ISSN 0035-8878

THE ROYAL ENGINEERS JOURNAL

Volume 98 MARCH 1984 No 1

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(Established 1875, Incorporated by Royal Charter, 1923)

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ISSN 0035–8878

THE ROYAL ENGINEERS JOURNAL

© *Published Quarterly by The Institution of Royal Engineers, Chatham, Kent ME4 4UG. Telephone Medway (0634) 42669* ©

Printed by Mackays of Chatham Ltd, Lordswood, Chatham, Kent ME5 8TD

Volume 98 MARCH 1984 No. 1

Contents

Authors alone are responsible for the statements made and the opinions expressed in their papers

4,250

It Figures!

Bulldozers and Nightingales

COLONEL G C CLARK OBE

DURING the last War many "War Babies" were born in the Services in the shape of new and special types of Units organised to carry out particular tasks. Many of these died soon after the end of hostilities; others, like the Airborne Units, have lived on and become vigorous additions to their particular Service; others, while retaining at least part of their original purpose, have remained, but under different names. Amongst the latter were Airfield Construction Groups, successors to the Airfield units formed in France in 1939-40 under Brigadier Appleyard in the days of Lysanders. Since then, in order to meet the requirement for larger Advanced Landing Grounds, those Units had been re-organised into Groups, each consisting of two RE Road Construction Companies and two supporting Companies of the Royal Pioneer Corps.

It was in November, 1943, that I was told that I was to form, and take command of, one of those Groups. Others already existed in England, preparing for the Invasion, and mine was to be the last of the family.

I received the news with some misgivings for my knowledge of Airfields was, to say the least, scanty and it seemed a formidable task to train a completely new lot of men to produce, rapidly, stretches of ground of billiard-table like smoothness. Admittedly I had once built an "airfield". In fact I might almost claim to be a pioneer of rapid airfield construction! But that airfield dated away back to 1934 when, with forty Indian Sappers & Miners, eight bullocks, four heavy baulks of timber and the odd pick and shovel, we had built a landing strip on that historic stretch of country South of Delhi where, in past ages, had been settled the fates of many Indian dynasties, and where, in happier pre-War years, the annual clashes between those inveterate enemies *Redland* and *Blueland* used to be staged. I believe that that Landing Strip was actually used; that an old Wapiti did land, and

It Figures

take-off again, successfully; but I knew that there was a vast difference between the standard demanded then and now, and bullocks dragging their bits of timber were much easier to control than the menagerie of bulldozers, caterpillars and what-nots which, I gathered, were now parts of the circus that made up an Airfield Construction Group.

My misgivings were in no way reduced after attending a conference at which were assembled the Commanders of the other Groups. Mysterious names and phrases, which meant nothing to me, were tossed about as carelessly as balls are thrown into the air by jugglers. The comparative merits of weirdly named machines were discussed with a technicality which left me in a bemused state, and I doubt if I should have slept that night if I had not been lucky and got tickets for a good show at a theatre.

It was, therefore, feeling rather like a new boy going to school, that I set off a few days later for my new Command.

I do not know when my Group first came into existence in the Planning stage but, for me, it was born on a cold, wet November day when I walked into a large Nissen hut, one of several which were slowly emerging from the mud and slush which had once been a lovely bit of Kentish wood and heathland. Outside the rain poured down; inside it was hardly more cheerful. After long habitation, and considerable effort, a small Nissen hut can be made very comfortable and home-like, but a large Nissen hut, even at its best, somehow lacks a sense of intimacy. And this one was not at its best. Even the most glowing, red-hot stove cannot diguise the fact that concrete is a cold form of flooring, and one needs more than two "Tables, Barrack, 6-ft", and two wooden benches to make a room measuring 24 feet by 60 feet look homely. It was, therefore, not surprising that the two occupants of that vast chamber looked a trifle lost and home-sick. One, my future Adjutant, a young Regular Sapper who eventually learned to answer to the name of "Minor", sat at one table. Like the unselfish man he is he had given his all to his room-mate at the other table, a Private of the Pioneer Corps, who was the sole representative as yet of our office staff. A study of this table showed that our total assets so far were, apparently, six file covers, neatly arranged in a pile and all neatly labelled with official sorts of headings, four pencils and—nothing else! (I wondered whether that file-cover, so neatly labelled "Promotions—Other Ranks", represented a sad little ember of hope from which a shivering Private had tried to extract some comforting warmth.) Perhaps in the months to come the two of them may have often thought with longing of the days when their tables were so clear of paper, but at that moment I am sure they would have welcomed something with which to occupy themselves.

However this state of affairs did not last for long. Soon men and equipment were coming in. There were our own Headquarters to form and, while forming, we had to try to help our other Units with their many problems, problems which were by no means small in the case of our two Sapper Companies who had to change themselves into completely different shapes. On top of it all "Minor" found that he had to try to train his new Colonel in the way he should go, and to cure him of a lot of strange Oriental administrative theories and ways of soldiering. He had his hands full in those days, and we owed a lot to him.

But gradually things started to take shape. It is strange what a mixture of men can be drafted into a small unit on such occasions. There was the little Scotsman who kept cracking on at his job and, until the War was over, never mentioned his own, very considerable, domestic problems or asked for leave to go and sort them out. How many of us, I wonder, do our jobs so honestly. On the other hand there was Sapper Tripper (not his real name but it fits him) who, as far as one could see, tripped off lightly wherever and whenever it suited him. He tripped off from his Draft on his way to join us and had a couple of days leave at his home until his long-suffering wife sent him packing. He tripped off again a couple of weeks later, and I imagine he would have continued to pay us fleeting visits had he not, during one of

his periods of enforced or voluntary absence, exceeded the permissable time limit and "Minor", with a sigh of relief, was able to pass him on to other spheres.

Then there was the simple soul who went on leave and, from his home, sent a wire asking for an extension of two days. "Minor", who had a nasty habit of requiring reasons for everything, signalled back a caustic "Why?" Back came the answer, delightful in its simplicity and obvious truth—"Father wants to sell pig Saturday". I have always been sorry that I was away when that answer arrived, for I have always felt that it deserved a kinder response than that which "Minor" gave it. I suppose he was right; but I wonder what price Father got for his pig, or even if, without his son's help, he ever managed to get it to market.

But all the time things were happening. More Nissen huts emerged from the mud, and more men were able to move out of the damp tents that had housed them for so long. Equipment and machines were coming in, and the two Sapper Companies were busy carving chunks out of the countryside, while the Pioneers learned about the various types of Airfield surfacing and went for long route-marches. Officers, too, ran about the country reconnoitring sites for imaginary airfields, and learning a job which was slowly becoming less of a mystery.

By the end of February 1944 we had taken part in two Exercises in which we felt that we had at least not disgraced ourselves—we thought, secretly, that we had really done much better than that—and by April we were wanting a real test. We were lucky, and were given just the right job, the construction of a real Landing Strip a few miles inland from Dover.

I do not think that I had ever hated Hitler and all his works more than I did that morning when I stood in those fields and saw what beauty we were about to destroy. Primroses and bluebells carpeted the woods that we were going to uproot. Larks, high in the sky, were glorying over their nests in the fields that we were to trample over and, though the sun was shining and it was high noon, a nightingale was singing from the corner of a small clump of chestnut coppice. It was with a very heavy heart that I gave the order to start the work which would mean the end of all that loveliness.

The next day or two was full of crises, not unmixed with humour, as our not-so-experienced drivers wound their way through Dover, and up the steep hill beyond, trailing behind them their monstrous loads. In the end all that was wanted was some proof that our labours had been good, and that proof was laid on by some understanding person at Olympus. At the proper moment three Spitfires appeared in the sky, circled the field and started peeling off to land. I am sure that all of us were keeping our fingers twisted into knots at that moment; I know that I was. But, one after the other, those three Spits came in, touched down and came to rest.—We had built a real Landing Strip!

Was it a happy augury for our future that the leading plane had been piloted by one of the most famous of our Fighter Aces? I took it as such, and I went to bed that night feeling that all was well, that, as a Group, we had passed out of our infancy and, though we might still have a lot to learn, that we would be ready to take our place beside our elder brothers when *The Day* came—*The Day* that we all realised would not be so very far away now.

Soon after this we moved. In November it would have been hard for any of us to imagine that we would ever regret leaving that sea of mud and those caves of damp canvas; but the Winter had passed, and Spring had brought real beauty to that home of ours. The scars were healed; the trees were green again, and young bracken fronds bordered the paths where once we had ploughed our muddy ways. It would have been so pleasant to have stayed on awhile but, as we all knew, that move was the *Beginning*, and the knowledge helped us to overcome any new-found sadness at leaving.

The move took us down to the South coast where, for a few weeks, we were busy tidying up all the loose ends and fastening the last buttons—and it is amusing to

remember the exhortations, which were really made, that we should ensure that our trouser-buttons were firmly secured; and very wise advice that was, for no man can walk up a defended beach with any feeling of assurance if his braces buttons have not been strong enough to support a pair of trousers sodden and weighted with sea-water.

It was, in fact, amazing how many little "buttons" did need tightening up and Jock, our Stores and Transport Officer, a lean Scot possessed of all the best characteristics of his countrymen, had a busy time, and many and strange were the journeys he had to make. Did anyone, I wonder, ever get from him the true story of the night he spent near Camberley and the Charmer in the ATS.

Everyone was busy. All the hundred and one little final adjustments were made, and at last, our Movement Orders to the Marshalling Area arrived. We were off!

I suppose that as I set out at four o'clock on a perfect June morning with my small party in two cars, the advanced reconnaissance element of the Group on the far side, I should have been thinking lots of noble thoughts. But I wasn't; somehow I didn't even feel very excited. That was to come later; but at that time it was all so quiet and beautiful and "England". There was no War. It must be all a dream. Those two horses looking over the gate into their field, the herd of cows which delayed us on our road, they were the realities, the things that would last.

Much has been written of all that followed during the next few days. Others have more exciting and better tales to tell than I, who cannot boast of having landed on D-Day, nor of having met anything more deadly on the beaches than some distant shellfire. But in spite of that lack of glamour there are memories of incidents which stick in my mind. There was the thrill that came in the night, as I lay in a tent in the Marshalling Area, and heard the roar and swish of planes passing overhead carrying the 6th Airborne Division into attack, and knew for certain that something big was happening, something that was the curtain raiser of the Invasion.

I remember the many little kindnesses of the excited, happy people in a back street of Southampton where our column of vehicles waited until boarding our Landing Craft, and the long, agonising delay, due to some engine trouble, as we waited in that Craft for it to sail. And, at last, in the dawn, there was the first sight of the French coast and the incredible Armada of ships assembled there. There was the bump and splash as we drove off the landing ramp into the unexpectedly shallow water; the drive up the beach to the de-waterproofing point; and the realisation that it had all happend, and that we had landed in Normandy.

Many men were not so lucky. They have kept their memories on the Beaches. For others, "D-Day" will conjure up pictures that even the wildest fantasies of Hollywood cannot surpass. But for me those are the memories of the day for which we had been waiting and training, dull and commonplace in the recounting but, still, just one little part of that tremendous adventure.

Bit by bit, my Group, which had come over in separate flights, assembled on the site which had been selected for our Landing Strip and started work. By the evening of the second day enough had been cleared to allow a disabled Spitfire to land safely, and by the end of the fourth day we were ready to receive the whole Wing which had been allotted that field. Once more there was the strain of watching the first planes land, and once more there was that feeling of intense relief when all of them were in safely. We were proved; we really had built an operational Airstrip.— Now for the next one!

Actually we had already started on our next one, about three miles to the East, and this one was to be made into an "all weather" one with the runway and taxi-tracks covered with a new type of surfacing material. It was a fine site, and I think that we made a good job of it, but somehow that field has not got the same happy memories attached to it that some of the others have. To start with, it was on the extreme left-wing of the Beachhead, in an area which was terribly congested, and much time was spent in bitter argument before we were able to get the ground clear and could start work. And I think that we were all suffering from some kind of

reaction after the first few days of the landing. Tempers were a bit frayed; there were moods of depression; and everything did not go smoothly to start with. Strangely enough the best tonic always came from the arrival of a shell somewhere near us, and it was surprising that there weren't more of them for the field was under distant enemy observation and was so close to the front line that I can remember standing one evening on the Strip watching our Typhoons take off and, almost immediately afterwards, letting off their rockets at targets on the other side of a low, intervening ridge.

All the time there was other work to be done; repairs to roads and tracks; the preparation of a strip from which the Gliders used by 6th Airborne Division could be towed off. There was the provision of a piped water supply on our first Landing Strip in an attempt to lessen the dust menace. That pump-house still stands. I have seen a photograph of it, taken only a few years ago, standing in what is now green pasture-land, with cattle grazing peacefully beside it. The motto *Carpe Diem*, carved on its door-lintel, is still legible, a reference to one of my early exhortations to the infant Group not to let the grass grow under their feet! The Sappers who built that house had certainly absorbed the meaning of that exhortation for, by the time an astonished Rest Camp Commander, into whose green and pleasant allotted area they had so rudely trespassed, had realised what was happening, and had time to make his complaint, they had got so much of it built that no one had the heart to tell them to pull it down. After that, I may add, the builders reverted to peace-time practice and, having found a good job in a pleasant place, were always able to find some small, "essential", improvement which kept it alive.

But at last our flank of the Beachhead began to react to the movement on our right and, after days spent in reconnoitring and planning a new Strip in the battle-littered countryside round Demouville and Frenouville, we suddenly jumped forward beyond Caen to the desolation of La Hogue and Basse. While the situation to the East and South was being cleared up we sat there, building a road and suffering the mosquitoes and flies, not gladly but at least with some resignation for we knew it would not last.

Then the flood broke loose, and in one incredible night and day we swept out, away from the stench and dust and muck of War, into a clean, smiling country where there were flowers and laughing children; where the houses had glass in their windows, red tiles still on their roofs, and walls which were not just gaping ruins. We came into a land where, instead of bloated, obscene corpses lying in fields blanketed by dust, fat, sleek cows grazed in green meadows full of familiar English flowers. At one place, where a willow-bordered stream wound its way through a wide gap in a line of low hills, a big white farm, roofed with warm red tiles, lay back from the road. Its lawn, flanked on each side by other white and red barns and out-houses, spread from the house in one unbroken sweep till it lapped the top of the sunken wall edging the roadside ditch. As I passed, some white geese were feeding on the lawn and, apparently careless of all the machines of War which roared past them in an unbroken stream, two little girls in blue and white checked dresses stood, with their heads close together, examining something which the younger one held in her hand.

Was it all a dream, or were we back in the land of realities again?

A few days earlier I had been given details of the area where we might be required to build our next Landing Strips and I had been studying the maps and considering possible sites. There, amongst all the names of villages and places, was one which drew me irresistably. "Le Forge Subtile". Somehow it conjured up in my mind pictures of Puck and old England, of Weyland Forge and of Magic. It fitted in so well with our probable future tasks that it was towards that Subtle Forge that I now headed, determined that my next Headquarters should be there and nowhere else. I think that it was Robert Louis Stevenson who said that it was better to travel hopefully than to arrive, and how often do we not find that to be true. But this time

hope had not outrun the truth. Admittedly I never found the Faerie Forge itself, but we did find fields of green grass, orchards free of flies and mosquitoes, a little barn for use as a cook-house, and air as clean and heady as the finest wine. While I went round seeing how the rest of the Group were getting on, my Headquarters settled in and that night, for the first time for weeks, we slept undisturbed.

I think that all of us were a little bit drunk next morning; drunk not with alcohol but with the sheer ecstasy of being alive in that new world. Lorries and transporters were still straggling in after their long bound forward, but nowhere did I see anything but sheer, glowing happiness. Men were tired, yes, but not with the heavy sort of fatigue that leaves one limp and dull. An hour or two flat on their backs in the grass, soaking up the sun and the air, a meal, and they were off again, for there was no time for a long rest. The Jerries were on the run, and the Air Force were clamouring for fresh Landing Strips. They got them, but, before they were finished, I was on my way again to reconnoitre fresh sites further on.

But this time movement wasn't so fluid. Ahead of us was the Seine. Crossings had been forced, and bridges had been built, but at all those recognised crossing places traffic was strictly controlled and the odds and ends like my little recce party got a very low priority amongst the flood of fighting units in pursuit. We had to look after ourselves if we were to get along as fast as I wanted. In the dark we managed to insinuate ourselves into a column which was stumbling its way across the ruins of a railway bridge at Rouen. Months before, while we were still in England, I had sat in the Ops Room of an Airfield and listened to Pilots being briefed for an operation in support of Bombers who were to carry out an attack on this bridge. Whether I was now seeing the results of that raid or not I do not know, but somebody had made a good job of it, and it gave us a bad night. Later on I heard that the bridge had collapsed a few hours after we had crossed. It was a wonder that it did not go sooner. In the weird, artificial moonlight of searchlights we scrambled our way through a tangle of twisted girders, across gaps spanned by only a few thin planks which splintered and cracked as the weight of a vehicle came on to them. Sometimes the column moved steadily on for a few yards, then it would halt for what seemed hours while men sweated and heaved at a vehicle which had got jammed. There was no way of by-passing such blocks, one just had to wait for them to clear. Everyone was doing his best to get on, and impatient explorations forward on foot were futile and often brought to a halt by some other unbridged gap. And there were other unpleasant nastinesses on that bridge as I found to my cost when, returning from one such investigation of a jam, I stumbled on something, fell forward and embraced the long-dead corpse of a horse. It took me a long time to get that smell out of my nostrils! But at last we were over, and the cobbles of the street on the far bank seemed very secure and comforting. Out of the town, and clear of any possible traffic jams, we pulled into the grounds of a big house to have a meal and snatch a couple of hours sleep. It started to rain, but it was a light, refreshing rain, and it was a happy party that shook itself together and was off again before the sun was up.

From now on it was just a mad rush. Landing Strips were reconnoitred, work was started, and then the fields were left far behind, sometimes before they had been used or even completed. I shall remember for all time a bright summer evening standing on the edge of a Strip somewhere South of Dieppe. Spitfires were circling round, all angrily demanding permission to land and all of them short of fuel. On one side of the Strip lay the remains of one of them which had been forced to land, and which had crashed. Beside me stood the Wing Commander. We had not guaranteed that the site would be ready until mid-day the next day, but he, perhaps over-complimentary of our prowess, had taken a risk and moved the whole of his Wing forward. With our fingers tied in knots, we stood and watched those planes come in. They all landed safely, on a Strip that was only half the proper width. It was a superb exhibition of flying, but I think we were both years older when it was all over.

And all the time our Transport Officers and the Drivers slaved away trying to close up our long tail of rear-parties and heavy equipment. Heaven only knows how those Drivers, often plugging along all on their own, ever managed to keep track of us, but we only lost one of them. He was driving one of those funny little jobs called a "Dumper". When stripped for speed and going flat out they might, in those days, have just been able to touch 20mph, but they were not meant for long-distance touring. However, in those hectic days, anything which could move on its own wheels was sent off to do so and thus free the transporters for the lift of the less mobile equipment. Somewhere or other this Dumper broke down and the rest of its fellows chugged along leaving it to follow as best it could. But it and its driver just disappeared and we were quite unable to trace it. Some weeks afterwards the mystery was solved, for we found them, absorbed dishonestly into a Sapper Company near Nijmegen, and were able to bring them back into the fold. All praise to that lad. He had been told to get on, and he jolly well did get on, to the very front of things.

It was all such a glorious confused, controlled, muddle. One issued orders and, somehow or other, those orders got down to all the scattered parties and individuals, to the lame ducks and rear-parties. And on we went.

And it was a confused countryside that we passed through. Germans, and rumours of Germans, left behind in their retreat, kept bobbing up. There was one of our Drivers who arrived at his Unit in the middle of the night and was told to go and doss down in a barn. In the morning he woke, looked at his watch, saw that it was time for him to be moving and took it upon himself to rouse his next-door neighbour in the pile of straw which they had been sharing. History does not relate who was the more surprised; he, or the German who sat up in answer.

But that mad gallop could not last for ever and, as time went on, we began to move into an area where German airfields had existed and, instead of building new Flying Strips, we were employed on the less interesting job of patching up their bomb-damaged concrete runways. For a few days we were halted in the neighbourhood of Ypres, and my Headquarters was located only a few hundred yards from Sanctuary Wood. It was hard to realise that, some twenty-five years ago, those stark skeletons of trees, still splintered and pock-marked by bullets and shell-fire, the tangles of barbed wire and traces of old trenches, left as a Memorial of those days, was typical of the landscape on to which our fathers had looked. Now that sea of mud and water-logged shell craters had become green, fertile farmland traversed by small drainage ditches. I had visited Ypres some years earlier on a "Battlefield Tour". Some members of our party had fought there and I had been told by one of them that two of his Sappers, plodding up to the front-line at night, had slipped off one of the rickety duck-board tracks which wound their way across that morass, and had been drowned in one of those ditches. One could easily step across them now.

But during that halt we had time to relax a bit and we had a chance to visit some of those War Cemeteries, so beautifully laid out by the War Graves Commission and so devotedly maintained all through the Occupation by the local people. It was good to learn that the Germans had co-operated fully in that work of maintenance. There was a wonderful feeling of peace in those Cemeteries: Perhaps They were glad to welcome us back.

There were others, too, who welcomed us, including the Mayor of Ypres who invited us to be present at the formal renewal of that most moving ceremony, the Sounding of Retreat at sun-down at the Menin Gate.

So, though there was plenty of work done, we had time to relax and sort ourselves out, and it did us all good.

