This he held for five months, until he was hit and died of wounds in October 1917.

From an historical point of view it would be of interest to know of other cases in which RE Officers have taken command of Infantry Battalions, either in emergency or as a posting. Perhaps readers may be able to give information on this.—Yours sincerely, J R V Thompson

Lieut Colonel M J J Rolt MA
1 Church Road
Byfleet
Surrey

TANKS THROUGH TREES

Sir—Each of N trees standing in an area A will have an average plot of area $\frac{A}{N}$. Assuming these plots to be square the average distances between each tree and its nearest neighbour would be $\sqrt{\frac{A}{N}}$.

Some actual measurements on Figure 5 (*"Tanks Through Trees", June 1980 Journal*) tend to confirm the accuracy of this formula. If it is correct it means that the NO-GO situation arises when S_m is less than the width of the tank, which is what intuition suggests.

Can Major Wilson or any other reader please explain the derivation of the formula $S_m = \frac{\sqrt{A}}{2\sqrt{N}}$? Perhaps the trouble is that I cannot see the wood for the trees and have formed the wrong concept of "mean tree interdistance".—Yours sincerely, Mike Rolt.

Memoirs

BRIGADIER F J R HEATH MA, FIMechE, MIEE

Born 9 March 1900, died 11 November 1979, aged 79

When Heath—it wasn't done in the '30s to use Christian names as freely as it is today—was Chief Instructor in the SME Workshops he ploughed a rather lonely furrow, but it always seemed to me a very creditable one.

He rode a horse and hunted with the Drag. He was not a natural horseman and I suspect he did not enjoy it much; but in a society where horsemanship was highly esteemed, he felt it part of his duty to show the world that workshop-oriented Officers could do it too. Whether he got credit for this I cannot say, but if guts are deserving of reward Heath certainly deserved it.

Next he built a sailplane with his own hands in the Workshop, and I believe flew it successfully. When I asked him what made him sure it would be a fit vehicle to trust his life in, he simply replied: "Because I made it myself". These are the words of a confident man.

Finally when it was his turn to give a Military History lecture during an Officers' Study Day he chose the Mesopotamia Campaign of World War I. He castigated the General Staff in India for their bungling of the campaign, leading up to the fall of Kut. He seemed to make a very good case for a view that was not popular with the Directing Staff—all *psc* boys—and got a terrible wigging for it. After the lecture, walking back to the Mess, I urged him not to take it too badly. "I don't", he said,

"They will make most of the same mistakes themselves". (To do them justice they did not make many mistakes when put to the test.) A singularly detached view that deserved more recognition than it ever got.

I expect he will have a "tiff" with St Michael.

MCAH

BRIGADIER N S COWAN OBE

Born 11 June 1910, died 2 April 1980, aged 69

It was only during the last two years of our Service 1957–59 that I got to know Sam Cowan well, as next door neighbour, and good family friend, in those very pleasant married quarters in Hereford Walk, or "Red Flannel Alley", as that corner of the Rheindalen Camp for HQ BAOR was nicknamed. Quite independently of each other, we then found ourselves not many miles apart, and both with good jobs in Buckinghamshire, so the family friendship prospered from this coincidence.

I have a shrewd idea that these last twenty years were some of the happiest of his life, first as Administrator of Waddesdon Manor, that French type Chateau near Aylesbury, with room after room full of the fabulous Rothschild Art Treasures, and then as Agent to Mrs James de Rothschild and her large estate Eythrope, close by. Seldom has it been so essential for a Sapper to be a Jack of All Trades.