But, as the Autumn passed and the whole forward movement slowed down, memories get blanketed in the fogs and mists of Winter. There is one day, however, which I shall always remember.

On our arrival in his area, some miles East of Antwerp, I had paid a formal call on the local Burgomaster. He was a Grand Old Man who, unknown to any member of his family or household, other than his wife, had allowed his Chateau to be used as one of the links in the chain of escape for Prisoners of War. He had, I think, appreciated my formal call, and we became friends. In due course he invited me to a Woodcock shoot in his woods, lending me a lovely Purdey 12-bore which during the Occupation had been carefully hidden with the rest of his armoury, in a ramshackle shed deep in his woods. It was a brilliant November morning as the guns assembled. Dewdrops sparkled in the sunshine, turning cobwebs into jewelled lacework; everyone was happy, for the War was, for that day, far away; and a good Fall of Woodcock was reported. I have always been grateful to the old Baron for that memory.

But that sort of memory is unique, for we were absorbed in the hard slogging match against the weather and mud, repairing old German Fields. From one repaired Airfield to another, we edged our way up through Belgium and Holland till January found us working flat out in the snow and frost—and later in the thaw, which was the worst of all—to build a brand new Airfield which had to be ready for the Reichwald battle. In spite of the weather we managed to complete the task on time and, once more, felt the thrill of achievement as we watched the planes coming in to land after making their first strike of the day.

My memories skip the following weeks till they come to a day when I found myself sitting in the sun on that same Airfield waiting for planes to come in and, perhaps, crash-land on the runway. It was, we had been told, imperative to keep it clear for, up in front, they were crossing the Rhine and some "lame ducks" could well be expected. But, as the day wore on and nothing happened to upset the continual stream of planes using the Field, and as the situation on the Ops Room map gradually began to get clearer, we realised that the day had gone better than, perhaps, any of us could have reasonably expected.

Soon after that we crossed the Rhine too, and with that crossing a new phase started. We still worked on repairing damaged Fields, and there were still occasional "flaps" when tasks still had to be completed "by yesterday". But we were more static and, after the Surrender, the work required of us became less temporary and more of a permanent repair and improvement nature. And, with the end of the War, there came "Release" and the gradual disappearance to Civvy Street of old, trusted faces. And so, though we lingered on for some months before we were finally disbanded, I like to leave the Group on the Airfields on which we were working when the fighting was over. And I like, best of all, to remember those last evenings.

By day one could walk on a part of the Airfield where Curlews called, reminding one of Scotland, of days spent on the moors exploring burns and little lochs full of trout. But always those thoughts could be broken by the roar of some plane circling the Field. But with the coming of dusk, when all those noises were stilled, one was left with silence and a feeling of peace until, hesitantly, the silence was broken by little snatches of elfin music which grew and mingled with each other until, from all round one, came the glorious song of nightingales. They seemed to be everywhere. Never have I heard them sing so beautifully as during those nights in Holland, and somehow my thoughts were carried back to that first Air Strip we had built, behind the cliffs of Dover, and to that single bird singing even as we decided on the destruction of his home. It was good, just as a fancy, to think that he might perhaps be one of those that sang to me on those final nights. And it was good to know that, because we, and others like us, were there, those woods and fields of Kent were safe again.

And so, with the song of nightingales to end, as it began, the manhood of the Group, I like to leave my memories. We had done the job for which we had been called into being and now we were to go on, in other ways, to other jobs.

"Carpe Diem"—yes, I think we did.

Soil-Steel Bridges—An Alternative

CAPTAIN C L HOWELL B Sc (Eng)

The Author joined the Royal Engineers in Sep 1970 on the University Cadetship Scheme. After obtaining his degree in Civil Engineering at RMCS, and training at RMAS and RSME, he served with 36 Engr Regt, 26 Armd Engr Sqn and JLRRE. He resigned his commission in 1978 to emigrate to Canada. Since that time he has been employed by Armco Canada Ltd as the Sales Engineer in Vancouver, BC. His duties include, amongst others, the design and installation supervision of the long-span soil-steel structures described in this article.

OVER the years the Royal Engineers have most certainly been well-versed in a variety of innovative and improvised bridging techniques; indeed, Sapper bridges can be found on every continent, in desert and snowfield, in swamp and on mountain.

Though a number of these structures are in concrete, the majority are either equipment bridges (Bailey, Acrow Panel etc) or timber improvised bridges. Indeed my first experience with overseas construction work with the Sappers was on *Exercise Waterleap 1971* when 50 Field Squadron built two 80-ton capacity bridges at Chilliwack Lake, British Columbia, Canada. One of these was a 120-foot long 3-span log stringer bridge, all timber, (the other utilized "I" beam stringers).

In 1967 a new kind of bridge appeared in Canada, a "Long Span Soil-Steel Structure". In the simplest terms this was a 12.2 metre span elliptical culvert, fabricated from curved corrugated steel plates and a pre-engineered structural backfill. This structure, patented under the name "Super Span", was an outgrowth of pioneer developments by Mr C L Fisher, of Armco Canada, at Rogers Pass in British Columbia, in 1961, where snow-sheds protecting the Trans-Canada Highway were built utilizing long span soil-steel structures (Fig 1).

The development of Super Span represented a major breakthrough for large corrugated steel plate structures (SPCSP). Prior to this such "pipes" were limited to about 7.5m spans with very few actually built beyond a 6m span. Super Span structures designed and built since these early days have exceeded 15m in span. To date over 1000 structures have been built in North America, Europe, Africa, Australia and South America.

As a result of the experience gained there is now a national specification for long span structures, the *American Association of State Highway & Transportation Officials (AASHTO) Standard Specifications for Highway Bridges*, 12th Edition 1977. This does not give a design method so much as tabulated design standards on geometry, flexibility and minimum cover requirements. I shall discuss design methods later in this paper.

The Sappers are well-used to handling and installing culverts, and for the most part believe that hydraulic design is all that is required of them; once a size has been selected throw it in the hole and backfill it. I recall from my days as an Armoured

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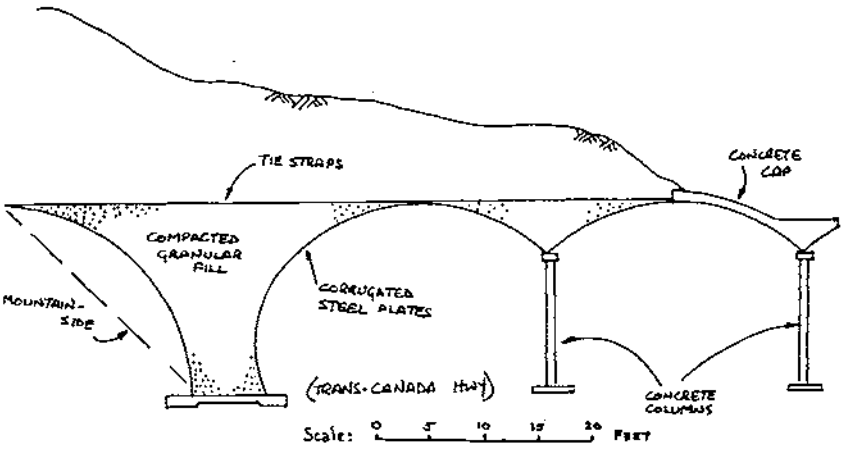


Figure 1. Rogers Pass Snowsheds (1961)

SOME SECTIONAL PROPERTIES

Note: All Multi-Plate structures are made of steel sections with corrugations (pitch 152mm and depth 51mm) running at right angles to the length of the section.

Physical Properties of Armco Multi-Plate

Nominal Thickness mm	Area of Section mm^2/mm	Moment of Inertia mm^4/mm	Section Modulus mm^3/mm	Radius of Gyration mm	Developed Width Factor (DWF)*
3·0	3·522	1057·25	39·42	17·327	1·240
4·0	4·828	1457·56	53·30	17·375	1·241
5·0	6·150	1867·16	66·98	17·425	1·242
6·0	7·461	2278·31	80·22	17·475	1·244
7·0	8·712	2675·11	92·56	17·524	1·245

*DWF measures the increase in profile length due to corrugating

Approximate Weight of Armco Multi-Plate Section in Kilograms

Nominal Length	Nominal Width	Approximate plate weight in Kilograms				
		Nominal thickness of plate in millimetres				
mm	mm	3·0	4·0	5·0	6·0	7·0
3050	1220	127	169	210	251	293
3660	1220	152	202	251	300	350
3050	1475	151	200	249	298	347
3660	1475	180	239	297	356	414
3050	2210	221	292	364	436	507
3660	2210	264	349	435	521	606

Figure 2. Product Information

Engineer that we would mount a culvert on the AVRE'S fascine cradle, approach the trench and drop it in (with the help of an unpredictable and ill-behaved blow-out pin). The AVRE would then back off, lower its blade and doze a few tons of dirt on top . . . . . *Voilà*, a complete installation!

With Super Span structures a little more care has to be taken, for that Corrugated Steel Plate Arch, 15m span by 10m rise, is to carry a dead load of maybe 15m of cover, yet the plates of the arch are only 7mm thick! How, then, is the strength developed in such a seemingly flimsy pipe? Two factors: firstly the inherent strength of the deep-sectional corrugation, the 151 × 50mm profile used in "Multi-Plate" pipes since 1931 (see Fig 2), and secondly the ability of a well-compacted granular material to mobilize into a soil-arch when installed to design specifications. As an additional design feature longitudinal concrete "thrust beams" are built into the structure at the extremities of the top arch (see Fig 3). The purpose of these is two-fold; firstly they enable compaction equipment to work very close to the structure and present a vertical face to the compacted fill, which will prevent spreading of the top arch; secondly they provide longitudinal stiffness to the structure and help to distribute point loads or to bridge soft spots in the fill.

The critical backfill zone is a composite part of the Super Span design, and all material in this zone is to be well-graded granular material, 75mm minus, installed in 200mm lifts and compacted to 95% Standard Proctor density. Because of the curved roof of the structure such a fill will develop soil arching above the pipe and will carry load away from the steel in much the same way as a properly-constructed road fill carries load away from the subgrade.

Design

The objective of the design method is to establish the following:

(1) Plate thickness of top (load carrying) arch
(2) Buttress dimensions
(3) Soil arch depth (where applicable)
(4) Requirement for additional roof stiffening (ribs, angles etc).

Before detailed design is undertaken a number of limiting criteria must be met (per AASHTO): (see Fig 3).

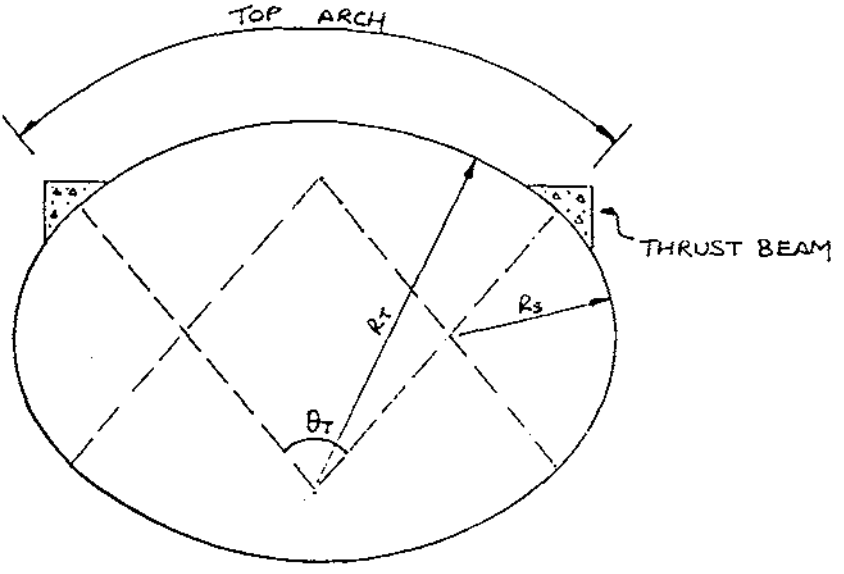


Figure 3. *Limiting Criteria Reference Diagram*

LIMITING CRITERIA

(1) R_T/R_S : minimum 2 maximum 5
(2) Max θ_T : 80°
(3) Minimum plate thickness for top arch radius (R_T) as follows:

Top Radius	4500	to 6100	to 7000	to 7600	mm
Min Thick	3	4	5	6	mm

(Plates available: 3, 4, 5, 6, 7mm)

Nomenclature:

D diameter of pipe (= 2 R_T for arch or ellipse)
R_T top radius (mm)
R_S side radius (mm)
R_C corner radius (mm)
R_b bottom radius (mm)
H_c height of cover above crown (m)
P_v vertical pressure at crown (kPa)
C_r ring compression (kN/m)
A sectional area of plates (mm^2/mm)
r radius of gyration of section (mm)
I moment of inertia of section (mm^4/mm)
γ = density of soil kN/m^3 (use $19kN/m^3$ as standard)

1. *LOADING*
   Dead Load DL = $H_c \gamma$ kN/m^2 (kPa)
   Live Load LL = Extract from Table 2. (from AASHTO)
   Total Load P_v = DL + LL = $H_c \gamma$ + LL (kPa)
2. *ALLOWABLE STRESS* f_c (= $f_b/2$)

t (mm)	3	4	5	6	7
r (mm)	17·327	17·375	17·425	17·475	17·524

Two conditions governed by ratio D/r
D/r (2 R_T/r) < 864.5 condition (1)
D/r (2 R_T/r) > 864.5 condition (2)
Condition (1) f_b = 230MPa =>$f_c = f_b/2$ = 115MPa

Condition (2) $f_b = \dfrac{34 \times 10^6 \times (180)^2}{(D/r)^2 \times (\theta_T)^2}$

(Note: if $\theta_T > 80°$ use condition (2)).

3. *RING COMPRESSION* C_r
   $C_r = P_v \times R_T$ (kN/m)

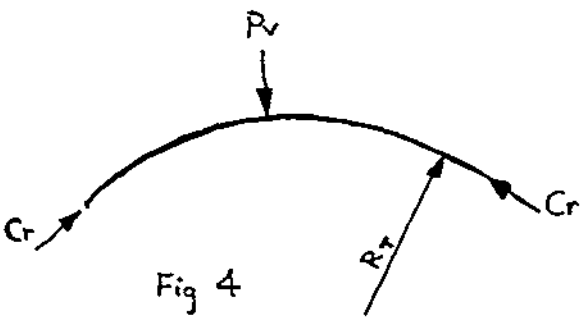
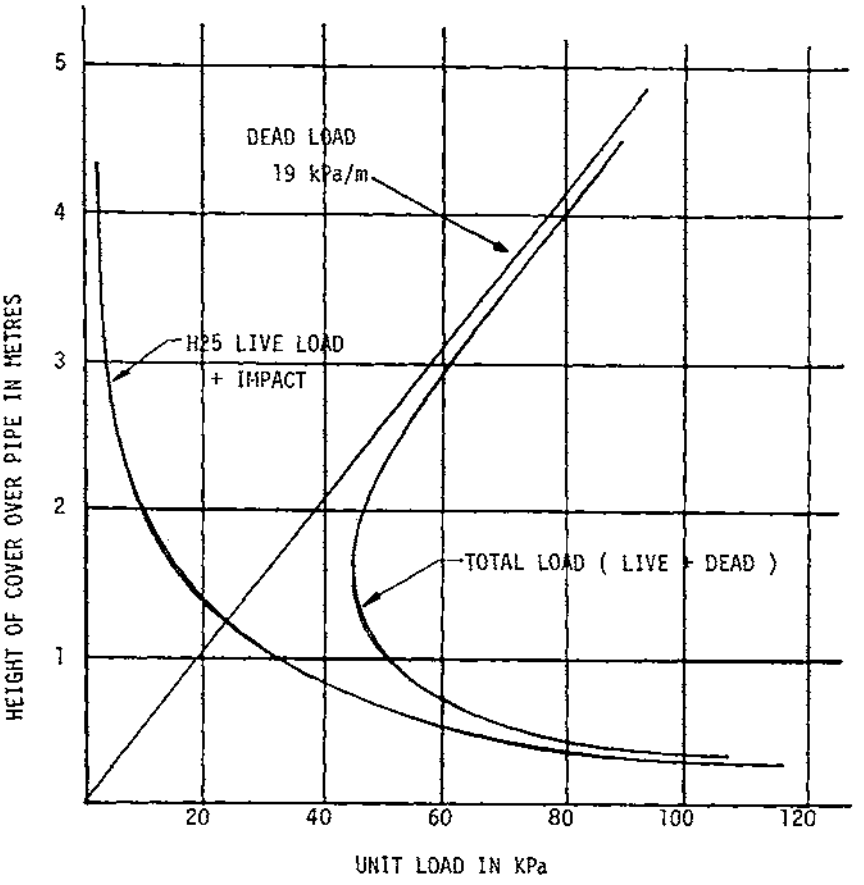


Fig 4



Height of Cover (m)	0.5	1.0	1.5	2.0	2.5	3.0	over 3.0
Load (kPa)	61	32	17	10	6	4	0

TABLE 2. HIGHWAY H–25 LOADING

4. *AREA REQUIRED* (ie Plate thickness)

$A = \frac{C_r}{f_c}$ (mm²/mm)

If $> 8 \cdot 712 \frac{mm^2}{mm}$ a compacted soil arch will be necessary.

t(mm)	3	4	5	6	7
A (mm²/mm)	3·522	4·828	6·150	7·461	8·712

(Note: check against min thickness for R_T)
Hence top arch plate thickness = mm.

5. *BOLTED SEAM STRENGTH (USS)*

t (mm)	3	4	5	6	7
USS kN/m	746	1120	1470	1840	2100

Select place thickness from 4.

$\frac{USS}{C_r} \not< 2{\cdot}0$ (factor of safety)

6. *FLEXIBILITY FACTOR* (FF)

$FF = \frac{D^2}{EI}$ (round pipes)

or $\frac{D^2 \quad \Theta_T{}^2}{EI \times 180^2}$ for ellipses or arches. $FF \not> 0{\cdot}114$

t (mm)	3	4	5	6	7
I^{mm^4}/m	1057	1458	1867	2278	2675

7. *SOIL ARCH ANALYSIS*

The analysis of the behaviour of a soil arch under load would present more than enough discussion for a complete paper. Considerable work has been undertaken by Messrs Fisher and Madsen of Armco, developing soil-shear theories established by Terzaghi (*Soil Mechanics in Engineering Practice*, Terzaghi and Peck 1948), resulting in the tabulation of a table of top radius to height of cover/soil arch selection (Table 1).

TABLE 1. SOIL ARCH ANALYSIS FOR H–25 ONLY

If a high fill situation prevents use of any Multi Plate thickness, a constructed soil arch may reduce pressure on the structure to a level which will permit ring compression to occur, without buckling.

To design for soil arch, enter Table at appropriate radius. Find correct range for total cover. Use plate thickness as specified at top of Table, and soil arch as per end column

For Top Radius of:	Range Of Total Cover Including Soil Arch in metres					Use Soil Arch Depth of:
	Use Wall Thickness Of:					
(mm)	3·0mm	4·0mm	5·0mm	6·0mm	7·0mm	(m)
Up to 4875	4·2–7·5	7·6–10·5	10·6–13·0	13·1–15·0		2·1
5180		4·2– 9·0	9·1–11·5	11·6–14·0	14·1–15·0	2·1
5485		4·6– 8·0	8·1–10·5	10·6–12·5	12·6–14·5	2·1
5790		4·9– 7·5	7·6– 9·5	9·6–11·5	11·6–13·0	2·1
6095			5·2– 9·5	9·6–11·5	11·6–13·0	2·4
6400			5·2– 9·0	9·1–11·0	11·1–13·0	2·7
6705			5·5– 9·0	9·1–11·0	11·1–13·0	2·7
7010				5·8–10·5	10·6–12·0	3·0
7315				5·8–10·5	10·6–12·0	3·0
7620					6·1–11·5	3·0

Briefly the behaviour of a soil arch is shown by Fig 5, and may be summarized as follows:

$$\sum_{o}^{n} P = \frac{nd\theta}{k} \qquad \sum_{o}^{n} nh_c = \left[d \quad 0+1+2+\ldots.(n-1) \right]$$

8. *BUTTRESS DESIGN (THRUST BEAM)*
See Fig 6

$H = C_t \cos t \frac{\theta_T}{2}$

$\sigma_3 = h\gamma$
$\sigma_1 = 5{\cdot}1\sigma_3$ (Terzaghi & Peck)

$h_b = \frac{H}{\sigma_1}$ (m)

Reinforcement: use minimum required for shrinkage ie 0·2% Gross Area.

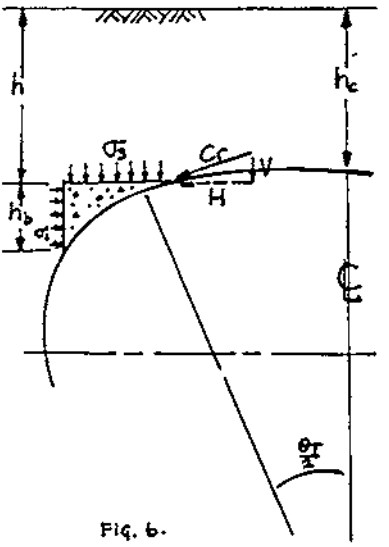


Fig. 6.

9. *ROOF RIB REQUIREMENTS*
a) Establish R_T/H_c ratio
b) Enter following table at appropriate value:

R_T/H_c	<3	3 to 3·5	3·5 to 4·3	4·3 to 5·5	5·5–7·5	7·5–10
MPL ribs at C-C	none reqd	4·27m	3·66m	3·05m	2·44m	1·83m

DESIGN EXAMPLE

R_T = 6780mm
R_S = 3050mm
R_T/R_S = 2·22
θ_T = 80°

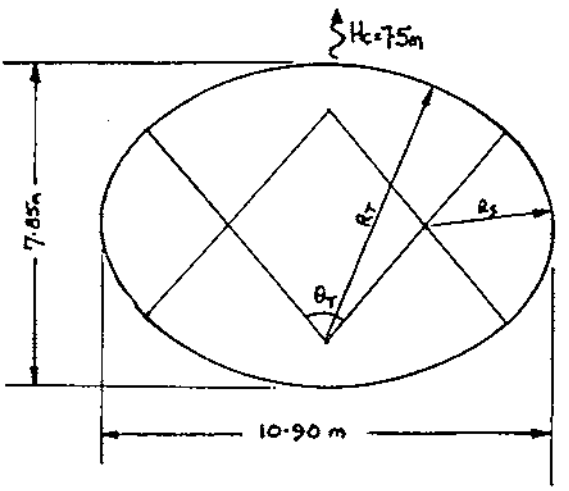


Fig. 7.

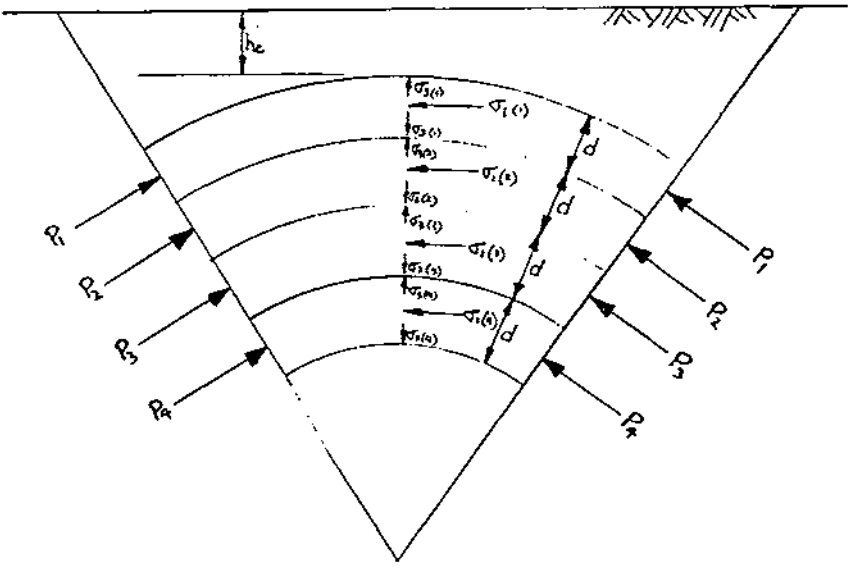


Figure 5. The Behaviour of a Soil Arch

If A = d × 1 = d/unit length; γ = unit wt of soil and $\sigma_z = k\sigma_l$

Then $\sigma_3(1) = h_c\gamma$ and $P_1 = A\sigma_1(1) = d\sigma_1(1) = d(h_c + \gamma)/k$

$\sigma_3(2) = \sigma_3(1) + \gamma d$ $P_2 = A\sigma_1(2) = d\sigma_1(2) = d\gamma(h_c + d)/k$

$\sigma_3(3) = \sigma_3(2) + \gamma d$ $P_3 = A\sigma_1(3) = d\sigma_1(3) = d\gamma(h_c + 2d)/k$

$\sigma_3(4) = \sigma_3(3) + \gamma d$ $P_4 = A\sigma_1(4) = d\sigma_1(4) = d\gamma(h_c + 3d)/k$

and $\sum_{0}^{n} P = \frac{nd\gamma}{K} \sum_{0}^{n} nh_c + d\left[0 + 1 + 2 + \ldots\ldots + (n-1)\right]$

Limiting Criteria

Minimum thickness for R_T of 6780mm = 5·0mm

R_T/R_S = 2·2 so OK

θ_T = 80° so OK

DESIGN

1. *LOADING*

Dead Load = $H_c\gamma$

= 7·5 × 19kPa = 142·5

Live Load = 0 (H_c > 3·0m) (Table 2)

∴ P_v = 142·5kPa

2. *ALLOWABLE STRESS*

$D/_r(2R_T/_r) = \frac{2 \times 6780}{17{\cdot}425}$ (r for min allowable thickness)

= 778·19 < 864·5

hence use f_b = 230MPa

f_b = 230MPa; ∴ f_c = 115MPa

3. *RING COMPRESSION*

$C_r = P_v \times R_T$

= 142·5 × 6·780 = 966·15kN/m

4. *AREA REQUIRED*

$$A = \frac{C_r}{f_c} = \frac{966.15}{115}\ mm^2/mm$$

$$= 8.401 mm^2/mm$$

A for 7mm plate gives $8.712 mm^2/mm$
Hence use 7mm plate.

5. *BOLTED SEAM STRENGTH*

For 7mm USS = 2100kN/m

$$\frac{USS}{C_r} = \frac{2100}{966{\cdot}15} = 2{\cdot}173 > 2 \qquad \text{so OK}$$

6. *FLEXIBILITY FACTOR*

$$FF = \frac{D^2 \theta_T^2}{EI \times 180^2} \qquad D = 2R_T \qquad E = 2 \times 10^5 MPa$$

$$= \frac{(2\times6780)^2 \times 80^2}{2\times10^5 \times 2675 \times 180^2}$$

$$= 0{\cdot}0679 < 0{\cdot}114 \text{ so OK}$$

7. *SOIL ARCH REQUIREMENT*

for R_T of 6780
H_c 7·5m
t = 7mm
From Table (1) no soil arch is required for a 7mm roof section. Note that we could use a 6mm roof with a 3·0m soil arch to achieve structural stability. This will produce a saving in material.
Hence use 6mm plate

8. *THRUST BEAM DESIGN*

$C_r = 966{\cdot}15 kN/m$

$$H = C_r \cos\frac{80}{2} = 740{\cdot}07 kN/m$$

$\sigma_3 = h\gamma$ $\quad h = H_c$ + top rise (from geometry)
$= 8{\cdot}8 \times 19 kN/m^2$
$= 167{\cdot}2 kN/m^2$
$\sigma_1 = 5{\cdot}1 \times 167{\cdot}2 = 852{\cdot}72 kN/m^2$

$$h_b = \frac{H}{\sigma_1} = \frac{740.07}{852.72} = 0.868m$$

Buttress face $\geqslant$ 0·868m high

9. *RIB REQUIREMENT*

$$R_T/M_c = \frac{6{\cdot}78}{7{\cdot}50} = 0{\cdot}904 < 3 \therefore \text{ no ribs required.}$$

Hence use the following
Top Arch thickness = 6mm
Soil Arch depth = 3m
} alternatively 7mm with no soil arch.
Buttress height = 0·868m min
No ribs required.
Standard Critical soil envelope applies (See Fig 8)
It can be seen, then, that the design procedure is simple and may be undertaken at troop level in the field if the appropriate tables are available.

Under normal circumstances the structure would be completely pre-engineered by an Armco Engineer and presented as a "Design and Supply" package. (In this way the patent rights of Armco are protected).

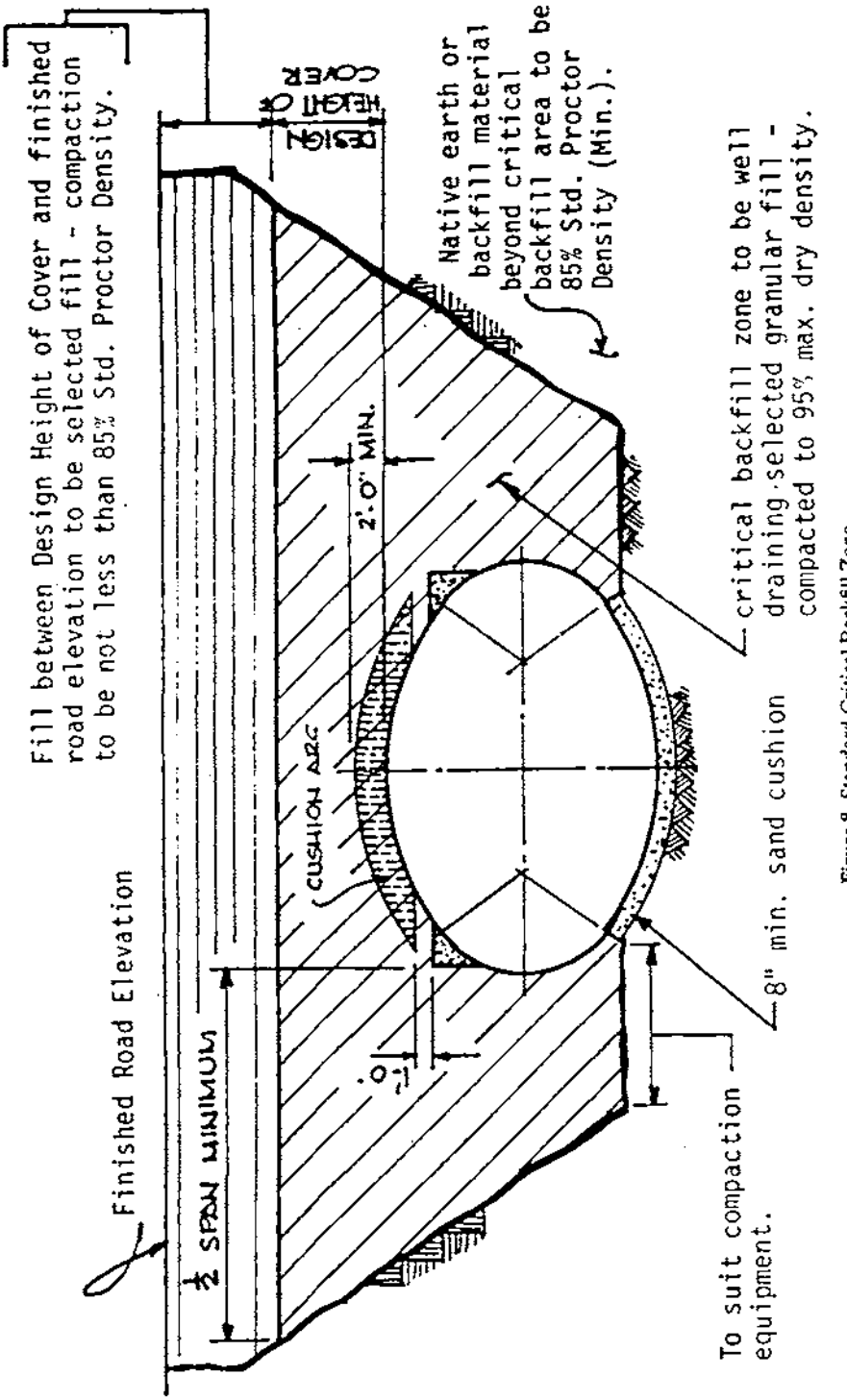


Figure 8. Standard Critical Backfill Zone

INSTALLATION

It is the installation of these structures which, I believe, makes them so suitable for Sapper bridging operations. Even the largest structures can be erected by a Section, with Support Troop assistance for backfilling, equipment and so on.

There are three phases of installation:

(1) Bed preparation (including de-watering if necessary)
(2) Erection of plate structure
(3) Backfilling of structure.

1. *BED PREPARATION*

The bed may be prepared in two ways

(a) A flat surface prepared to the grade of the culvert (see Fig 9).
(b) A pre-shaped bed to grade, shaped to accommodate the curvature of the invert plates (see Fig 9).

In both cases the foundation must be able to support the load of the culvert (P(base) = P_v at crown) and will be furnished with a minimum of 300mm fine, loosely-compacted granular material (sand).

2. *ERECTION OF PLATE STRUCTURE*

Erection may procede in three basic ways:

(a) Plate by plate assembly on the site.
(b) Pre-assembly of invert, roof, side units at a sub-assembly site for final assembly on site.
(c) Complete assembly away from site. This method depends on the size (weight) of the structure and the lifting capacity of available cranes. Most often used when a structure is to be lowered into an existing waterway where diversion or damming is not possible.

An equipment/manpower Summary follows later.

When the Super Span is designed and installed accordingly one has a permanent bridge structure of great strength and high overload capability, and one which requires no maintenance once in place.

As an example of the high load-carrying capacity of such structures, an ellipse of 10–12m span could support the load of a Chieftan tank with only 1·5m cover over the crown.

Installation Equipment and Manpower

When one looks at the type of equipment and crew size required to install a Super Span one can see why such a structure would be ideally suited to the Sappers:

(a) *Bed Preparation:* Section NCO
4 man crew
Rakes, shovels etc
Small tracked dozer (D6 or smaller)
Front end loader (A500 or similar)
Double drum SP Compactor (walk behind) (Bomag B75W or similar)
2 man survey crew to shoot in.

(b) *Plate Assembly:* Section NCO
4 man assembly crew

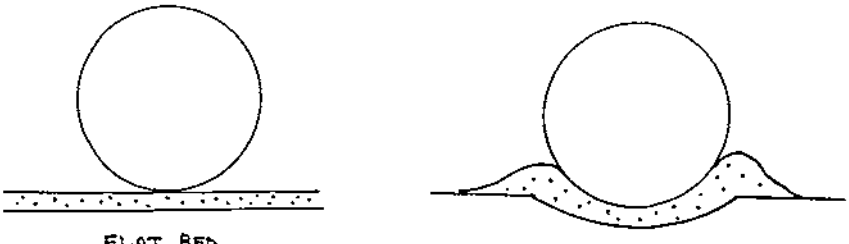


FIG 9

4 man pre-assembly (optional)
Pitman/Hiab/backhoe for lifting plates. *Note*: depending on thickness and plate dimensions, plates will weigh from 127kg to 606kg
Scissor lift platform or truck mounted scaffold
2" × 1/2" drive air wrenches
Compressor
Spud wrenches, bars etc
5–10 ton crane if large pre-assembled sections are to be lifted.

(c) *Backfill:*
Section NCO
4 man crew
Shovels etc
2 double drum rollers (Bomag B75)
SP Compactor (15T)
D6 or smaller
D4 (for going over roof)
Hand tampers or air tampers
Water (to aid compaction)
Density testing crew
Sufficient dump trucks to maintain adequate supply of material (up to 3500 tons per day is possible with the compaction equipment shown.

Given the above even the largest structures can be completed in a matter of 4 to 6 weeks where the conventional bridge would take 3 months or more. In addition no specialist skills are involved, though organization can contribute enormously to a job.

3. *BACKFILL OF STRUCTURE*

As has been mentioned the critical backfill zone forms part of the composite soil-steel design and will usually be specified by the design Engineer. A standard zone however has been devized by Armco Engineers and provides a conservative design. (see Fig 8)

The design of the critical zone comprises three parts:

(a) Type of material - well-graded granular 75mm minus (typically AASHTO Granular "A" "B" or "C".)
(b) Shape of zone (see Fig 8).
(c) Compaction of material: laid in 200mm loose lifts and compacted to minimum 95% Standard Proctor density. Further limitation on equipment size, placement of lift etc are specified on the construction drawings

SUMMARY

Super Span bridges provide a very economical alternate to more conventional bridging methods and lend themselves well to installation in remote locations where specialist skills and equipment are not available.

Curved plate segments can be stacked and transported to site by a handful of trucks; the other major construction material, soil, is readily available in most locations. When put together the two will present a permanent and durable bridge structure.

From past experience as a Sapper and from my current experience in designing and supervising the installation of these structures I am convinced that they would be ideally suited to Sapper Projects.

Footnote: In 1979 the Sappers did indeed build such a structure, at Gagetown in New Brunswick.

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Ex Northern Quest 1983 —A Troop in Norway

CAPTAIN A D MACKLIN RE, BA(H)

The Author joined the Corps on a University Cadetship at Cambridge. Graduating with a First in Engineering, he attended Victory College RMAS and the YO Course before his first tour. As a Tp Comd with 50 Fd Sqn (Const) he saw service in Canada and was involved in the initial rebuilding of Port Stanley Airfield before flying back to take command of the Indep Fd Tp RE AMF(L) in Nov 82.

AMF(L), NATO's reaction to any Soviet sabre rattling, holds regular exercises in Norway. By way of repayment and to improve facilities for exercising units, the Independent Field Troop RE AMF(L) has undertaken construction projects in the training areas around Voss (S W Norway) since 1978. The tasks are always varied and challenging. They have ranged from carving roads through some of the roughest country in the world to constructing 3-span bridges over fast flowing rivers and company sized hutted camps from virgin sites. This year proved no exception with a Cl 20 road, a blockwork ammunition bunker, a target store, two building extensions, an RC field kitchen base and two roofs all on the agenda.

With the extreme weather conditions experienced in Norway, all roads are built on a low initial cost/high maintenance principle, range roads are no exception. The technique is simple, an excavator leads the way picking the course of the road and digging out the side ditches, dumping the spoil in the centre of the road (topsoil, turf, bushes; they all go in!) A roll of *Terram* is laid, followed by tippers dumping stone which is spread by a bulldozer. That is it! No "remove all vegetable matter" or "six passes with a vibrating roller over each 300mm layer". From a technical viewpoint it appears disastrous—but it works!

This year however was rather different. The specifications required a Cl 20 road to provide civilian truck access to an ammunition storage area. That meant working to line and level, removing topsoil and major earthworks in some of the hardest rock in Europe. The major equipments available were a D6C from UK and, Norwegian supplied, a D7 (1954 MCT with winch operated blade), 2 Broyt excavators (which have one pair of rubber wheels and one pair of metal wheels with no power to either axle; they are the epitome of economy, a simple bogey, a cab, a diesel engine driving a hydraulic pump and a digging arm) and a Le Roi Compressor (an air compressor mounted on a 6t chassis, 1946 model).

Neither bulldozer was able to move much sub-topsoil material which resulted in many hours of drilling and blasting using the compressor, which worked up to fifteen hours a day non-stop, and industrial dynamite. The Broyts dug the ditches and worked a quarry that was opened up on one side of the first cutting on the road alignment. After the road had passed the quarry and all was in full swing progress was made at a very good rate. It was a road built on a shoestring budget, the only

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Photo 1. "And we get paid extra for working with that scenery"

outgoings being for the culvert pipes and hire of the excavators. In seven weeks 650m of sub base were constructed involving the laying of approx 10 000m^3 of stone.

The great attraction of most of the other jobs was the completeness of the section sized tasks. Too often "construction task" involves spending the whole time at or near ground level frequently only putting in the foundations for someone else to complete later. This year, sections were spread over 300km with building tasks that started with a bare excavation and finished with a complete building; foundation, drains, floor, walls and roof. The ability to stand back at the end and see the finished product ready for use makes a very satisfying achievement.

Some of the tasks were along familiar lines with blockwork foundations, timber

Photo 2. Their Broyt, our D6, the nations working in harmony

Ex Northern Quest 1983 A Troop In Norway 1 & 2

walls, pre-built trusses and corrugated sheeting roofs but the ammunition bunker used a technique, common in Norway, that is very simple and easy. A *FORSKALINGS-BLOKK* is a hollow concrete block of dimensions 0.6 × 0.3 × 0.2m with recesses cut into the webs to accept reinforcing bars. The blocks are dry laid three or four courses at a time and then filled with concrete. The result, one reinforced concrete wall with none of the problems, expense and time of extensive formwork or precision brick and mortar work. As soon as the first set of the concrete has taken place one can build on up. If necessary, a simple slurry finish adds "beauty" to the finished product.

Those were just two of the tasks that kept the Troop busy and justified our eight week period amidst the beautiful scenery of the Norwegian Fjordland in summer. *The value of the exercise for the benefit of PR for the British Army in Norway, for* the improvement of training facilities for both British and Norwegian units and for the trade training value for the members of the Troop in their deployment area is tremendous. The attraction of this exercise is just one more thing that draws people to the Troop and creates a spirit within the Troop that makes the Independent Field Troop RE AMF(L) just a little bit different.

The Sandbaggers

71 (SCOTTISH) ENGINEER REGIMENT (VOLUNTEERS)

CAPTAIN M A PAYNE RE

The Author was commissioned into the Corps in December 1977. On completion of the YO Course he was posted as a Tp Comd with the Junior Leaders Regt for one year. His next posting was with 32 Armd Engr Regt, again as a Tp Comd. Since leaving BAOR in September 1982 he spent a further six months with the Junior Leaders Regt until he was posted as Intelligence Officer with 71 (Scottish) Engr Regt (V).

This is not a tale of how the Regiment broke an international Spy ring but how, over a sustained period of time, the Regiment was able to fill 400 sandbags per hour with only five soldiers. It all started a long time ago and if you are sitting comfortably then I shall begin.

Once upon a time there was a Commanding Officer who took his Regiment to Annual Camp at Inverness. Part of the work included tasks at RAF Kinloss, and to cut a long story short, required 6500 sandbags to ensure completion of the work. Like all good Sappers the first reaction was to turn to our Bible, *The Royal Engineers Pocket Book*, and other rarely used pamphlets relevant to the matter in hand.

"My God!" we cried, "There's no DS solution."

This called for "Initiative" and soon ideas began to formulate. There were

Captain M A Payne
The Sandbaggers.