I heard of him climbing minarets to replace finials; I listened to him contrasting the merits of paintings by the Dutch masters; I heard always of the knowledge, taste and skill of the direction and help given to him by the untiring, yet no longer young, Mrs R as he fondly called her. I watched him arranging priceless porcelain and lighting it for better display; I have seen him designing structural alterations within the Manor, and an extensive wrought iron aviary enlargement for more exotic birds outside; and I sometimes joined him in visits to Mrs R's magnificent Racing Stud close by his house. All these interests are of superlative quality; but how the security problems for such priceless treasures allowed him to sleep so soundly I could never understand! With these few words as background, I feel that the rest of this Memoir should fittingly be in Mrs R's own words; she writes:

"It was the happiest of hazards that brought Brigadier Cowan to Waddesdon Manor as Administrator not long after it had been bequeathed to the National Trust. We were delighted that he proved superbly competent in his various tasks, but never could we have anticipated the speed with which he acquired knowledge of works of art and the intricate problems of catalogue production. His innate taste and delicacy developed at lightning speed and were sustained at the highest level. When the opportunity came for transfer from Waddesdon Manor to the Estate, all these qualities were needed and used to the full. The gifts of his character earned him the respect and affection of all people with whom he came in contact. As for myself, I can only say that the immensity of my good fortune is balanced all too evenly by my sense of loss and sorrow; he was the truest of friends. Joan was, indeed, the ideal wife for him; superbly calm and always at hand. Our only comfort, now, lies in the thought that he could never have tolerated a life of restriction".—D de R

Knowing the scene, as I do, the superlative standards involved, and the ability, the knowledge, and character of those concerned, that is praise indeed.

JFG

Brigadier N S Cowan OBE

BRIGADIER E A GLENNIE CIE, DSO

** Born 18 July 1889, died 15 February 1980, aged 90*

EDWARD AUBREY GLENNIE was a man of very varied interests, a soldier, surveyor, scientific geodesist, a lover of music, an explorer of caves, and a student of cave fauna.

His father, Colonel Edward Glennie, also served in the Corps, almost entirely in India, being at one time CRE Bombay, but Aubrey was born in England. From quite early childhood he was much interested in natural history, flowers, snails and snakes, an interest which he retained and amplified throughout his life. He was educated at Haileybury and the RMA Woolwich, and was commissioned into the Royal Engineers in July 1910.

After the usual two years at the SME he was posted to India and for the next three years served in various Garrison Engineer posts, mostly at Karachi and in Baluchistan. In June 1916 he was posted to the Expeditionary Force in Mesopotamia, where (as Captain or A/Major) he served with great distinction as Assistant Director of Works at Qurnan, Amarah and Baquba, being twice Mentioned in Despatches and awarded the DSO (Aug 1917). Later, he served with the Sirmur and Malerkotla State Sappers in the 17th Division at Samarra, and as Adjutant RE of the Division. After a short time at GHQ Baghdad as Staff Captain and Brigade Major RE, he returned to India, where he joined the Survey of India in Dec 1919.

For the next twenty years he served in the Geodetic Branch of the Survey, where his prime interest was in the swinging of pendulums to determine the varying intensity of the earth's gravitation, over the whole of India. This seemingly rather exotic activity had been attempted in India by Major J P Basevi RE as early as in 1870. Work had been resumed with better apparatus in 1903, and by 1913 modern observations had been made at 118 stations, when the work was interrupted by the War.

Aubrey restarted pendulum field work in 1923, and with steadily improved equipment he had added 236 stations by 1934, including visits to Northern Kashmir, the Great Indian Desert, Ceylon and the Maldive Islands. By that time he had trained an assistant, Mr M N A Hashmie (later Surveyor-General of Pakistan), who took over the field work, and who by 1940 had added another 220 stations, including two seasons work in Burma. The gravity survey then provided fairly uniform cover over all India (including Pakistan) and Burma. He was of course also much concerned in interpreting the observations as clues to the variations of crustal density. In 1935 he was a Founder Fellow of the then newly created National Institute of Science of India.