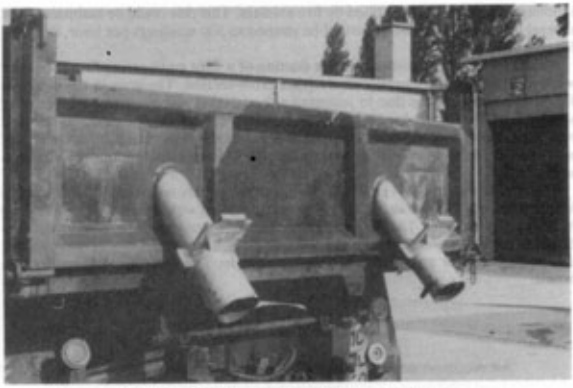


Photo 1. The bastardising of the tailboard—Plan Y

visions, to a greater or lesser degree, of hoppers ready made and improvised from 40-gallon drums on 6ft pickets. Others thought they saw pipes coming from tipper tailboards, whilst others had pictures of plant pirouetting and spewing out just sufficient sand to fill a sandbag.

Consultation followed and the end result was a home-made 4-ton tipper tailboard with three pipes coming away from the truck. The pipes were produced by a light engineering firm with close ties to the Regiment. When put into operation it was found that as the saying goes "too many cooks spoil the broth" and so the centre pipe was made redundant, but not forgotten. Soon Plan Y was adopted and as can be seen in Photo 1 it involved bastardising an existing tipper tailboard.

Further consultation followed and work progressed until it was found that 400

Photo 2. The "modus operandum"

The Sandbaggers 1 & 2

sandbags per hour could be filled by five soldiers. This rate could be maintained for several hours and if necessary could be pushed to 500 sandbags per hour, but only for short periods.

If the pipes had not come from the ducting of a light engineering firm then they were to have been produced with a square cross-section. The door in the pipe was found to be superfluous due to jamming although this was overcome by removing some screws and loosening the plate. Furthermore, because the sand was damp it was easier for the people in the tipper to regulate the flow than if it had been dry and hence a continuous flow was produced. The "modus operandum" can be seen at Photo 2.

The aim of the article is two-fold. Firstly to tell others one solution to the problem and secondly to find out if others have been faced with a similar problem. If so how was it overcome? The Regiment would be delighted to know. Finally the tailboard is currently on show with the Edinburgh Squadron and can be seen on any day providing prior arrangements have been made. The first offer secures the tailboard!

Canute Bombay

AN ACCOUNT OF SOME SAPPER WORK FOR CIVIL AVIATION IN INDIA

The late LIEUT COLONEL THE REVD J R S W ELKINGTON
(died 23 April 1983)

Author's Note

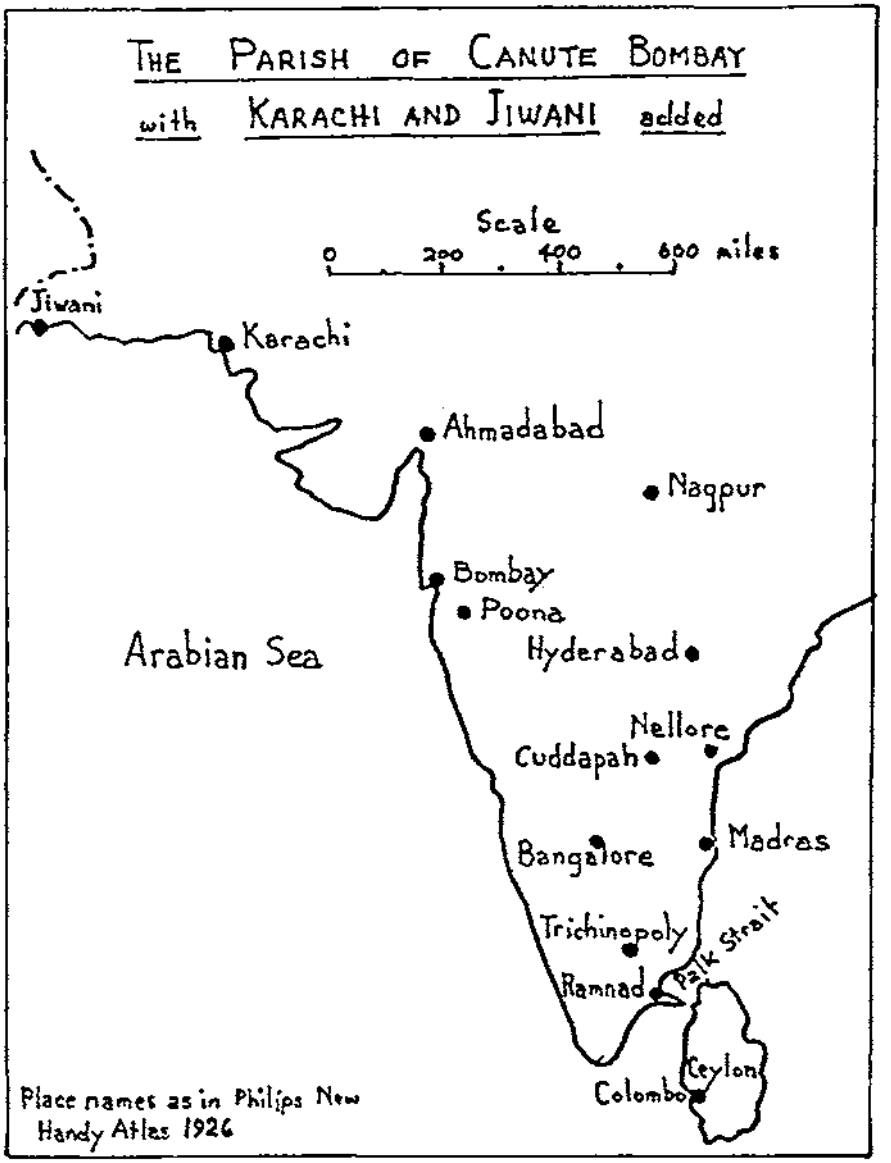
The railways, roads and other communications in India owe much to Sapper effort. It was my privilege to make a humble contribution to Civil Aviation. This Article is intended to throw some light on a little known activity. For the sake of simplicity I will use the word India to cover India, Pakistan and Bangladesh, similarly I shall refer to the Provinces as they were under the Raj. Readers please forgive.

A Robin Calls

In the early and mid 1930's I was happily employed as a Madras Sapper in charge of the Workshops at our HQ in Bangalore. One morning a "Robin" arrived on my desk. It was a letter from the Engineer-in-Chief explaining that the Indian Government were engaged on a Capital Works Programme for Civil Aviation. They required more engineers than were available from the Central Public Works Department. Would any RE Officers like to volunteer to fill the vacancies? I was very happy at the time; running the Workshops under Maurice Jeakes and, later, C J Fearfield was fun. I had a small but, to me, interesting string of ponies. I was the Secretary of our Madras Sapper Polo Club and also of the Bangalore Garrison Club. The future looked bright with only a vague suggestion that perhaps I ought to think about working for the Staff College. Why under these circumstances did I say "Yes" to that Robin's call? I don't know but I am glad I did.

The Bombay Aviation Division

One forgets about the "Call of a Robin", thinking that nothing is likely to happen anyway, but in due course something did happen. Information arrived from Delhi that the Government of India would be expanding their Central Public Works Department to accept works for Civil Aviation all over the sub-Continent. To this end four Aviation Divisions were to be formed based on Delhi, Calcutta, Karachi and Bombay. The Executive Engineers (EE's) in charge of the Delhi and Karachi Divisions would be PWD men, Sapper Officers were required to raise and control the Calcutta and Bombay Divisions. So it came about that a Sapper Captain from Bangalore with eleven years service became the Executive Engineer of the Bombay



Division, not yet formed. Work for the Central PWD and, later, for the Director of Civil Aviation in New Delhi was to take me away from Sappers and Miners from 1935 until after the outbreak of War. The Sapper for Calcutta was T E Longfield, a man I did not know. We had very little contact later.

The Bombay Aviation Division spread over a very large area, covering the Bombay and Madras Presidencies and the Central Provinces. The existing airfields, only grass or earth fields, were at Ahmadabad, Bombay, Poona, Hyderabad (in the Nizam's State) Madras and Trichinopoly. There were important centres such as Nagpur which, as yet, had no airfield. Instructions were sent to me by Mr D V Deane, the Superintending Engineer (SE) in Delhi, under whom I was to work. My first task was to make a detailed survey of the grass landing ground at Bombay

known as Juhu Airfield. It was to be converted to an all weather airfield with runways, a hanger, the usual airport buildings including quarters for an Aerodrome Officer and with full lighting for night flying. There were similar plans for the development of St Thomas' Mount Airfield at Madras. The outline planning for the Capital Works Programme was done in the office of the Director of Civil Aviation (DCA) where a Sapper, Jesse Wyatt, was Engineer Officer (EO 1).

There were two EO's, EO 1 who dealt with new work and EO 2, a PWD man, whose sphere was maintenance.

The Division was concerned with the Karachi to Colombo route from Ahmadabad to the Palk Strait between India and Ceylon (now Sri Lanka). There were proposals for intermediate landing grounds between the existing airfields and for new grounds but these had got no further than suggested sites, the rest was for me to investigate.

To start the Division off Delhi sent me a first class, Roorkee trained assistant, Mr Kundan Singh, complete with survey instruments. An Accountant Mr Gupta, a very useful chap and a Sikh draughtsman also arrived from Delhi. The rest of the staff for the Division had to be recruited locally. Getting Engineers, Overseers, Clerks and Draughtsmen proved much easier than I expected. Some of my recruits had University degrees. I was lucky in my selections for I only had to dismiss two as unsuitable. The Office was established in some semi-permanent accommodation in the old Marine Lines in Bombay. Juhu Airfield, our first concern, was on the mainland some sixteen miles North of the town.

Juhu Airfield

Juhu, a grass field roughly square with sides half a mile long was the only airfield serving the city of Bombay. It bordered on the Indian Ocean being separated from the beach by a low sand dune and a plantation of palm trees. It was very low lying below, in fact, the level of the highest tides. There were *bunds*, banks, around the field to prevent sea water flooding the ground. Bombay rainfall is considerable during the monsoon and the draining of water from the landing ground could only be arranged by providing extensive borrow (catch) pits between the landing area and the bunds keeping out the tides. The borrow pits were intended to hold any water which would drain on to the ground during a period when the tide was too high to allow of normal drainage. There were drains provided with tidal flaps through the bunds which together with a number of syphons emptied the pits when the tide permitted. Fortunately for me the Superintending Engineer, then Albert Croad, designed the syphons. He was an irrigation expert and did not think I knew much about Hydraulics. He was right, of course. The borrow pits had to be extended and made a little deeper. (Because the borrow pits had to be relatively shallow, because of the water table, they extended over a wide area). When work started on this there was great indignation in the local Press. By digging pits on the flats North of the airfield I was blocking a short cut from residential huts on Juhu beach to the main road into Bombay. One morning the Governor's car was held up and had to turn back and go round a longer way. I was summoned to see the Governor and explain what I was doing. Lord Brabourne was very kind and sympathetic when I explained that the works were on Government of India land and that they were very necessary. Thereafter Lord Brabourne took quite an interest in what was going on at Juhu.

Two Divisions

The Central PWD did not have many spare men. When someone went on leave doubling up seemed to be necessary. I had the works in Bombay and Madras under control and a number of surveys for new airfields started when my opposite number in Karachi went on UK leave. I was asked to take over his Division. This gave me a very extensive area from Jiwani on the Persian (now Arabian) Gulf and near the frontier to Ramnad near Adam's Bridge between India and Ceylon. Part of the route from Karachi to Delhi was also in the area. There was a large hangar under construction at Karachi, administrative buildings planned and partly built and there

were plans for extending the landing area. The Karachi Division also put me in touch with work required for the Empire Flying Boats, lovely comfortable creatures. I was to have more to do with them after I went to Delhi. There were arrangements for them to land at Karachi and at Jiwani where, in addition, administrative buildings and quarters were under construction at the Airfield and the Flying Boat base.

Running two Divisions involved me in a great deal of travel only some of which could be done by air. During the monsoon I did not like having to leave Bombay because of the need to keep Juhu Airfield open but I had to spend some time in Karachi. One comes across people with wonderful powers in India. Some can walk across red hot coals, others can push meat hooks through their flesh without any bleeding and then tow heavy wagons along from the meat hooks. There was a time when I would have loved to meet a man who could control the tides of the Indian Ocean. The phone rang in the Karachi office. Lord Brabourne's Military Secretary told me that heavy rain and high tides were being experienced. The Governor wanted to know what I could do to keep Juhu open. I said that I had my best man on the job and I knew that he would do all that was humanly possible to keep the tides out. I did not think I could do anything else except perhaps change my telegraphic address to *CANUTE BOMBAY!* I said I would return to Bombay next day. Kundan Singh's men had been able to repair breaches in the bunds, the highest tide did not defeat them. I found that it had certainly been raining, a fall of twenty-one inches in ten hours was recorded at the airfield.

Karachi gave a pleasant reminder that I was a Sapper and Miner. One evening in the Sind Club two Madras Sappers, Tom Bostock and Teddy Parker arrived in the Bar. They were starting a UK leave, the first leg was to be the sailing of a dhow from Karachi to Aden from where they would proceed by P and O. We dined together but I did not see them off next morning. A week later my wife and I started on a short UK leave from Bombay. At Aden a rather yellow but cheerful Tom Bostock came to join the ship. Both the sailors suffered from jaundice and Teddy Parker was still in Aden Hospital. There is an account of their journey in the *RE Journal.* (Volume 11 March 1937).

The Aircraft

Tata Airlines with Headquarters in Bombay were the only Airline operating the Karachi/Colombo route. They were a great help to me, we worked very happily together. In 1935 their aircraft were a Fox Moth, other Moths, a Vega Gull and an Auto-giro. The Fox Moth reminded me of a London Hansom Cab, you sat in the cabin and the pilot was behind you and up above out in the weather, like the cabby. Going from Bombay to Madras I was often the only passenger and sat surrounded by mail bags. Later more modern machines appeared, American Wacos and a Dragon Rapide. There was no radio, no beacons, no aids to bad weather approach and landing at airfields, no airfield lighting or obstruction lights. Initially too there were no weather reports from the airfields. Having been taught to fly by a cheerful Parsee Instructor of the Bombay Flying club, N M Gazdar, I was able to appreciate what a wonderful job Tata's pilots were doing. With somewhat primitive aircraft and very little help from the ground they were able to fly right through the monsoon. The Club aircraft at the Bombay, Madras, and Delhi Clubs, the only Clubs I knew well, were the Moth breed, from Gipsy 1 to Tiger Moth and the cabin versions, the Puss and the Leopard Moths. Some Clubs had the B A Swallow, I liked it for it was very kind to inexperienced pilots.

Reconnaissance for new Fields

The likelihood of traffic was the main factor in determining where new airfields would be built, there were also operational considerations and military ones. There was a need for emergency landing grounds on some of the long hops, two were in my Division, at Cuddapah, half way between Hyderabad, Deccan and Madras and at Ramnad near the crossing to Ceylon. Tata Airlines asked for Ramnad as a sort of funk hole. Unpleasant storms of fairly short duration were experienced between

India and Ceylon. If a pilot saw that he was heading for one of these he could get down at Ramnad and wait for a clear spell. The Collectors and others in the Districts would put in suggestions for possible sites. We might get six or eight suggestions for any one location. A reconnaissance was necessary to select those sites worth surveying in detail. This work was most interesting and took me to places a soldier in pre-war India would be unlikely to visit and to meet people I would not normally come across. There was an American Baptist missionary right out in the blue serving a small railway colony and surrounding villages. There was a lone Englishman collecting iron pyrites and "railing it" off to merchants in Calcutta. In the extreme South, near Ramnad there were marvellous beaches of lovely sand and with surf rolling in from the Palk Strait. It was never too hot and there was always a small boy available who would run up a palm tree and get you a coconut. I wondered how long it would be before some developer built an hotel there and the tourists arrived. There were sharks about but they did not seem to worry the local fishermen. Wherever we went we met the great friendship of the Indian villager. They would find you a vehicle even it it could only be a bicycle, guide you round, offer food and drink and often helpful advice. If the *Sirkar* was going to buy their land obviously the price was of great importance and steps might be taken to push it up. There was a gentleman who owned land on the air approach to Juhu. We saw foundations being dug and learned that a tobacco factory was going up. There was to be a high chimney which would be an air obstruction, the owner had to be bought out. Information can travel very fast in India and by unknown routes. It was common to be met by several Press reporters when on tour and one became expert at saying much which meant nothing.

Some of the difficulties

India is a big place and has plenty of fairly flat land which is not criss-crossed by railways, metalled roads and powerlines. One would think that enough land suitable for an airfield could be found without difficulty almost anywhere. Though the hazards operative in, say, Europe were not present others were. Except in the desert regions Sind and Baluchistan, making a new landing ground usually meant taking up cultivated land and maybe the village which lived off that land. The villagers, as I have said, were very friendly, the Headman and a party would accompany the Recce. Near a village one might find a small stone pillar dyed red. This was revered. Then there might be some graves and possibly one of a holy man. Small shrines housing the image of some Hindu god with an offering of rice, flowers or a sacrificed cockerel were not uncommon. There would be a tree which was sacred. Are not all trees sacred? for "only God can make a tree". The Collector's men would discuss these hazards with the villagers and if we could not adjust our site to omit them they could usually be moved at a price.

At Cuddapah the ground was very stony. Tata's feared that the tyres of their light aircraft would suffer many punctures. Probably the best answer here would have been to use the local stone to make concrete runways. This would have cost too much so gangs of men, women and donkeys cleared the stones and built them into a perimeter wall.

We had some trouble finding durable markers for the channels used by the flying boats. At Jiwani a high temperature and very salt water gave the metal drums used as buoys only a short life. Some hard rubber buoys with a brilliant red top arrived from the UK. These were splendid in the water of the Persian (now Arabian) Gulf but in the Indian rivers the crocodiles took a fancy to them and sinkings were common.

Water Supply

Water supply was no great difficulty but problems at two sites I had to deal with were of interest. The Trichinopoly landing ground had a well but tests showed that the yield would be inadequate. The well went down through solid rock but obviously there was a stream or streams running through it, could we tap them in a better place? My Overseer on the spot was an Engineering Graduate of Madras

University and he found a Hindu gentleman who was a water diviner. I was present when this gentleman traced the course of several underground streams and suggested that we drill near the junction of two of them. He put the sticks in my hands and with his hands on mine I found I got a reaction. It was my first experience of water divining. In the Estimate I had provided for the fees of a water diviner but the man would not accept payment. He said that the power was a gift from God and he had vowed not to make money from it. We made a donation to a Hindu Charity. Some 1300 miles away to the North West there was water trouble at Jiwani. This was in the desert and water for the few residents at the landing ground and the Flying Boat Base was being supplied by tanker from Karachi. The ship used to bring in about two months supply, a more permanent arrangement was required. I had watched the local Baluchis watering camels. There were some damp places and there the men scraped away some of the sand with their hands and found water, it was very salt but the camels and the local people drank it. We thought that if we went deeper we would find fresh water. The reverse proved to be the case, the deeper we went the more salt did the water become. The SE now stepped in and told me to sink a deep tube well. He was an irrigation man and said that we should be able to tap water from the River Dasht which was some thirty miles away to the North. Drilling produced nothing and I was beginning to think that we might find oil if not water. In the end I set in motion a plan for obtaining a distilling plant from the UK.

Sidelines

Before the Aviation Divisions were formed the Government of India had no staff in the Provinces to carry out Engineering work which was a Central Government responsibility. They had to get such works done by the Provincial PWD's and pay departmental charges on top of the cost of the work. Once the Aviation Divisions were in being it was natural that the EE's be asked to take on other Central Government work in their Divisions. In this way a number of side lines came to me.

In Bombay there was a big building for Central Government Offices, a building for the Customs Department and work on the disposal of plots of Military land. In Anand near Ahmadabad there was, of all things for a Sapper to get tied up in, a Government research creamery. At Karachi there was work on the house for the new Governor of Sind. Until I got these sidelines under control they tended to swamp the Aviation work so perhaps a little description is justified.

The Central Government Offices

This was a new building to house the offices of my Division, of the Accountant General and the offices and studios of All India Radio. It was to be a multi-storey concrete-framed building on piles with two residential flats on the top floor. One of these flats was intended for me and my wife had some say in choosing the bathroom fittings but we were transferred to Delhi before we could move in. At the time this building was, I think, the biggest office complex under one roof in the city of Bombay. The design was by the Government Architect in New Delhi and an estimate amounting to some 6 *Lakhs* of Rupees had been approved. This was a lot of money in pre-war India. I took over at the detailed design stage and the calling for Tenders. An excellent Indian firm got the contract, their concrete man was a highly qualified Engineer, I was glad to have him working for us. I saw the building through to about 95% completion and partly occupied.

Customs Accommodation

There was a proposal to build new accommodation for the Bombay Customs Department, it had to be near Ballard Pier where the Mail Ships came in. Before an estimate had been prepared a large concrete framed building, The Ghulam Mahommed Building, on Ballard Estate fell vacant and was up for sale. Delhi asked me to inspect it and say whether I thought it worth buying. I advised against it but some weeks later the SE was in Bombay and looked over the Building. I heard no more till the very last day of the financial year. Delhi telephoned saying that it had been decided to buy the Building. I was to go and see the owners, an

Indian Bank, pay for the building and take it over. This I did, it was the biggest cheque I have ever signed, and my action gave the Accountants a lot of fun. At my level this was breaking all the rules. There was no sanctioned estimate to cover the purchase, there was no allotment of funds and, horror of horrors, the expenditure of my Division had taken a huge leap upwards on the last day of the year. It apparently made no difference that the purchase had been ordered by the Finance Secretary. My Mr Gupta had to plough his way happily through the Audit objections.

The Creamery

The Creamery at Anand did not give me a lot of work but I had to visit a similar creamery in Bangalore to see the machinery. The Manager at Anand, a New Zealander, bought all his milk from local farmers. He told me that it was quite impossible to buy unadulterated milk. He tested all supplies for fat content and paid accordingly. All the farmers knew this but continued to add water to their milk and the Manager complained that it was dirty water. I learned from my creamery visits that it is not necessary to live in Cheddar to make Cheddar Cheese. All the well known varieties can be produced in India.

The Military Lands Scheme

There was a considerable area of Military land which was no longer required. It was to be disposed of in suitable plots of residential building. There were building rules framed to ensure that only good quality buildings went up. The purchasers plans had to be approved by my Office. The sales were on long leases not outright. There was little Engineering work in this but the bargaining and legal work was very heavy. People would call at my Office and make an offer for a plot, if I thought it reasonable I would send it to the Accountant-General, then there were long hours closeted with the Government Solicitor over the legal documents.

Techniques

Our methods of work were fairly primitive. Bulldozers, excavators, graders and dump buggies could be obtained in India but it was still cheaper to do the work in the old fashioned way. Earthwork was done mainly by professional excavators, contractors would hire whole families. The man, with a mattock did the digging, the women collected the spoil in baskets and loaded it on to donkeys which were the dump buggies. The children of the family were also on the work, the elder ones helping the women. One saw infants laid out in the sun. I asked why they were not given some shade and was told that they were exposed *pakane ke lie*, that is to cook them, so that in time they would be able to work through the day in the sun. Clearing of light shrub, work for a dozer, was done at Karachi with a heavy chain towed between two camels. At the Central Government Office building we had a mixture of old and new methods. The aggregate and water fed into the concrete mixer was meticulously checked. Cubes of concrete were sent to a laboratory for test to destruction. Further, on one of the upper floors we loaded a complete bay with sand and took a deflection test. When it came to getting the concrete laid the method was old fashioned. There were bamboo ramps built from ground level to the upper floors, and gangs of women carried concrete up to the builders.

There was a firm in India engaged on Air Survey. It would have speeded up our work considerably if we could have employed this firm more than we did but for reasons of cost most of our surveys were by chain and level. During my tour it became obvious that Juhu Airfield could never be enlarged to provide an adequate airport for Bombay. A new site was indicated and an air survey of the area, where Santa Cruz airport was later built, was ordered. Santa Cruz had been a Military Cantonment and there were still some solid military buildings there. My main recollection of the place is that there were more snakes to the acre than anywhere else. This was because the site being slightly higher than the surrounding land offered the snakes a dry home during the monsoon. An air survey was also carried out at Jiwani and found some mistakes in the work of my surveyor on the ground.

Home leaves

During my tour I had two short leaves to the UK, one in 1936 when I had the good fortune to get married and one in 1938 which was extended by Hitler. I had embarked at Marseille to return to India and found a cable on the ship telling me that I must not leave the UK without War Office approval and to report there. I returned not too reluctantly for my wife had just produced our first child, a daughter, and I had only seen her just before leaving. Both leaves were working leaves for I visited airfields under construction, the aircraft makers and firms dealing with airfield equipment. Seeing the huge machines used for earth shifting I thought of my men, women and donkeys doing similar work much more slowly but more cheaply. It was the time when the tricycle undercarriage was coming in. A firm near Heston gave me a demonstration flight. We flew happily towards Windsor the pilot saying that he could not see the Royal Standard flying from the Castle. It was a windless day and when we got near the Standard was seen to be draped around the flag pole. The plane had been built for ambulance duty and had large Red Cross insignia on both sides. We hoped that an illegal flight would not be reported as we would be deemed to be on an errand of mercy. A visit to Short's at Rochester gave a flight in the Mayo "composite" Aircraft. It was a simple take-off and landing, the seaplane and the flying boat did not separate on that occasion but is this flight a Sapper record?

Death of Robin

After my second leave I left the Central Public Works Department and went to the Directorate of Civil Aviation in New Delhi. I succeeded Jesse Wyatt who had already left. Having been at the executive end of the programme it was interesting to tackle the planning end and to deal with the trans-India and Empire routes. The Director, Frederick Tymms, now Sir Frederick, was very kind to my wife and me. I enjoyed working for him but Hitler put an end to it. When war was declared I felt I had to ask to be released to return to soldiering, so December 1939 found me back in Bangalore forming the RE OCTU.

During my tour with Civil Aviation I thought that we were providing for comfortable if not luxurious travel. It did not seem at all extravagant to provide good handmade furniture for passenger accommodation at Airports. When I see the milling crowds at, say, Heathrow I wonder whether our furniture, some of it in rosewood, is ever noticed. How fortunate were my generation of Sappers to serve when our King was Emperor of India. The Empire gave me an extensive, interesting and unusual Captain's command. May the present generation find equally satisfying work.

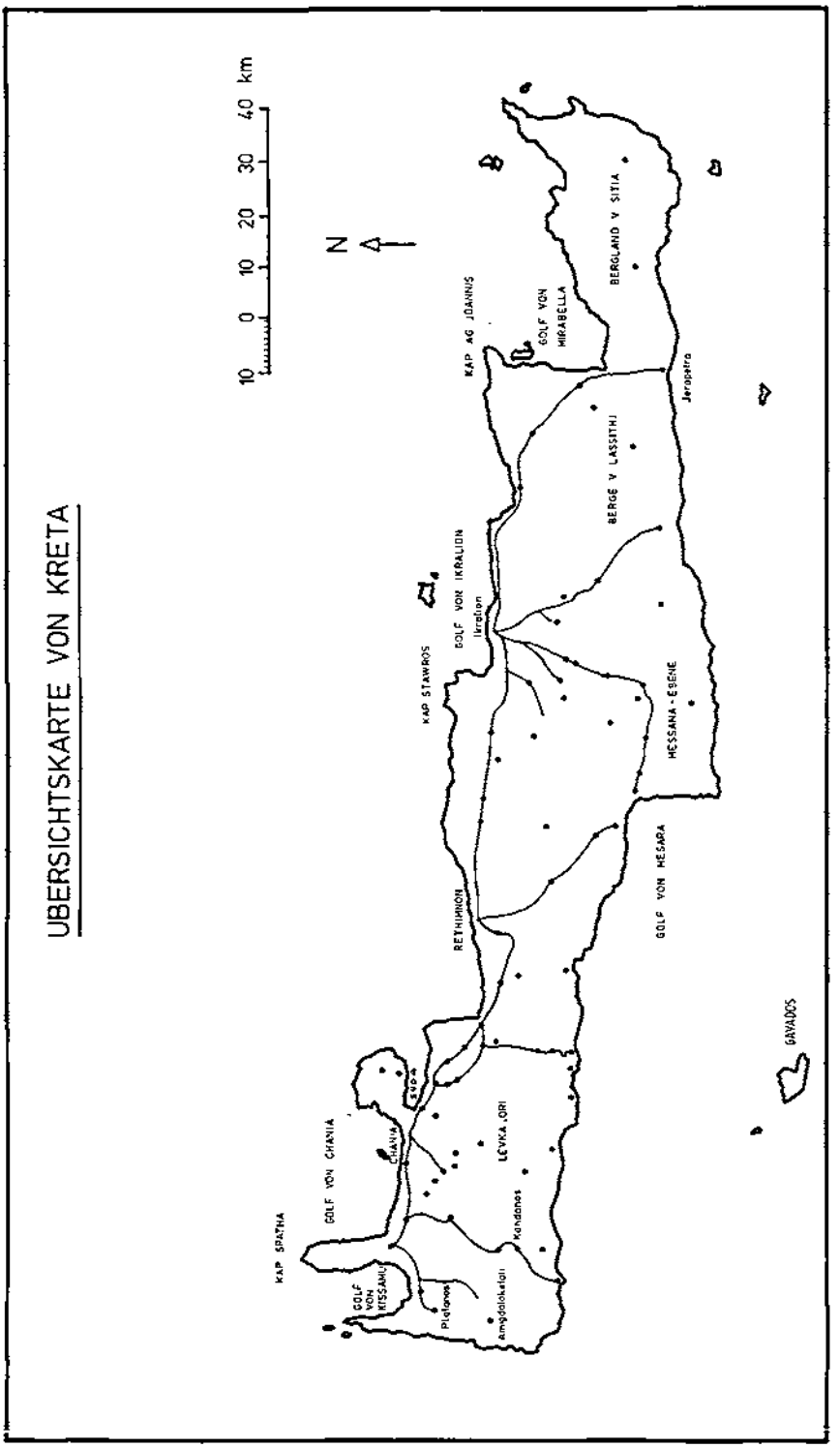
A Piece of History

MAJOR C E E SLOAN RE, B Eng

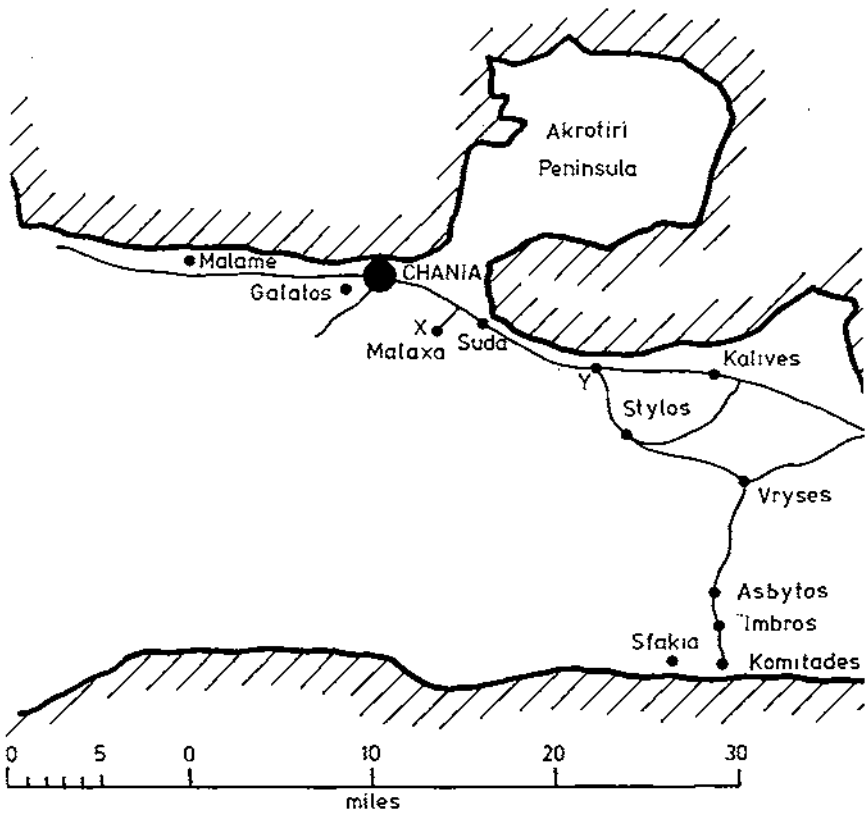
42 Field Squadron, normally based in Hameln as part of 35 Engineer Regiment, have just completed a tour in the Falkland Islands. This was not the first time that this well-travelled unit had found itself on an isolated, but strategically important, piece of rock.

Towards the end of 1940, 42 Field Company as it was then, was ordered to embark for Crete. They arrived in mid-December and began work at once. Field Troops as we know them, were called Sections in those days, and *Four-two* were split as follows: No 1 Section was employed at Heraklion, No 2 Section was between Chania and Suda and No 3 Section was based at Rethimnon. Their tasks included road construction, bridge building, major camouflage works and the installation of naval guns on a mountain near Stylos, overlooking Suda Bay. Guns which later played an important part in the destruction of enemy shipping.

A contemporary German map of Crete, acquired by the Company in 1941 is



Map 1. A contemporary German map of Crete



Map 2. Sketch of area of immediate interest to 42 Field Company

shown as Map 1. A more detailed sketch of the area of immediate interest to the unit, and drawn by the OC of that time, is at Map 2.

Life on Crete became more and more uncomfortable as the bombing and straffing by *STUKAs* increased. By May 1941 it was clear that a German invasion was imminent and the British forces were trying desperately to organise themselves against this. Although there were considerable numbers of Allied troops on the island, most were evacuees from the unsuccessful defence of Greece and were consequently short of arms, vehicles and equipment. Nor was there much air support, whilst the Luftwaffe in contrast were attacking with skill and daring. These attacks restricted allied movement, lowered morale and did tremendous damage to our shipping, which was attempting to bring supplies into the main port of Suda.

Four-two was the only Sapper field unit on Crete with all its equipment and in full fighting trim. In consequence, they were earmarked as Corps Troops in operational reserve under direct control of Force Headquarters. Company Headquarters was located on 42nd Street, a small road built by Four-two running south from the main Chania—Suda road (see X on Map 2). From this point they could see the coast and aerodrome at Malame, the likely beach landing sites in Chania and Suda bays and the Chania—Suda landing strip. These were thought to be the likely targets for the invading forces, who would need urgent reinforcements and supplies by land and sea.

Almost as predicted, in mid May the first parachutists dropped onto Malame and the Akrotiri peninsular, whilst gliders landed near the monastery at Chania. The battle for Crete had started. German paratroops had also dropped near No 1 and 2

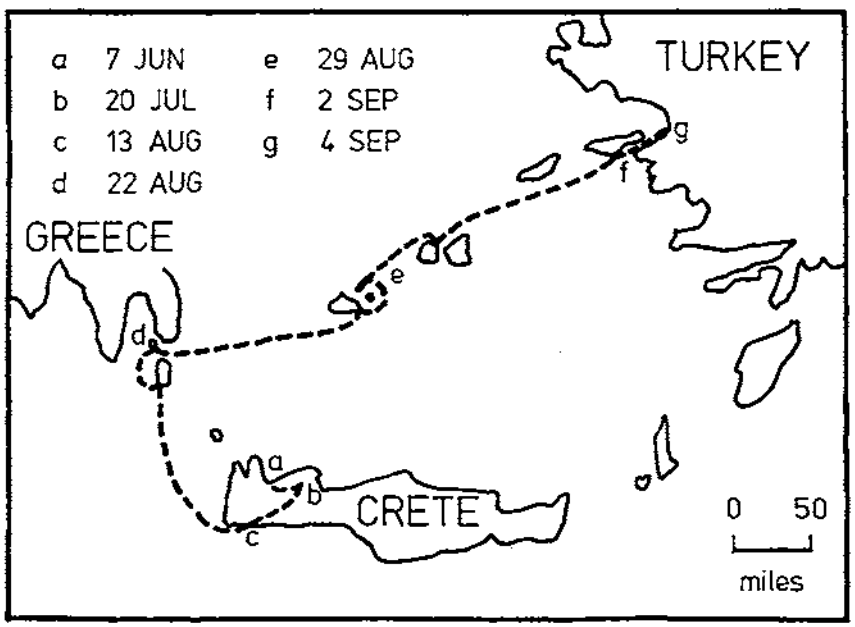
Section's positions at Heraklion and Rethimnon. Initially, the Allied troops were able to isolate and surround these groups of veteran *Wehrmacht* soldiers, but the tough parachutists held on grimly. As the days and nights slipped by more and more enemy forces arrived, the German planes machine-gunned and bombed continuously, with heavy gun-fire from the sea adding to the chaos.

On 26 May, the already vicious fighting, noticeably increased in intensity. The OC was called to an O Group with the CRE east of Suda (see Y on Map 2), to be told to prepare a demolition plan between Sfakia on the south coast and Suda. That night the order came to put the plan into effect, starting near Suda as the defensive line west of Chania had cracked. Over the next four days a confused delaying action was fought along the narrow, twisting roads. This required very close co-operation between the Sappers preparing charges ahead of the rearguard tanks and infantry, then blowing the demolition in the face of the enemy, once the last of our own forces were beyond it.

At the end of May, Four-two had regrouped as a Company protecting the right flank below Komitades. The situation was desperate by then. Contact with neighbouring troops had been lost, there was no means of supply of rations or ammunition, and reserves were low. At 0500hrs on 1 June, the Company liaison officer from Force Headquarters arrived with the unfortunate instruction that all British forces were to surrender at dawn. After first light no more shots were fired, despite the constant rain of fire onto the beleagured Company defences from the surrounding German infantry.

That morning 42 Field Company with about 7000 others surrendered as ordered. Most of the survivors, not killed or wounded, were force-marched on meagre rations to Malame aerodrome. Thereafter, the long journey to prison camps in Germany began. However, not all of Four-two ended up as prisoners of war. Some managed to slip away and escape, either to join resistance fighters in the hills of Crete or, as in the case of Corporal B Murfet, take part in one of the most incredible escape stories of the war.

Conditions of captivity at Malame, waiting to be flown to Athens, were not good.



Map 3. Corporal Murfet's escape from Crete

The guards were mean and brutal, beating soldiers on any pretext; there was little food, shelter or water, and many men were ill with dysentery or wounds. Enormous incentives to escape! And several officers and soldiers did manage to do just that, including Corporal Murfet. In league with two officers from the Sherwood Rangers, he began the epic journey revealed on Map 3. This escape seems to have formed the basis for part of Auberon Waugh's classic *Sword of Honour* and is a tribute to the toughness and determination of soldiers at that time.

After over two months of walking across, and hiding in, the rugged terrain of Crete, living off the land or with friendly villagers or partisans, missing recapture by

Photo 1. Lieut M Hildyard Corporal B Murfet RE Carrolambris
Capt F Embrey AIF Lieut Comd Vernikos Lieut M Parish
Photographed in Turkey immediately after their escape from Crete

the smallest margin on several occasions, the group eventually succeeded in finding a boat to take them off the island. It was little more than a 20-foot *caique*, already loaded with Greeks, but the brandishing of a pistol and a heavy bribe got them on board.

The journey was unpleasant, varying from stormy conditions to being becalmed under a glaring sun. Most of the passengers were sea-sick and several of the Greeks close to death. And this was just the start. After landing in Greece they found another, smaller boat for the next stage of their journey. Using a rough map found on Crete and a service compass they rowed at night, island hopping across the Mediterranean via Milos, Polino, Paros and Samos towards Turkey. Constantly hungry, always alert for enemy patrol boats or aircraft, it was a tense and demanding period.

Ninety days after escaping from Malame the small group of dirty, exhausted but determined men landed in Turkey. The worst was over, although their journey had to continue via Damascus and Jerusalem before they were entirely safe in British hands at Cairo. Perhaps a small piece of history now, but an enormous effort then, and a useful reminder to Sappers from a different generation of the trials and triumphs of their predecessors. A history to be remembered as a source of inspiration when the going appears to get rough these days.

Disaster Preparedness—A Critical Examination

LIEUT COLONEL G N RITCHIE

George Newbigging Ritchie was commissioned into the Corps in 1947 after studies at Manchester University and Emergency Commissioned Service in India. Served tours in BAOR with 7th Armd Div Engrs and 35 Fd Engr Regt but most of his regimental service was with the QGE in Malaya and Borneo. In 1974 he was invited by the University of Manchester to join the Dept of Administrative Studies for Overseas Visiting Fellows where he was to spend three years in research into the effects of natural disaster in the developing countries and the implications of this upon the training of public servants. He lectured and taught in these subjects and has been involved through the Commonwealth Secretariat and the United Nations in consultancies and workshops concerning disaster in the South Pacific, India and Bangladesh. On retiring he took up an appointment as a Senior Research Scientist at the RMCS. In 1967 he was awarded the Arthur ffolliott Garrett prize for his article "Airstrip Construction in Borneo".

The Author presented this paper at the Administrative Staff College of India. It has stimulated the introduction there of some of the measures it proposes.

Disaster—A Definition

A situation resulting from a natural or man-made catastrophe, other than war, demanding total integration of the rescue and life support systems available to the officials responsible for the *stricken area*, together with the communications and transportation resources required to support the relief operation.

Lieut Colonel G N Ritchie

INTRODUCTION

Guidelines for action in most activities are evolved from research and experience. To some degree this is true of disaster preparedness planning and relief management, but until now the great weight of work and study in the field has related to scientific research into prediction and prevention of disaster caused by the natural phenomena.

Research into prediction of the natural phenomena continues, but even modest levels of success in accurate warning are likely to demand greater investment in resources than either rich or poor countries will be able to make for the remainder of this century. Even if accurate prediction was available now however this would not reduce the administrative load on government, but would indeed add to it. Scientific warning is but the first link in a long chain of administrative action, if advantage is to be drawn from it.

Prevention and mitigation of the effects of the natural phenomena upon communities through planning, land zoning, and regulations can provide an effective course of action. But the growth of population in the disaster-prone developing countries, the pressure on land which this causes and external economic influences over which they have no control, create administrative, social, political and economic problems which frustrate the prevention of disaster by planning and regulation.

Physical control and prevention of the natural phenomena must remain but a hope for the future.

Disaster situations calling for international relief action occur with apparent increasing frequency, particularly in poorer and developing countries. Although improved communications thoughout the world, and the widely available news through television are doubtless among the reasons for the public's greater awareness, statistical analysis at the University of Bradford[1] indicated an actual increase in the occurrence of disaster, both in scale and in the number of people affected. It is people who are the essential factor in the equation however, because without people we have no disaster.

My research within the Department of Administrative Studies for Overseas Visiting Fellows of the University of Manchester, focused on disaster in the developing countries, and examined the maintenance of life support systems, namely, rescue, water, food, medical aid and shelter, and the communication and transportation systems associated with these. The project examined the roles and responsibilities of an Administration for pre-disaster planning and for management in crisis.