In 1937 Aubrey was promoted to the grade of Director in the Survey Department, with the rank of Colonel. At the outbreak of War in 1939 he was Director of the Geodetic Branch, and in April 1941 he was transferred to Delhi as Director of the Frontier Circle. In peace time, the Frontier Circle had been responsible for liaison with the Army in Northern Command and with preparations for the raising of two Indian Field Survey Companies from the Survey Department if required, but at that time there was no survey representation at GHQ India in Delhi. By 1941 the Survey's liability had been increased to the proposed raising of seven companies, together with a number of smaller units, and Aubrey's Frontier Circle became the

Brigadier EA Glennie CIE DSO

Military Circle, located in Delhi. At the same time the military post of Director of Survey, India, at GHQ (Brigadier) was created and also filled by Aubrey Glennie, so that he was responsible to the Surveyor-General (the holder of a civil post) in one capacity, and to the General Staff in the other. This was no doubt a peculiar arrangement, but the raising of military units from the Survey Department created many tricky administrative problems, and it was advantageous that in such matters the Surveyor-General and the General Staff should receive identical advice from the joint holder of the two posts. Aubrey's imperturbable temper and his capacity for hard work well qualified him for this task. Until 1944, survey units employed with the Army in India and Burma were under his technical control as D Survey, India, but when the South-East Asia Command was formed, units in SEAC came under their own D Survey, leaving with D Survey (India) the provision of their reinforcements and survey supplies, and also the farming out of very large printing demands to the civil department. Aubrey retained this post until 1946, when he returned to the UK on long leave pending retirement in June 1948. He was awarded the CIE in 1942.

For his work on geodesy in India and his contribution to mapping in the Far East he was awarded the Founder's Medal of the Royal Geographical Society in 1946.

On his retirement, Aubrey preserved his interest in the earth's gravity field, and continued his studies of the probable sources of its variations. He regularly attended the triennial assemblies of the International Association of Geodesy.

His interest in caves began when he was at his preparatory school, and during the 1930's he entered and explored several caves in the Himalayan foot-hills between Simla and Mussourie. On his retirement from the Army he became a founder member of the Cave Research Group of Great Britain, of which he was President from 1953 until his death. Apart from his interest in the mapping and structure of the caves themselves, he developed a great interest in the subterranean fauna of generally small, and often blind, animals which have specialised in living in such localities. Several previously unknown species bear his name, and he contributed seventy or more papers to the proceedings of the Group. He also wrote a number of papers on subjects connected with his gravitational interests.

In his family life Aubrey suffered two tragic bereavements. He was married in 1923 but his wife died in 1929, leaving him with a son, Michael, who later joined the Fleet Air Arm and as a Sub-Lieutenant was killed at the age of nineteen while attacking a German convoy off the Norwegian coast.

Aubrey Glennie was a quiet and unassuming man. It was always easy to work with him, and a pleasure to share his company.

GB

I worked under Aubrey Glennie when he was making gravity observations in the Himalayas around and north of Kashmir. At the time he was suffering from back trouble and sciatica, which made it painful even to walk. He showed great determination however in carrying through the whole programme, involving long marches over high passes, and delicate observations sometimes far into the night.

He was a keen naturalist as well as a scientist, and on one occasion when a snake appeared crossing his path, I saw him pick it up by the tail and identify it as poisonous while it was trying to reach his hand.

His interest in caves is well known, but it was really wonderful to see him climbing up and down a 90-foot rope ladder hanging free from the roof of Moila Cave near Chakrata, in India, as also to see the fearsome squeezes that he would negotiate in his underground explorations.

He was shy, but a very determined doer, with little use for roundabout delays. Thus his position as Director of Military Survey (India), during the last war, was well earned.

GHO

COLONEL C M MACLACHLAN OBE

Born 25 December 1899, died 6 December 1979, aged 79

CLIVE MACLACHLAN will be remembered as a man who lived life to the full and enjoyed every minute of it. People who met him never forgot him. All the contributors to this Memoir refer to his habit of slapping his thigh in high glee over some joke and then bursting into roars of laughter, to his efficiency and effectiveness, to his love of all games and to his ability to get people to join in—he was an enthusiast and his enthusiasm was infectious.

When he first joined the KGVO Bengal Sappers and Miners he was a somewhat reluctant volunteer for posting to a mounted unit, but as was characteristic of him he was determined to master the job thoroughly. He volunteered to go as a student/Sapper instructor on the Long Equitation Course at Saugor, Central India, to attend which was the aim of every Indian Cavalry Officer. Clive took with him a big waler, which he had named "Non-Cooperator", that word being on all political tongues at that time. He was very popular at Saugor and his Sapper lectures were considered valuable as well as great fun.

Returning to his Field Troop at Risalpur with 1st Indian Cavalry Brigade he certainly raised the equitation standards. He entered Non-Cooperator in many steeplechases in Rawalpindi and Peshawar, and as a fearless and capable rider he became a well known figure on the racecourse. His thoroughness was evidenced too in the training of the Regimental Polo Team. Tactics were studied, set plays and movements were introduced and matches were won.

As OC of a Field Troop he was in one of the Indian Cavalry Brigades. In the general mobilisation scheme of those days one of the functions of the Troop was to assist the Cavalry Brigade across the Kabul River. How he would smile and how he would slap his thigh if he knew that the "enemy at the door" was providing the threat some forty years later.

In Aldershot, before WW2, the Sappers of 1 and 2 Divisions, 1 Cavalry Brigade and the RE Mounted Depot all lived together in the old Gibraltar Barracks. Mac was an inspiration to the Subalterns, helping them and pushing them on "in every direction" (as he would have said) to ride, hunt, play every kind of game or organise Subalterns dances. Morale was high.

Between 1941 and 1943 he was CRE 8 Indian Division. In 1941 all were "Learners" from the Divisional Commander downwards. In the Field Companies the Subalterns were straight from OCTU and the Sappers straight from the Training Battalion. Somehow Clive, through his personality and enthusiasm, welded the Divisional Engineers into an efficient fighting machine. The Company Commanders could always rely on maximum support from Clive in their dealings with the Infantry Brigadiers. He was particularly proud of the "impossible" bridge which the Divisional Engineers constructed over the River Moro in southern Italy. A painting of this crossing is the only picture hanging in the Commandants Office in Roorkee.

When SME returned to Chatham after WW2 Clive was, for a time, D Comdt. He had lost a leg during the war but his enthusiasm for games was undiminished. This was the time of Supplementary Courses, which overlapped, and the Mess was always full. It was also the time when Mess Games were popular. Clive had organised a

Colonel C M MaClachlan OBE

Permanent Staff Team for all the "official" games and the Staff team were virtually unbeatable. He led the Freda and Billiard Five teams himself.

His exploits on horses have already been mentioned. When he took up skiing he went full tilt from the beginning, exploding down the slopes. At Rugger his quick acceleration, good eye and hands made him a first class fly-half. His playing days over he became the motivating force behind Rugger at Chatham and to his delight was elected a Life Member of the US Rugby Club, attending the Annual Dinners virtually every year until his death.

Clive Maclachlan was the last person to assert himself and it took time to appreciate his remarkable qualities. There was always a lurking sense of fun which could bring a sudden sparkle to his eyes and a resounding smack of his thigh, a habit which happily survived the loss of his leg. He liked to mimic people, particularly his seniors, but never with malice. Clive contributed much and it was appreciated.

Clive loved the countryside and all outdoor pursuits. One of his last post retirement activities was the growing and marketing of Christmas trees. One likes to picture him tending his trees and chuckling at the thought of the fun and joy they would bring to people. He died suddenly and peacefully while busy in the garden he so loved.

To his wife Jan we offer our sincere sympathy.