It is in this area that we find a pattern in disaster—a pattern difficult to establish if we look for it in the occurrence or effect of the natural phenomena.

By examining what evidence there is of the pattern of action in disaster relief operations, we can see that although natural phenomena cause havoc, destruction and death, the resultant distress affecting the survivors frequently results from failures in management and administration.

Analysis of these failures show that in many instances, actions and contingency plans (described as disaster preparedness in this article) could have resulted from pre-disaster planning and would have helped the Administration to cope in this period of crisis and provide quicker and more cost-effective relief. To a large degree, this would have come from the planned employment and deployment of local resources.

In his study of drought relief operations in an Indian State, Bhattacharya[2] illustrates how realisation of this point has aided both the victim and the Administrator in India. In most cases, management skills are of greater importance than the technology made available to provide relief.

Management of a disaster, whether this results from a catastrophic earthquake or an erosive drought and famine, is a natural extension of an administration's responsibility for the maintenance of order and the provision of life support requirements. Unusual pressures for action will be present. But, if no contingency

plans exist and no precautionary action has been taken, the pressures on government and the difficulties in taking action to bring relief will be greatly magnified.

One must, of course, acknowledge the problems attendant upon initiation of pre-disaster planning and preparedness programmes. Among these:
– Inertia, resulting from a lack of knowledge of the possibilities for disaster preparedness;
– Fear of the financial commitments involved, based upon realisation of the huge, but unrelated, costs of disaster relief; and
– Cultural attitudes related to "acts of God".
All these are very real problems.

There are also, no doubt, fears that an ability to help oneself may affect the availability of outside aid. India and China among the developing countries have probably perfected to the greatest degree the ability to employ, deploy, and rely upon their own resources. There is no indication that relief donors are less likely to help those who endeavour to help themselves. The evidence indicates that the converse is true.

Disaster Preparedness is not necessarily the creation of stockpiles of food and supplies and the provision of expensive specialist equipment. Rather, it is a sensible analysis of possible situations with a view to determining how authority and responsibility for action should be delegated, what local human and material resources exist, and how these can be earmarked and deployed.

This precautionary planning should be complemented by a programme of public education and training, so that all elements of the population understand what is being done, what they must do, and how to do it. The role of government must be to initiate this programme of Disaster Preparedness, and the Administration then becomes responsible for implementing and maintaining its effectiveness.

What is Required

To help define the guidelines for future action and to establish the principles upon which planning should be based, we need to know much more of what has happened in disaster occurrences in the past. For example, much more research is needed into what happens in disaster situations in relation to:
– The flow of information which provides the basis for all decisions and consequent actions in the provision of relief;
– The needs, attitudes and reactions of people in disaster situations, people who may be of different cultural backgrounds and much less sophisticated than those involved in providing relief, and
– The availability of resources within and close to the disaster area.

Although significant work has been done in the US concerning the reaction and attitudes of individuals and communities in disasters, it is doubtful how relevant this is to disaster situations in developing countries. Not only are there vast cultural and social differences, but economic development and available resources are such that any attempt at extrapolation is of doubtful validity.

We know that disaster in poor and developing countries demands the provision of food and shelter, but we are unclear how best to provide these necessities without developing attitudes of dependency amongst people whose lives have, in so many cases, been spent on the border line between hunger and starvation.

Most of the reports which are generally available concerning disaster relief operations are either too bland and diplomatic, as in the case of UN agency reports, or are written from the tunnel of their own activity, as in the case of many of the voluntary and charity organisations. The researcher does not acquire any clear idea of how the national administration was operating or how the various UN and international agencies related to one another and most importantly, to the indigeneous administration.

Unfortunately, official reports prepared by the stricken countries are not generally available. I was fortunate in being given access to the UK Foreign and Com-

monwealth Office and Ministry of Overseas Development files and to personal reports by OXFAM personnel dealing with specific disaster situations. From these a valuable insight has been gained into the nature and causes of administrative failures in many disaster situations.

Because of the shortage of data, relevant to the assessment of disaster relief requirements, it was proposed in 1975 (with the Bradford Disaster Research Unit) to the Ministry of Overseas Development and to the United Nations Disaster Relief Office (UNDRO) that opportunities should be created to make objective on-site research into current disaster situations in developing countries. This was aimed at making an assessment of the disaster situations and evaluating "post-strike" operations with a view to building up the experience upon which guidelines for future action by disaster-prone developing countries and international relief agencies, could be based.

The need for this expert assessment and evaluation is exemplified by our knowledge that frequently requests for aid are based on hasty, superficial and understandably emotional judgements of the situation and that demands are often greatly in excess of true requirements. Alternatively, a rush to help, based on the best of motives, results in large quantities of unnecessary and inappropriate items being sent by expensive air freight.

There are strong reasons for suggesting that many of the needs in disaster situations can be met either from within the stricken country or from her immediate neighbours. But we need to know much more about the true needs and the regional availabilities, if realistic plans are to be made.

When Managua was all but destroyed by earthquake on Christmas Eve in 1972, there was a great rush by charitable organisations in Europe and elsewhere to send tents, blankets, and medical aid—action based to a large degree on the needs of a previous earthquake in Turkey. By 28 December, the Government of Nicaragua was endeavouring to stem a flood of unnecessary aid and was seeking cash to purchase locally available necessities instead.

Meanwhile, the US, aided by her proximity to the scene, sent in disaster assessment teams which quickly determined that what was needed was drinking water, food, and field hospitals to replace those damaged in the earthquake. Most of the population had fled to live with relations, in the extended family situation prevailing in the country. The tents and blankets were not required; the survivors in the city were short of water, food and medical aid.

What We Need To Know

An important pre-requisite for rapid and accurate assessment of disaster relief needs is comprehensive and up-to-date information concerning local and regional conditions and resources.[3] A study of the types of information referred to here will show the close relationship to the data which are necessary to national development plans of many kinds, for example health, education or agriculture.

It follows therefore, that in those developing and disaster-prone countries, with which we are concerned, the cost and effort involved in collecting and collating the data upon which statistics, appropriate to disaster preparedness, are based would have a valuable return in this much wider field which relates to development strategies. Furthermore, the techniques of management and the administrative, social, cultural and economic problems which are highlighted in disaster, relate to similar problems which arise in the planning and implementation of development projects too.

For example, studies of the droughts and famines in Africa and India indicate that increases in herd size in the past resulted from improvements in animal husbandry. As an element of the development, additional water was usually provided by modern drilling methods but was not always accompanied by improved grazing and the creation of outlets by export manufacture of the animal products. In consequence, areas became over-grazed, but migration of herds to compensate for this

were often inhibited by rigid political boundaries of the post-colonial era. In drought, herds concentrated in proximity to the drilled wells and quickly grazed out already over-grazed areas.

There is already evidence to indicate that major disasters in developing countries attract vast quantities of international and bi-lateral assistance. This relates not only to the phase of immediate post-disaster relief, but projects into the period of reconstruction and continuing development. It is clear, therefore, that national disaster preparedness plans must embrace the planning and management of this period of reconstruction and development, so that external assistance can be rapidly and usefully employed.

THE MANAGEMENT PRINCIPLES OF WAR AND DISASTER

Clausewitz "Vom Kriege"	*Disaster Management*
Maintain the Aim	Maintain the Aim
Retain Mobility	Control Transportation
Maintain Offensive Action	Communicate
Remain Secure	Acquire Information
Achieve Surprise	Disaster Preparedness
Concentrate Force	Define Priorities
Economy of Force	Assess Requirements
Remain Flexible	Retain Reserves
Co-operation of Forces	Co-ordinate Activities
Administration	Administration

PRE-DISASTER PLANNING

Within the context of this paper it is not proposed to deal with the process of pre-disaster planning in detail. The following, however, indicate areas which must be considered.

Vulnerability analysis:

Areas of the world lie within natural hazard zones and are subject to the effect of one or more of these. The planner must assess the probable effects of the natural phenomena upon the area under consideration with a view to determining how life and livelihoods will be affected and what plans and precautions are necessary and possible.

Appropriate levels and areas of responsibility:

These must be identified to ensure that those responsible are provided with the authority necessary to carry out their tasks. The level of this authority will differ between countries and administrative systems, but unless it is at a point which ensures that both in planning and execution the normal administrative procedures can be co-ordinated and adjusted to react to disaster situations, it is unlikely to be fully effective.

Disaster planning and management must follow the normal administrative structure (channels of communication and responsibility), with delegated authority within their area of responsibility passed down to subordinate "disaster co-ordinators". This is essential to avoid situations in which responsibility is divorced from authority or authority rests with someone without responsibility, or not immediately aware or involved with the situation.

Again, we refer to Bhattacharya's article to see the stimulus provided by "the Chief Minister's intense involvement" which ensured that authority was placed where responsibility lay, and that hierarchies were modified to suit the requirements of the situation.

Operations:

At all levels disaster co-ordinators should be served by a co-ordinating committee. These will vary in composition in relation to administrative systems, but should be made up of members of the principal elements of the Administration and its supporting agencies, notably legal, finance, public utilities and works, public health

and medical services, police, fire, transport, military forces, and voluntary agencies. At the national level, this committee should also include representation from the local UN agencies. At all levels, these co-ordinating committees must plan the machinery of management by which they will control response to the initial situation and its development. Planning must ensure that the available resources are integrated into an efficient and manageable whole. This must extend to UN and international relief of all kinds, and to local voluntary organisations.

Disasters, whether from natural or man-made causes, bring situations frequently demanding continuous, round-the-clock activity. The essential services (medical, police, fire, telecommunications, etc) are organised to operate in this way. So that the disaster co-ordinator and his committee can fall into this pattern, they must organise themselves so that each member has his deputy who is fully briefed concerning his role and responsibilities. To ignore the difficulties arising even in such apparently simple arrangements would be unwise.

Military forces are well designed and equipped to work along these lines and in addition have the mobility and ability to operate away from their static bases for extended periods of time. Their ability and training to reconnoitre by land, by sea and from the air, to observe and report back, where necessary by radio, is in itself an essential and important feature of any disaster relief operation. They are trained in logistic planning which involves the comprehensive integration of all procurement, movement, storage and distribution of resources in support of an operation. Those responsible for pre-disaster planning will see the relevance of the military organisation, and particularly of its engineers and transportation agencies, to the task of disaster relief.

Communications:

Information is an essential element of any operation, demanding free and rapid passage of information not only up and down the chain of command but laterally between those engaged in the same operation. It is this free passage of accurate information which provides the material from which decisions and plans are made, precautions undertaken and which permits the co-ordination and co-operation that leads to the effective and most economical employment of often scarce resources.

Plans:

Disaster preparedness plans will result from this necessarily comprehensive process of analysis and the matching of the anticipated requirements with the available resources. Out of this process will come the organisation whose task it will be to plan the action and manage the situation. The plan will identify authority and responsibility and will allocate available resources. Shortages will almost certainly remain but impediments to the utilisation of local resources will be overcome through anticipatory legislative, financial and administrative action and the disaster co-ordinator will know what scale of help he needs from outside. Action along these lines will create an organisation and a plan, but to ensure that it can be implemented and will function as intended, depends upon people. They must be trained and practised in their roles and know where and how they fit into the overall organisation.

Education and Training

Earlier, it was suggested that people are the essential ingredient in any disaster situation. People are also the essential element of disaster preparedness and relief but require programmes of education and training to make them fit for their roles. We have suggested that pre-disaster planning and disaster preparedness provide not only the most effective but also the most cost-effective way of ensuring the rapid employment of all available human and material resources. It is clear, however, from surveys by both UNDRO and the League of Red Cross Societies that very few countries in the developing world, even the most disaster-prone, have any formal policy or structure of disaster preparedness. This situation is slowly improving but on a very narrow front and progress is slow.

The proposals relating to education and training which follow, emanate from the programme of research at the University of Manchester and if implemented, could greatly broaden the front on which progress in disaster preparedness is being made and must also speed its advance. There are three groups to which the proposed programmes of education and training relate:

- to those in principal positions of responsibility in the country;
- to the country's administrators; and
- to its people.

If action to initiate pre-disaster planning is to be taken, it is essential to develop an awareness and understanding among those in responsible positions of government of the consequences of disaster, of the possibilities of Disaster Preparedness and of the close relationship between development strategies and pre-disaster planning. Opportunities need to be taken to reach responsible members of government, the administration, the press, broadcasting services and others, by introducing presentations and discussions concerning Disaster Preparedness whenever this is relevant to the many conferences and meetings which take place each year.

This might be described as appreciation education and is the means of generating and stimulating the understanding and the concern from which all further action will originate. To be effective, this programme of education should be aimed at as wide an audience as possible and should be extended through universities and administrative training colleges.

By this means, those with the power, responsibility and influence to create public interest and concern will be reached and the foundations of realistic policies of Disaster Preparedness will be laid.

If this appreciation education is successful, senior members of the Administration will be identified with responsibility for disaster preparedness. In turn, their subordinates within the administrative structure will become similarly responsible with delegated responsibility and authority. By this means the channel of management and communication relating to disaster follow from, and remain within, the normal administrative structure and machinery to ensure the most effective means of smoothing the transition from "normal" to "disaster" administration, and of minimising the inevitable confusion. Those involved in pre-disaster planning are, almost certainly, also those concerned with the formulation, implementation and administration of development plans and strategies. This relationship of responsibilities can only lead to improved strategies affecting both development and pre-disaster planning.

We are now entering the sphere of leadership which must remain as a separate study in itself, but the problem of nominating the disaster co-ordinator must be given careful consideration against the knowledge that disaster situations bring special strains and make heavy demands upon those with responsibility. It is equally important that their authority is protected and that they are free from interference by those with political and other interests but no indentifiable responsibility. The best protection almost certainly lies in a sound Disaster Preparedness Plan which clearly defines where responsibility and authority lie.

Disaster Co-ordinator Training

The preparation of disaster co-ordinators for their task is seen as the second tier of the programme. Training of developing countries' administrators takes place in a vast number of state, national and regional institutes and staff colleges. Large numbers, funded by a variety of agencies, continue their studies at many universities and institutes in the UK and other western countries. At none of these are the problems and techniques of pre-disaster planning and crisis management studied. This is an omission which I suggest should, and could, be easily put right to the advantage of the people and the economies of many of the countries of the developing world.

The syllabi of many of these training courses could be expanded so that they would usefully embrace:–

– the processes of analysis and planning in relation to disaster;
– the problems and techniques of crisis (disaster) management; and
– the study of environmental management and the relationships between development strategies and the proneness of disaster which these can create.

This would hopefully also have the effect of showing that pre-disaster planning and disaster management are within the public administrator's normal field of responsibility.

There are advantages in basing the training of national disaster co-ordinators on regional institutes (eg University of the West Indies, University of the South Pacific, and similar institutes in SE Asia, East Africa, etc). Even in the case of larger countries where national training is a requirement, provision for representation from neighbouring countries should be made.

A regional policy of this kind has the following advantages:
– problems are studied against the background of a commonly understood threat: earthquake, hurricane, drought, etc;
– those involved are of similar culture and from countries at similar stages of economic and social development;
– regional co-operation can be engendered by the study of common problems and the realisation that the employment of national and regional resources is likely to provide the most rapid, appropriate and effective aid; and
– it will develop and create a capability to maintain training of this kind as an ongoing element of the curricula of regional universities and colleges of administrative training.

Co-operation in the study of problems and in developing ways in training to solve them regionally is also likely to make the provision of funds and specialist advice from UN, international and other sources more economical and easier to arrange. It could also lead to the establishment of regional depots where equipment, such as shallow draft boats, water purification equipment, tentage, field hospitals and kitchens, radios and similar specialist equipment, might be held in readiness. All of these can be identified as items which have been urgently required in the past and have often been transported by air over long distances.

In administrative situations, decisions are usually reached as a result of a consultative process in which the best possible information is brought together over what may be a considerable period. In a disaster, the converse is likely to be true. The available information will be conflicting and of doubtful quality; it may be scarce or abundant but it will most probably be difficult to assess what is accurate or inaccurate. Almost certainly, however, there will be urgent calls for action and a need to make decisions based on what is known. Therefore, disaster simulation exercises in the programme of training are proposed.

These problems are probably most effectively illustrated and studied using techniques of simulation exercises in which groups play the roles of the disaster co-ordinator and his committee. Although simulations have obvious limitations, in these exercises we shall be exposing the participants to situations unusual to them but similar to those which disaster will bring, rather than exercising them in the techniques which they are called upon to employ in the normal course of their duties.

This form of training will aim at demanding rapid assessment of confused situations, decision-making and the subsequent implementation of plans, all within a demanding time frame. An analogy will be found in the training of military commanders and staff, whose careers are to a large degree devoted to training for war, a situation which the majority will only experience once in their lifetime. Since 1975, IBM's Scientific Centre in the UK has supported the development of a computer-based simulation exercise in disaster management. This provides a realistic and credible situation in which the problems and techniques of resource management in disaster can be examined and from which lessons concerning these, as well as the nature and value of Disaster Preparedness, can be drawn.

The simulation is based upon a computer programme in which a series of models interact to represent:
– production and consumption of food, water, fuel and power;
– the effect upon people and the infrastructure caused by death, injury, infection, deprivation, destruction of stocks, damage to roads, railways, etc; and
– the means of relief and repair and the transportation requirements to deploy these.

Throughout the exercise, the directing staff and the computer are playing the part of the disaster zone, its people, and of the world beyond.

The directing staff are available to react to players' decisions and plans in a way that ensures that the tempo of play is maintained, that the important but unquantifiable problems of disaster are brought under consideration, and that important lessons of disaster management are learnt. The role of the computer is storing and providing information, processing decisions, and analysing their implications more accurately and rapidly than the many additional directing staff who would otherwise be necessary.

The exercise was given a number of trials which involved people with a variety of senior responsibilities for training in the developing countries. Senior officials from the public services in the UK and from UN agencies in Geneva have also taken part. All have given the simulation their full approval. It is now in use as an ongoing element of the Overseas Command Course at the UK Police Staff College Bramshill.

The foundation of the studies envisaged for disaster co-ordinators rests principally on the techniques of management which relate particularly to the collection, transmission and collation of information and to methods of consulation, co-ordination and communication. These are the means by which decisions are made and resources rapidly translated into effective action.

In-country Training

One of the principal responsibilities of disaster co-ordinators at all levels will be preparation of the plan which mobilises, co-ordinates and deploys national resources in relief at the time of the disaster. A central plan will co-ordinate the activities of a number of organisations with specific responsibilities and roles within the plan. Ultimately, however, implementation of all the various elements of this central plan will depend upon the ability of individuals and groups of people to carry out their allotted tasks. This will require a comprehensive understanding of their own particular task, training and practice in it.

In order to base the training of national disaster relief organisations upon clear objectives, there are strong and obvious arguments that this training should relate directly to tasks defined in a national Disaster Preparedness Plan. Once a national Disaster Preparedness Plan exists, all training can be based upon realistic objectives and ceases to be open-ended. Those involved become aware of how they fit into the overall organisation and plan and know what is required of them.

Specialist training for disaster of this kind should take place "in-country" and as far as possible within the organisation and group in which the individual will operate. Such methods ensure that those involved are aware of the conditions in which they will have to operate, of their own limitations and capabilities as a team, and how to make the best use of the available resources.

Besides individual and group training which develops skills and capabilities, there is also the need for practice and exercises in order to develop the capabilities of many separate units to work together. This calls for realistic exercises in which operating procedures are tested and developed. Such exercises make demands on the imagination of those designing them but need not be expensive to set up and run.

A proposal for training along the lines described above has been put to the UN agencies, such as UNDP, UNESCO, UNEP and UNDRO which have a defined responsibility or interest in disaster. Understanding and awareness of the necessity

and the advantages of pre-disaster planning and preparedness is growing and it is clear that education and training provides very rapid and cost-effective means of improving and stimulating indigenous capabilities.

Some proportion of the vast sums presently allocated to development projects and disaster relief should be earmarked for this sensible form of insurance. A pound or dollar invested in Disaster Preparedness will provide its return in the effective employment, deployment and management of all the available resources in times of need. It cannot prevent the catastrophe from occurring, but it will effectively reduce the distress and suffering that follows.

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No 2 Section 19 Army Troops Company NZE in the Greek Campaign 1941

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The writer was commissioned in the New Zealand Territorial Army in 1934. On the outbreak of World War II in 1939 he enlisted with the 2 NZEF and was appointed a Section Commander with 7 NZ Fd Coy NZE, 2 NZ Division. He served in the UK during the Battle of Britain, and in Greece, Crete, and Libya.

From June 1941—February 1942 he was Adjutant 2 NZ Div Engrs and returned to New Zealand in April 1942 to take command of the Engineer Wing of the Army School of Instruction, and from March 1943 to January 1944 was Senior Staff Officer Engineers, on the General Staff at NZ Army Headquarters, Wellington. He returned to the Middle East in 1944 and rejoined 2 NZ Div at Cassino in Italy, commanding his old Unit 7 NZ Fd Coy until the cessation of hostilities.

In 1950 he rejoined the Active List of the NZ Army and commanded 1 Fd Engr Regt RNZE from 1953–56, and was Colonel Commandant RNZE from 1964–70. He continues to take an active interest in RNZE Corps activities.

He is an Honorary Member of the Institution of Royal Engineers and holds the rank of Honorary Colonel of the Retired List, New Zealand Army.

Introduction

This article has been compiled from the diary of Major H C Page MID, RNZE (Retd), AMICE, during the Greek campaign 1941, when as a 2nd Lieut, he com-

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manded No 2 Section 19 Army Tps Coy NZE and is written in the first person with his permission. The military abbreviations have been retained throughout as in the diary.