EFEA, JMLG, PFH, WGAL, GRM, EEP

* * * * *

Book Reviews

ALEXANDER'S GENERALS
THE ITALIAN CAMPAIGN 1944-45

GREGORY BLAXLAND
(Published by William Kimber, London. Price £9·95)

THE object of the Italian Campaign was to tie down German forces. To do this demanded continual offensive pressure, over a terrain which was very suitable for defence in depth, by a force of some twenty nationalities. To achieve this object the Generals needed to be masters of tactics and man-management. In addition, the C-in-C, General Alexander needed to be a master of tact!

The author has made full use of recently released War Diaries, published works and privately expressed views, and of his own knowledge and experience as a participant in the campaign. The book describes the campaigns and battles but concentrates on the influence of the highly individualistic Generals involved and their frustrations.

To your reviewer the author seems to emphasize differences rather than the similarities in approach and attitudes. In fairness serving in a campaign does tend to colour one's views and the author may well be close to the truth.

The book reads well and is more than adequately indexed as befits a book written by an accomplished writer on military matters.

EEP

WAR DEPARTMENT LOCOMOTIVES

R TOURRET

(Published by Tourret Publishing. Price £4·95; 9 US$)

UNITED STATES ARMY TRANSPORTATION CORPS LOCOMOTIVES

R TOURRET

(Published by Tourret Publishing. Price £5·85; 12 US$)

THESE two books are published separately but are related in a two-volume treatment of Allied Military Locomotives of WW2. During that war many types of interesting locomotives were built and sent all over the world. In the books an attempt has been made to gather as much information as possible and to present the overall story.

They are well researched, written and illustrated. Some readers may find the detail dry but such detail is inherent in books of this type. My only objection is to the 11·75in × 8·25in size which, wrongly no doubt, suggests children's books. As most railway enthusiasts remain children at heart this is a minor criticism!

EEP

RAILWAYS AT WAR

JOHN WESTWOOD

(Published by Osprey Publishing. Price £7·95)

THE coming of railways in the 19th century had almost as profound an effect on the waging of war as the introduction of gunpowder. For the first time it became possible to mobilize and support vast armies in the field.

The author, a professional historian, was at one time on the staff of Canadian National Railways and was Associate Professor of History at Florida State University and Senior Lecturer at the University of Sidney. As such his study is both penetrating and fascinating. Looking back over the decades to the 1830s, when the military significance of railways began to be appreciated, it is difficult to resist the impression that railways were at no period quite so decisive an influence as had been forecast. There can however be little doubt that railways did much to influence the nature of wars. Total war was a product of the railway age and without railways would have been impossible.

The book is essential reading for railway enthusiasts and military historians alike.

EEP

BOOK NEWS FROM INSTITUTION OF CIVIL ENGINEERS

All books in this section are published by Thomas Telford Ltd and are obtainable from the Marketing Dept, Thomas Telford Ltd, Telford House, PO Box 101, 26–34 Old Street, London EC1P 1JH

CORROSION IN CIVIL ENGINEERING

Price UK and Eire £10·00; overseas by air £13·00

PROCEEDINGS of a conference sponsored by the Institution of Corrosion Science and Technology and the Institution of Civil Engineers, held in London 21/22 February 1979.

Each year corrosion destroys the equivalent of one-fifth of the annual world production of ferrous metals. Although structures can be given various protective coatings there is no permanent cure that would make technologists and designers redundant.

The problem is created by the use of metal, the value of the problem is fixed by the metals selected, the environment and the design adopted. Unfortunately often it is not known in advance what the problem is or its solution. The conference explored the problem and economics of anti-corrosion technology.

REVISED PRICE LIST FOR HISTORY OF CORPS

BECAUSE of reprinting the prices of Individual Volumes and Sets of *The History of the Corps of Royal Engineers* have been revised. The policy of the Institution is still to recover costs only from Members.

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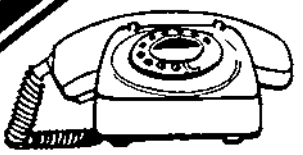

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