19 Army Tps Coy NZE, after a busy period in the Western Desert during the first Libyan offensive, moved to Greece on 11 March, 1941 and 2 NZ Division, replacing 8 Fd Coy NZE, which had arrived in Egypt but could not be equipped in time to take part on the campaign. This account describes the work done by No 2 Section during the Greek campaign and is generally typical of the tasks 2 NZ Div Engrs were called upon to do.

Major Page visited Greece and Crete with the 40th Anniversary Contingent from NZ in 1981 and returned to Ay Dhimitrios on the Olympus Pass which he found much as it was in 1941. On the other hand there is now a motorway from Athens to Salonika and a third bridge under construction over the Pinios River at Larissa.

The Greek Campaign 1941

The Coy left Helwan Camp, near Cairo, on 3 March, 1941 with a full complement of personnel, forty vehicles, stores and tools, for Amyria, near Alexandria, and I embarked with the Coy transport and sailed for Greece on 11 March, arriving at Pireas on 16 March after a rough voyage, and camped on the outskirts of Athens. After a day or so, the Unit transport and equipment was unloaded, and on 21 March moved North to Katerine, near Mt Olympus, where the Coy was to carry out road works.

The remainder of the Coy entrained in a special troop train at Athens on 22 March, with the Sappers loaded thirty per wagon and the officers in the only railway carriage.

The train also included other Units and a Greek Mountain Battery complete with mules. They received a great ovation from the assembled crowd as the train pulled out, troops waving and singing, and the Greeks firing their rifles out of the truck doors.

The Coy detrained at Katerine on Sunday 23 March, and was billeted in the picture theatre for the night. The CRE, Lt Col G H Clifton MC, called and detailed the work to be undertaken by the Coy and I was instructed to move No 2 Section to Ay Dhimitrios at the summit of the Olympus Pass to complete a deviation of the Pass road. Next morning, complete with transport and equipment, the Section moved out while I went ahead to the village to arrange billets. The road surface was good, but very narrow and steep. Snow-covered Mt Olympus was a magnificent sight in the morning sun and I found the village of Ay Dhimitrios, the oldest, quaintest, little hamlet imaginable, with its stone houses, thick slate rooftops, and narrow little cobbled streets.

With the aid of the local schoolmistress who spoke a little French I managed to get part of the disused school house and a large room in the local church for my Sappers and a little room over the local cafe owned by Monsieur le Marie, for myself.

An inspection of the task as ordered showed that it entailed the completion of some three miles of partly formed roadway, including the construction of fifteen large culverts, most of the formation being solid rock. Almost all the male population of the village were away in the Greek Army and the only labour available consisted of old men, women and boys. The local public works Foreman had a work force of about 300 of these and was able to help.

On 25 March, Major Langbein, OC 19 Army Tps Coy, called and went over the task with me and decided that the work programme proposed was out of the question with the labour and plant available, and instructed me to carry out improvements to the existing road where practicable.

The two trucks I had sent down to Katerine for cement returned empty. Cement had to be obtained from Larissa. 26 March was a busy day organising labour

through the local Mayor, Priest and public works Foreman, who respectively spoke French, a little English, and Greek only. However, 100 workers were promised for the next day.

All the Section Sappers were busy in the afternoon carting road metal and widening two very bad hairpin bends on the Elasson side of the Pass. The formation was all solid rock and without a compressor, progress was slow. River shingle was readily available but had to be loaded and unloaded by hand. A long convoy passing through all day, made the carting of metal very difficult, and guns and trucks kept getting held up on the very sharp bends, blocking the road.

The Sappers were out early on 27 March and a 100 strong labour force, mostly women and boys, arrived and were put to work clearing the road of spoil and loose rock left on the shoulders, while the Sappers proceeded with blasting away the inside of the sharpest bends.

A visit to Coy HQ near Gannokhora, produced two compressor trucks from 5 Fd Pk Coy NZE for work at Ay Dhimitrios. The lack of a cigarette and tobacco ration and uncertainty regarding pay was not the best of news to bring back to the hard-working Sappers.

An inspection next day 28 March, showed that, except for the hairpin bends, the road was in fairly good order, and with the help of the compressor trucks, a considerable quantity of stone was moved, although the local explosive provided was of poor quality. A heavy shower of rain slowed work down in the afternoon, but that was offset by the arrival of a cigarette issue with the rations.

Capt T A McFarlane NZMC, our Medical Officer, called in the evening for a check-over and advised that all drinking water should be boiled before use. The bully beef and biscuit ration was augmented by the purchase of a sheep for eighty drachmae, a welcome addition to the diet.

A number of refugees passed through the village during the day from the border area, mostly in cars, all loaded up with goods and chattels.

Saturday 29 March was a very good working day, from 0730–1800hrs. With the aid of the compressors and gelignite obtained from Katerine, a large amount of stone was blasted away and the hairpin bends improved. With over 300 villagers on the job, the metalling of the road down the valley to the South made good progress. The women folk made a picturesque scene in their coloured skirts and bodices. It was unusual for the NZ Sappers to see young women and girls spitting on their hands and spreading road metal, but they could certainly swing a wicked shovel and push a pretty wheelbarrow. The Section cook did a good trade at forty eggs for 4lbs of sugar. The villagers were unable to get sugar and used sacharine, but they made a beautiful rye bread which was quite cheap and a welcome addition to the rations.

One of the Sappers killed a large snake about five feet long, reputedly poisonous, an unknown experience for New Zealanders. Tortoises and large toads were often seen.

A half day was worked on Sunday 30 March to allow the Sappers to have a wash-day. I went down to Gannokhora to Coy HQ and was forced off the road on the return journey, being helped back by a truck load of Greek soldiers, much to their amusement.

Maj Langbein arrived Monday morning 31 March, with pay for my Sappers, only 500 drachmae per Sapper, equivalent to 18s 9d stg (£0.93), but nevertheless, welcome.

The top hairpin bend on the South side of the Pass was completed during the day and work on the lower bend well advanced. With the aid of an Abney Level obtained from Coy HQ a deviating grade of 1 in 8 was run in the afternoon to cut out five bad bends in the Pass, but the work involved looked too heavy. Explosives were hard to get and the Section was using about fifty detonators daily. The nearest supply dump was at Larissa, about seventy miles away.

A long convoy passed through during the day, 28 Maori Bn in the morning, artillery during the afternoon. The Maoris had the locals puzzled as to why some New

Zealanders were white skinned and others brown.

The Section strength on 1 April was one Officer and 41 Other Ranks with 4 trucks plus 7 others attached and one M/C. There was no wireless communication. The Greek labourers now totalled about 350 and I was glad that the responsibility for paying them was the responsibility of Capt M Carrie, Adjutant 2 NZ Div Engrs. More long convoys moved forward during the day and did not welcome being held up by our blasting operations.

Capt J Anderson 2 I/C Army Ttp Coy came through on Wednesday 2 April. He had made a reconnaisance down the coast from Katerine to Platimon and then back through Larissa, the significance of which was apparently not appreciated at the time. The weather warmed up with many of the Sappers wearing shorts. It was hot work setting several big charges on the hairpin bend and the realignment was almost completed.

Next day, 3 April, six more trucks from 23 Inf Bn arrived to help carting metal and the Section was again running out of explosives, particularly detonators. It was a busy day and I made a reconnaissance of the road Elasson—Levadhion to provide artillery access. The grade up to the village was 1 in 4 in places, with a narrow track about eight feet wide most of the way, and a drop of several hundred feet below. My truck was the first motor vehicle ever to reach the village and was well received by the villagers. Perched on the side of the mountain, Levadhion was larger than Ay Dhimitrios and how all the people who lived there made a living was hard to understand.

I also ran a grade at 1 in 8 for a deviation to cut out some of the many hairpin bends on the northern side of the Pass, sufficient for a one way track down. Some Greek masons started work on two stone culverts, their workmanship, using the minimum of tools, being remarkable.

On Friday 4 April, ten trucks were busy carting metal and the flat section of the road was almost completed. A visit to Gannokhora produced some new boots for the Sappers, clothing and explosives. Also, instructions were received forbidding any mention of Greece in letters, all mail to be held in the meantime. I also received instructions from the CRE to start on a road access job between Kokkinoplos on the slopes of Mt Olympus to Petras, approximately eight miles North, to provide access to 23 NZ Battalion and to serve as a withdrawal route. Five trucks were carting metal during the night down to the Northern side of the Pass, to avoid traffic congestion on the narrow roadway during daylight hours.

Next day, 5 April, I reconnoitred Kokkinoplos, located high on the slopes of Mt Olympus. The access to the village, branching off the main road, was little more than a track and only negotiable as far as Kokkinoplos. There were only two possible routes through the village, the lower one being most suitable. I met the local school mistress who spoke good English and arranged for some 200 villagers, mostly boys, to start work on the following Monday. I was well received by the villagers, many of whom spoke French, and had my photo taken in the village square.

Following this, I reported to the Bde Major 5 NZ Inf Bde HQ regarding the construction of a Battle HQ and arranged a meeting with Brig Hargest.

Foreman Evangopolos made good progress with his gang of women and boys in the Pass and work was in hand lengthening several culverts. Unfortunately one of the compressors was recalled by 5 NZ Fd Pk Coy for urgent work elsewhere.

Sunday 6 April was eventful with Germany declaring war on Yugoslavia and Greece.

After inspecting my Sappers at work on the Pass I went to 5 NZ Inf Bde HQ and with the Brigadier, Bde Major and CRA, and my OC Major Langbein, moved off to inspect several access routes to be provided for artillery positions in the Pass, and a Battle HQ for 5 Bde, an urgent task, with infantry labour to be provided.

After lunch, with Sgt Pearce and two Sappers I went up to Kokkinoplos, arranged billets in the School and laid out a route through the village and around

the mountain side. Having no interpreter, but with a little French and a few Greek words acquired, and the help of the school mistress, I arranged for the promised local labour to report at 0800hrs next day, which turned out wet and very cold, the village being just below the snowline. A few labourers turned up but without tools, sadly lacking in village, and quite contrary to information. Setting Sgt Pearce and a working party to commence a retaining wall I went down to Ay Dhimitrios and sent a truck to Katerine for 100 picks and shovels, returned to Kokkinoplos, set out a length of road for the Greek work party, and had Sgt Foley start on culverts to dispersal areas off the main road. Major Langbein arrived with word that another Section of 19 Army Tps Coy would start work on the Katerine side of the Pass as events were moving rather rapidly. I set out the three access roads into the artillery positions for the CRA and surveyed the bridges through the Pass for widening. It was a busy day with word of a battle on the Bulgarian border.

Next day, 8 April was also busy. On the job at 0700hrs with Sgt Witting and Cpl Madely. Called at 5 Bde HQ and found labour from 22 Bn being provided and although it rained steadily all morning with the main road very greasy and rough, two Coys of infantry arrived in the afternoon, commencing work on the artillery positions under the supervision of No 2 Section Sappers. Both Brigadiers inspected the work during the afternoon. Eight trucks were busy carting metal all the afternoon to the bad places on the road. At 1600hrs I went up to Kokkinoplos and handed over the Kokkinoplos—Petras access road to Major Hanson of 7 NZ Fd Coy which had arrived by train at Katerine on 6 April, collected its transport, moved through the Pass, and had been given the task of improving the road to Kokkinoplos and extending it beyond the village. My Sappers under Sgt Pearce had made a good start with a big gang of Greeks and had almost completed the road through the village and left, with some regret, what promised to be a good task. This was now taken over by No 1 Section 7 Fd Coy under Lt G A Lindell, the writer of this article. At Kokkinoplos next morning I was awakened at 0530hrs by a DR with a message from my Coy Cmdr instructing me to be prepared to move to the rear at one hours' notice, necessitating a hurried return to Ay Dhimitrios with my detachment in heavy rain. A second message arrived advising me to carry on with road work in the meantime and await further instructions. The Pass road was badly affected by the heavy rain and maintenance made more difficult with the withdrawal of the six 23 Bn trucks.

The 26 Bn work party turned up in strength for work on the access road to the artillery positions, and made good progress with the job almost completed by nightfall.

In contrast to the previous days, a continuous stream of traffic was pouring back over the Pass from Katerine and the three Section trucks were busy carting road metal to the worst places all day. One work party widened three culverts by building crib walls with railway sleepers from the Greek dumps and another under Sgt Foley proceeded with crossings and dispersal areas on the eastern side of Ay Dhimitrios. It was still raining that night making the road very greasy in places, and as most of the trucks and gun tractors passing through to the rear had chains on their wheels the road surface suffered.

Next day, 10 April, 2 NZ Division was still withdrawing over the Pass, heavy traffic passing through all day. The road stood up very well apart from a few soft places. Guns, armoured cars, Bren carriers and trucks had been groaning up the pass since Tuesday night, 8 April. The Greeks were also on the move, causing a lot of trouble with their vehicles continually breaking down and blocking the road. The Sappers had to heave two trucks over the side of the gorge. I went down to the bottom of the Pass in the morning in search of the Coy bulldozer (which had come from New Zealand) and found it parked at the bottom of the Pass on the GOC's orders. I saw Brigadier Hargest, Comdr 5 NZ Inf Bde and obtained permission to bring it through with the blade removed, unfortunately, in doing so, cutting the main telephone line on the way and incurring the wrath of the Div Sigs.

The access road to the gun positions was completed and the guns arrived in the evening, but with the heavy rain since mid-day, it looked as if the bulldozer would be needed to haul them up the muddy track. Two more culverts were widened and the Greek labour carried out maintenance through the Pass most of the day. The villagers in Ay Dhimitrios had started to move out. It was a long tiring day.

It was still raining heavily next morning, and with traffic passing through the Pass all night, most of the vehicles with chains on, the road was very wet and slippery with mud 3ins deep in places. 27 Bty had managed to pull the guns up the access road and were in position. The blade was put back on the bulldozer and it began pushing the heaps of spawls and loose rock so laboriously stacked on the edge of the road by the Greeks into the gorge and levelling off wider parking areas. 2 NZ Division was still withdrawing and the Pass just below Ay Dhimitrios was full of artillery, with the village becoming a likely enemy target. The Sappers worked hard all day in the pouring rain, in spite of the traffic, and were all "dead beat" by the end of the day, but with some satisfaction at seeing their road standing up very well.

Raining again on Saturday 12 April, with the road very slushy and all hands out carting metal and spreading it on the worst places. One work party was out in the morning cutting pines for bridging timber, with the bulldozer pulling them out and on to the road. Sgt Pearce did a good job improving the culverts. The rain stopped at midday and the sun came out for an hour when it again clouded over and at 1600hrs it began to snow quite heavily. Everything was in a white mantle that evening, encouraging snowballing among the Sappers.

There was a report during the day that the German armour was held up between Salonika and Servia across our front. There was constant traffic passing along the slushy road and through the snow covered village, which had become very quiet, many people having moved out.

13 April, Easter Sunday, was bitterly cold with six inches of snow in the village, but the Section was again out on road maintenance, and the bulldozer was sent down the Pass to collect the carry-all scoop. HQ 19 Army Tps Coy had moved closer and I called to hear the latest news. Contact had been made with the enemy on the Servia front and things were livening up. The first enemy plane was sighted during the afternoon and driven off by anti-aircraft fire.

Next morning word was received that the enemy were approaching Katerine. The bulldozer completed the filling over the new culvert extensions and pulled some logs into position on the bridge above the village, after which it picked up the scoop and departed for the rear. The Divisional Cavalry came into the pass in the afternoon after a fighting withdrawal. My Sappers placed demolition charges on the three bridges at the foot of the Pass in the morning and we had a situation where one half of the Section was building, new bridges, and the other half was preparing others for demolition only a few miles away. The enemy was expected at the foot of the Pass in the evening with our artillery ready to open fire at any moment. As the Div Cav rearguard passed through later in the evening, the three bridges were successfully demolished.

Just before dark an enemy observation plane came over, the Sappers opening fire with their Bren gun without success. Immediately after, a flight of our bombers passed over, cheering up everyone immensely. The Section demolition party was the last to leave "No Mans Land", after blowing the bridges and our infantry set up wire immediately after the demolition party passed through. Enemy dive bombers had been active during the day.

At 0100hrs Tuesday 15 April I was awakened by a DR with a message from the CRE instructing me to mine the Pass and to stand-by ready to blow by 0800hrs. The Sappers got moving smartly. Leaving Sgt Whitting and one party to pack up and be ready to move by 0800hrs, I with Sgt Pearce and one party, and L/Cpl Lennox with another party, and the compressor, set to work on two positions, excavating through the rock at two narrow and precipitous places in the Pass, with the compressor running back and forth in the dark between the two demolition sites. It was

necessary to blast both holes foot by foot through the solid rock. Two naval depth charges (forty of these charges, each 300lbs, had been obtained from the Navy in Alexandria by the CRE 2 NZ Div before departure from Egypt) were placed to a depth of 6ft and all wired up ready to blow by 0700hrs. Two Sappers were left standing by each charge. These demolitions were later taken over and fired by 7 NZ Fd Coy.

Two enemy planes came over at dawn and opened fire without success. Our artillery opened up in the morning and fired continuously along the Pass on to the foothills where the enemy was massing. I went down to the foot of the Pass with the Bde Major 5 NZ Inf Bde and saw some of the enemy patrols the infantry had dealt with during the night. During the afternoon the Section withdrew, moved over to Pythion near 19 Army Tps Coy and then South for Tyrnavos about 1600hrs. Large numbers of enemy planes kept flying over all day, bombing Larissa and all and sundry, with none of our planes to be seen. The Section reached Tyrnavos at 2200hrs and bivouacked on the side of the road. All hands were very tired. The remainder of 19 Army Tps Coy moved on to Larissa.

Next morning, 16 April, awakened early by an AA gun across the road. Three Dorniers swooped low over the village machine gunning the road, but hitting no-one. About 1000hrs another Dornier swooped over the back of the village, and dived over the housetops with its machine guns blazing. Cpl Madely got in a lucky burst with the Bren gun and brought him down, bursting into flames, across the river half a mile away. Some of the Sappers went over later and brought back a Luger pistol, binoculars, a Leica camera and other souvenirs. All four of the crew were dead.

The Section moved into the school house during the day. There was not much they could do as all explosives were now reserved for demolitions. The bulldozer and scraper were sent on to Larissa. It rained hard most of the day but in the afternoon about thirty Dorniers came over and bombed the village. They flew in very low and did some accurate bombing. The Sappers were in and out of slit trenches most of the afternoon, some bombs coming very close, and made much use of their Bren.

On Thursday morning, metalling of the road through the village was in hand in pouring rain. In the bad places the brick walls were knocked down and the rubble spread in the holes. At 0900hrs I received a message that I was to be responsible for immediate maintenance of the bridges entering Larissa, and with L/Sgt Pearce and six Sappers went down to Larissa to inspect the bridges and found that the large masonry arch bridge nearest the town had to be prepared for demolition and the other two concrete bridges maintained under heavy bombing.

The Section moved down to Larissa in the afternoon and camped just off the road about 300yds from the main bridge which was an eight 50ft span masonry arch structure with spandrel arches in the piers 6ft by 7ft 6in high. All the masonry was very heavy and well built. A truckfull of ammonal was found at the Railway Station and it was decided to place a charge of two tons in two of the pier spandrel arches. One party commenced filling sandbags for tamping and another collecting timber for maintenance of all three bridges. The other two concrete bridges were close together, about one mile north of the masonry bridge.

Enemy bombers came over in force about 1500hrs and dropped many bombs in the vicinity of the bridge. The German bombing was rather different from the high level Italian bombing we were subjected to in the Western Desert. These "Stuka" dive bombers appeared to be fitted with some kind of siren which reached a crescendo at the bottom of the dive as the bomb was released—hard on the nerves when it went on for some time. Traffic was pouring through and the Sappers were set a hard task to prepare the charges ready for firing before the withdrawal was completed. They worked all night and completed one charge which could be reached by wading in the river.

Next day, Friday 18 April, was a hard day with flights of enemy bombers coming

Photo 1. Larissa Bridge. This was the closest the enemy ever got to it in two days of almost continuous bombing. It was fortunately only a small bomb as Harold Page and two Sappers were inside the pier beside it at the time with half a ton of High Explosive

over from day break, until dark, with most of their bombs appearing to be directed at the bridge, but, fortunately with no direct hits. About 1500hrs we counted forty-three bombers approaching and in a few minutes "all hell" seemed to break loose. Nevertheless, no-one was hit and the job was finished and wired up by dark.

Traffic was still passing through at midnight but the rearguard came across at 0200hrs and my three trucks and most of the Section personnel were dispatched to the rear, dumping all the tents and any surplus gear to make space for the Sappers. The last of the Div Cav screen crossed at 0300hrs and as the Officer in the last armoured car assured me without slackening speed, that "If she's going up, boy, she has to go up now", I ordered Sgt Pearce to press home the exploder. Judging by the noise of the falling masonry the demolition was successful but as some enemy m/c machine gunners began to fire at my torchlight across the gap, I could not wait to make sure, and slinging the exploder on to the truck pushed on through the deserted shambles of burning Larissa. As we passed through the town we quite clearly heard the sound of enemy AFV's approach from below the bridge. They had obviously made a crossing downstream of the bridge demolition and we had evidently got clear just in time. With myself, Sgt Pearce and five Sappers aboard, my truck was the very last vehicle to leave Larissa.

We caught up with the Div Cav about five miles south of the town and progress

No 2 Section 19 Army Troops Company NZE in the Greek Campaign (1)

was very slow from then on, as the road was too narrow for passing and the armoured cars kept stopping to fire a few rounds over us. Eventually we got clear and were very glad to have the armour, light as it was, behind us. We caught up with the rest of my Section about daybreak and found all well, with everyone but the drivers asleep.

The trucks were grossly overloaded and all the Sappers very tired after two days and nights working flat-out without sleep and being bombed continuously. It was remarkable that the Section incurred no casualties during that time, apart from two missing, as four men of 18 NZ Inf Bn who stopped for shelter during one of the worst raids were killed.

The main road South on Saturday, 19 April, was one long line of traffic and progress was slow. I had no instructions and was intent on rejoining my Coy, but had no idea where they were. As soon as the trucks stopped for a few minutes all the Sappers fell asleep, and I had to force myself to keep awake. We proceeded on to Lamia and found the rest of 19 Army Tps Coy, at about 1600hrs, all safe and glad to see No 2 Section back without any known casualties. On arrival the Sappers just tumbled off their trucks and slept where they fell.

Sunday 20 April, was a very trying day. The Coy was camped between the road and the sea near Thermophylae under the shelter of a grove of olive trees. The enemy airforce was very active with bombing and machine gunning, but we had to make the best of it and awaited orders. A party of eight Sappers under Sgt Witting was sent out early in the morning to lay anti-tank mines and the rest of the Section were busy digging slit trenches for their own protection and resting as much as possible. The continuous bombing and machine gunning from the air was bad for morale, especially as our own Air Force was not to be seen. The sight of a few "Hurricanes" or "Spitfires" would have put new heart into the troops, who at this time were located just behind the infantry, on the narrow isthmus at Lamia where a stand was to be made. It was in and out of slit trenches all day and not at all enjoyable. No one was hit, though one burst of tracer hit the cab of a No 3 Section 3-ton truck and set it on fire. Being under continuous fire was not so good, with nothing to do, and it was much better to have the Sappers busy.

Next morning 21 April, I was detailed to make a reconnaissance of the flat land between the sea and the road with the construction of tank obstacles in mind. 7 Fd

Photo 2. Bridge over Pinios River, Larissa. Demolished by 19 Company on 18 April 1941. Note bomb damage at end of bridge

19 Army Troops Company NZE in the Greek Campaign (2)

Coy NZE blew the bridge in front of the forward defensive positions while I was there, and the infantry were all prepared for the coming attack. With one Sapper I waded through a mile of knee deep swamp before reaching high ground. The water was very sulphurous with quite remarkable deposits. We were attacked by a Dornier on the prowl and took shelter in a ditch full of water at one stage, but were able to see that the flat denied the passage of tanks, there being a deep 40ft wide stream between the swamp and the sea.

The Sappers were making the most of their situation, sleeping on the ground, but living well on tinned rations salvaged from an abandoned dump at Larissa. That evening my feet began to irritate having been badly burned by the swamp sulphur, and next morning, 22 April, I could not put my feet on the ground, both being very swollen and inflamed. I sent my Sappers out to repair the craters on the road leading up to the forward positions, and then called on the MO. The enemy bombers were streaming over all day towards the South. Not one of our fighters to be seen but we had news that a Squadron of Spitfires had shot down sixteen enemy planes the previous day, which cheered up the troops. It was very trying being continually bombed and machine gunned without being able to make reprisals. However the enemy airforce gave us some respite and directed their attention elsewhere. We were informed by the CRE that we were to evacuate Greece as the Greek forces had collapsed. This meant another "Dunkirk" with tough times ahead. At this stage only the officers were informed and it meant the loss of all the MT, guns, equipment, and most personal gear. It was hard to take after all the hard work done in Greece.

Wednesday 23 April was an eventful day with some of the Sappers on road works and a camp party sorting out the Section stores. It was a heartbreaking task destroying the whole of the plant and tools. Carpenters tools, survey instruments, plumbers and mechanics kits, electrical gear and exploders, all ruthlessly broken up and burned in a slit trench. Most of the equipment was brand new with some not even used, and we had waited for months to get it. To see it all broken up and scattered was hard to bear. All reserve gas equipment, explosives, rations and petrol were destroyed, leaving us with our trucks, arms and ammunition, one blanket per man and what personal gear could be carried.

The enemy airforce was on the job again *straffing* with impunity. The work party arrived back at 1600hrs and were told the sad story of the coming evacuation, a bitter pill to us all. I was sent to 5 NZ Inf Bde HQ as a liaison officer in the evening and on my return found 19 Army Tps Coy had moved out, leaving my truck and five Sappers to follow on. This we did, travelling all night without lights on a rough narrow road with deep ditches on either side and lined with wrecked and burning vehicles, about two per mile. Greek Army remnants were straggling back along the road, tired, hungry and footsore. We caught up with 23 NZ Inf Bn during the night but there was no sign of our own Coy.

It was rather nerve wracking driving in complete darkness on a strange road at high speed and I had to relieve the exhausted driver at 0300hrs and drove the rest of the way until daylight, passing through Athens at dawn and reaching the staging area pine woods. All hands immediately fell off the truck and dropped off to sleep, and I found it was all I could do to stay awake long enough to get out and lie down. I was still suffering with painful swollen feet. Most of that day was spent sleeping, with time to have a couple of meals from tinned rations brought from Larissa. I found thirty of the Coy personnel including two officers, but no sign of the rest. My Section now consisted of myself and five Sappers. Flights of enemy bombers passed over during the day but left us unmolested.

Contact was made with Coy HQ and I was detailed to destroy the remaining Coy vehicles before embarkation without fires or undue noise. Late that night we set off for "D" Beach, Porto Rafti, a mixed convoy of waifs and strays, unloaded about a mile from the beach, and wrecked the trucks as best we could. It was a struggle down to the beach, with our packs and all we could carry, to find that the rest of our

Coy had already embarked, and the ship full. I had hung on to two exploders and a testing box, but after wading out waist deep to a landing craft which came into pick up stragglers, I had to dump them.

Friday 26 April, Anzac Day, almost a re-enactment except we were retreating instead of attacking. There were about 600 men crammed on to a small flat bottomed boat, with shovel type bow and drop type landing door. We were a mixed lot, Sappers, Maori infantry, gunners, supply column, a few Aussies and Tommies, all packed in the hold like sardines. There was no room to lie down, even if there had not been some inches of water therein, and we had an uncomfortable two hours trip with everybody dog tired, carrying heavy packs, and no-one in the best of humour. An island was sighted at dawn and at 0630hrs we landed on a small beach, wading ashore. A conference of officers was called and learned we had landed on the island of Kea, twenty miles from Athens, where we were to remain until picked up by the Navy and transported to Crete. If the navy failed to pick us up within two and a half days we were to find our own way to Crete, how, it was hard to say. We had practically no food, and little ammunition. The enemy airforce was over the island several times during the day, machine gunning and bombing. So everyone spent the day resting between the air attacks. However, there was plenty of water, and a bath in a little wooden tub was very welcome.

Next morning, Saturday 26 April, we woke up very stiff and sore after a night spent on the stony ground, but we had a good meal of brown bread, hard boiled eggs and spring onions, from local sources and felt much better. Bombers were over most of the day making it uncomfortable. At midday two Naval officers arrived to say that we were to march across the other side of the island to embark on the same tank landing craft that had brought us to Kea, and be shipped back to Porto Rafti for transhipment to Crete.

Some 600 men in small parties left from about 1400hrs, the last man boarding the boat at 1930hrs. It was a hard march and most of the men were all in at the end. It was about ten miles across the island by rough track, rocky and steep. Gear was down to a minimum at the start but the route was soon littered with cast off equipment and personal gear. It was very hot up to 1700hrs and we were continuously forced to take cover from enemy planes. As far as I could tell all my party of twenty-two men got aboard although other Units had to leave men behind. We arrived at Porto Rafti at midnight and after an unsuccessful attempt to get alongside the main transport in the heavy swell, were shipped aboard a light cruiser. Three of us were packed into a small cabin—just heaven. I lay on the floor and "died" about 0200hrs.

Sunday 27 April, found we were aboard HMS *Carlisle*, and it was wonderful to have the first hot drink for some days and to be able to move around without fear of enemy fire. We had a good breakfast, our first hot meal for a long time. My feet were still very sore from the effects of the sulphur burns and the long trek across the island. The cruiser was crammed with troops. In addition to the 600 men from Kea there were about 1000 from the Greek mainland. The ship sailed at 0500hrs, in a convoy consisting of two transports and four light cruisers. We were attacked by dive bombers shortly after leaving with some near misses only. There was a Bren gun mounted on one of the aft searchlight platforms and I fired a few bursts at enemy aircraft during the day. The eight 4-in guns made a shattering din when all were fired at once and everyone had their ears packed with cotton wool. A number of attacks were made on the convoy and one enemy plane was shot down. After being bombed and machine gunned for so long, and not being able to hit back, it was grand to be with AA guns in action. A bath and a shave made one feel much better and everyone had a good word for the Royal Navy following a substantial lunch and tea.

We arrived at Suda Bay in Crete at 1800hrs. The bay was full of shipping, transports, cruisers, one battleship, and numerous seaplanes and "Sunderlands". The troops came ashore on a tank transport, marched some six miles inland to a transit

camp and slept under olive trees. The following day I gathered my twenty-two Sappers together and set off to find 19 Army Tps Coy. Luckily I came across my OC, Major Langbein, and were soon welcomed by the rest of the Coy who had given us up as "missing".

Of my own No 2 Section of forty-two all ranks, two Sappers only were posted missing. I later found that these two men had volunteered to drive a train carrying 26 NZ Bn from Larissa to Lamia and were eventually captured at Kalamata. And now we had the Crete campaign, in which we fought as infantry, ahead of us. But that is another story.

Correspondence

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Who's Curious

Sir,—I was greatly intrigued by Brigadier Sir Mark Henniker's curious toys, probably because I am one of his "curious people" in more than one sense of the word. As he says, neither of those illustrated are new and I vaguely remember making several versions of both some fifty years ago. To the collection could be added the "tank", made from an old fashioned wooden cotton reel, a short but strong elastic band, a thin slice from a candle, a half inch leather tap washer, an orange stick and a drawing pin. The deep-cut type of cotton reel is the best and its edges are then cut to produce "teeth", with which the device will climb up and over step-like obstacles of height up to half the diameter of the reel.

Then there is the "helicopter", for which a hand carved wooden propeller of about 150mm (6in) long is mounted on a wooden meat skewer which in the high and far off times used to be supplied by the butcher with the joint. The skewer, about 175mm (7in) long is put through the hole of a reasonably large cotton reel and then a length of fine string is wound tightly round the skewer about 25mm (1in) below the propeller. A good strong pull on the string while holding the cotton reel firmly in the other hand will send the helicopter whirling up to the ceiling, provided of course that you wound the string in the correct direction!

There are many more such toys to be found in Victorian books for children and also in more serious writings of that time, such as *Piesse's Magic*. I remember other resurrections and the occasional new idea in *Hobbies*, *The Scout*, *Practical Mechanics* and other magazines of the 1930s.

There are around us today many ingenious devices which utilise ideas once thought of only as curiosities and playthings, as well as those based upon quite new ideas, and all of these we tend to take very much for granted. Heinz Wolff was heard to observe recently that there is a difference between the days before the Second World War and now. Then many people understood how the gadgets of the day worked but could not afford to buy them. Now everyone can afford a wide range of gadgets and toys but hardly anyone understands how they work. Perhaps we take our world far too much for granted. Perhaps we all should be more curious. I like Kipling's verse:

> I keep six honest serving men.
> (They taught me all I know.)
> Their names are What and Why and When,
> And How and Where and Who.

My purpose in writing is of course not to compete with the Brigadier but rather to philosophize on the value of those toys, ancient or modern, to the engineer who, first and foremost must be an ingenious man. (There is little or no etymological

connection but the similarity sounds good.) They are of small direct value but indirectly many such toys serve as an illustration and mnemonic for the useful principles which they contain and which may thus be recalled to mind at times when a good idea really is essential.

About 1934 or 35 I learned in school about polarised light and made up a toy wherein light from a lamp struck a piece of plane glass with an incident angle of 57½ degrees and thereby became polarised. A second piece of glass parallel to the first acted as the analyser and if one placed between the two a piece of cellophane it could be seen in brilliant colours which varied with the number of thicknesses of cellophane and the angle(s) at which it was set. In 1943, as stage manager of the "Rice Bowl" Theatre, mine was the only stage in Changi with full three-colour lighting, although normal colour media were unobtainable. The other stage managers all wanted to know the source of my beautiful colours but I never would tell. The glass came from truck windscreens and the cellophane (not the modern plastic) came from big packets of cheap cigars.

On a slightly different tack but still on the main course, in recent days I have on several occasions shown to young RE officers a sardine can key and asked them what value they would put upon it. All have replied more or less as follows:

"Well, as I don't happen to have a keyless can of sardines on me at present, not much."

"Would you think of giving me £4 for it?"

"No! Certainly not. Why do you ask?"

I have then explained that in a POW camp, where one is cut off from the normal sources of supply, anyone can take a piece of old fence wire or similar and rub it on a stone to make a pin; but how does one put the eye in a needle? I do not know who's curious and questing eye first lit upon the sardine or bully can key. The going rate in Changi for such a key was four packets of fags, today costing about £4. When the work had been done on it the resulting needle would sell for ten packets, today costing about £10.

If the unthinkable ever does happen and we find ourselves having to survive in conditions such as I saw in Nagasaki in 1945, then who are those who will lead the survival? Not necessarily, I suggest, the previously nominated commanders, governors or senior civil servants but far more likely those curious and admirable people who remember the Brigadier's toys, have an ever curious mind and whose name might be Crighton.—Yours sincerely, Peter Rhodes.

Colonel J N S Drake B Sc, C Eng, MICE, MIE(Aust)
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Post Graduate Training at RMCS

Sir,—There can be no sensible quarrel with Brigadier Willmott on two important points he made in his letter, *Should Civil Engineering Die at RMCS?*, in the September issue. Certainly our officers must be trained so that the Corps can undertake any Sapper task on the battlefield. Secondly, he is absolutely right that Sapper officers need a more broadly based technical education for it becomes increasingly likely that in the engineering field it will be the mechanical, electrical and electronic problems which will have the greatest significance for us. Modern equipment and technology certainly help to save manpower and effort, but it takes modern men to keep them going on the battlefield, and of course without the labour-saving equipment we are back well behind "square one" because we no longer have the manpower which it replaced.

However I do question his opinion on post-graduate training at RMCS. In many ways the technical training of most other arms at RMCS is the mirror image of that required by a Sapper. The bulk of their technical training is directed at their ability in peacetime to help in providing the best equipment for the battlefield. By contrast

Fort St Elms at the seaward end of Valetta, but I was surprised by the almost complete absence of any reference to the Corps in the Museum.

Considering that we had two Sapper Companies and a CRE on Malta when WWII started, I am sure the Corps must have played a significant part in the defence of the Island, and as we have surely got Sappers living in retirement on Malta, it should not be too difficult for the Corps to offer a suitable display to the War Museum, which currently concentrates mainly on the RAF and Gunner contributions to the defence of Malta in WWII.—Yours faithfully, Gerry Chapman.

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Aerial Mines

Sir,—Major Blad's letter in the December Journal brings to mind a book (*The Secret War*, Gerald Pawle) which tells of a device called "Parachute and Cable" (PAC) which was developed by the Royal Navy in 1940. A wire, to each end of which was attached a parachute, was hoisted aloft by means of a rocket which was fired into the path of an oncoming aircraft. These proved effective against low level attacks on shipping, on one occasion severing part of the wing of an attacking plane and on another virtually bringing an aircraft to a halt in mid-air causing it literally to fall out of the sky. The more usual effect was to entangle itself in the airscrew, with predictable results.

Later the "Free Balloon Barrage" (FBB) was developed, where one end of the wire was attached to a balloon and aerial mine, and the other to a parachute. The parachute would draw the wire across the plane until the mine made contact and exploded. As the targets were several hundred feet up, the system had to be free-flying (hence the name FBB). As so often happens, it was put into use before development, (particularly of the balloons height control mechanism), was complete, thus bringing widespread consternation to an unsuspecting civilian population. A number of strange stories are told. Despite the early tribulations, it was eventually developed to a quoted "80% efficiency" (whatever that means), but the Nazi mass raids ceased before the final version could be used in anger. Its main drawback was that, in order to be effective, many hundreds needed to be released at once against massed aircraft. The administrative effort was considerable. However the concept was proved to be feasible, and the use of modern materials (eg *Kevlar*) as well as keeping the device tethered would simplify matters a great deal. Indeed Churchill in Vol II of *The Second World War* says that "It was surprising and fortunate that the Germans did not develop this counter to our mass bombing raids in the last three years of the war". But I have a feeling that getting the right amount of Helium to the right place at the right time with the right inflation equipment could prove the stumbling block.—Yours sincerely, Mike Lewin-Harris.

Lieutenant R D Thomson
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Reservists

Sir,—If it is vital for Regular and TA units to maintain close contacts in peacetime to enable them to work harmoniously in war, it is equally necessary for Reservists to maintain similar contacts with the TA units to which they would report on mobilisation. Yet under the present arrangements such contact is not encouraged. Of course, many ex-Regulars do join TA units, to their mutual benefit, but many more

the Sapper is more often preparing himself in peacetime so that he can use his engineering skills for whatever he may happen to meet on the battlefield. It is therefore very much more difficult to train the Sapper in a civilian-based establishment, for it is essential that his training is very closely related both to what is expected in war and to the practice for it which is undertaken in peacetime. With the best will in the world civilian academics have great difficulty in keeping abreast of the true meaning of military engineering; this can be done very much better by Sapper officers teaching at RSME in a military environment surrounded by all the allied military trades and disciplines. Having to teach a subject is also a marvellous incentive to learn it and military instructors at RSME benefit accordingly. I therefore submit that it would be a retrograde step for the Corps to allow its officers to receive post-graduate technical training in the comparatively academic atmosphere of RMCS rather than at the heart of the Corps at Chatham.

No doubt some will suspect me of bias, but I do consider that Brigadier Willmott, who was Deputy Commandant (Designate) RMCS when he wrote the letter and is now in post, might equally be accused of viewing life through tinted glasses.—Yours sincerely, J N S Drake.

Lieut Colonel Edward De Santis
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Brigadier H W R Hamilton CBE DSO MC

Sir,—I am presently doing a study on the life of the late Brigadier Hugh William Roberts Hamilton CBE DSO MC. I would like very much to correspond with any Members of your Institution who may have biographical information or photographs pertaining to Brigadier Hamilton.—Yours sincerely, Edward De Santis.

Lieut Colonel P F White OBE
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Curious Toys for Curious People

Sir,—I was amused to read Mark Henniker's description of Curious Toys. I know nothing about the Propeller, but, some 70-75 years ago, I had a Diver toy. My man was made of celluloid. He was in a glass bottle with a rubber cap similar to the foil caps on modern milk bottles. Pressure on this cap had the same effect as squeezing Henniker's plastic bottles. My toy was probably bought from either Harrods or Gamages. I remember that one of my friends also had a Diver.

I am very surprised that such an amusing toy should have disappeared from the shops and I hope that Henniker's reintroduction will be a success.—Yours sincerely, Peter White.

Major W A Chapman FRICS
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Malta GC War Museum

Sir,—I recently spent a holiday on Malta, and like most visitors became enthralled with the island's history. The story of the island's siege by sea and by air at the hands of the Italians and the Germans is very well set out in the War Museum near

cannot afford the time which the TA demands, with the result that professional military skills become rusty and outdated. In such circumstances would it not be wise (and relatively cheap!) to allow Reservists to attend TA training at the appropriate daily rate of pay, but without the yearly commitment of a TA soldier. Even if a Reservist turned out only once a year, this would be better than not at all – and it's infinitely better for us to get to know each other before we step on a plane to war.—Yours faithfully, R D Thomson

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The Royal Engineers Journal
A representation not amounting to a complaint!!

Sir,—I have just received Volume 97/4 of the Journal and, being left-handed, I naturally read it starting at the back and finishing at the front.

As I got near to the front I found myself thinking what an interesting and lively journal it was, full of unusual and revealing articles. For example I had no idea that my near neighbour the Chief Engineer UKLF now has a strange new title : I was very interested to read of the activities in Heriot-Watt, a University I have often visited : I am always interested in D–Day activities, having been involved myself in a small way : I was impressed by Major Harrison's activities in airfield construction—once one of my subjects : and I liked the article on Batri-trikes.

So I had a pretty good impression of the number before I even got the Sir Mark Henniker's entertaining article on curious toys.

I was therefore somewhat surprised to read, last of all, your Editorial reporting that the Journal has been criticised as being too serious, too technical, insufficiently readable. That certainly isn't the way it strikes me and I thought you should know that at least one of your readers thinks the Journal is a "good thing" and a credit to the Corps.—Yours sincerely, R M S Maude.

PS: Could you persuade Sir Mark to invent a really useful toy? What we need is a golf ball which, on the putting green, is invariably attracted towards the hole rather than away from it as at present.

Memoirs

MAJOR GENERAL S W JOSLIN CB, CBE, MA, C Eng, FIMechE, FIEE

Born 25 March 1899, died 6 October 1983, aged 83

Stanley William Joslin—"Jos" to all his friends—was educated at Hackney Downs School and was commissioned from The Shop in 1918. On Armistice Day he was at the SME on a Short War Course. With most of his Batch he was posted to the Rhine Army and it was many years before he returned to Chatham with one of the last Supplementary classes. The intervening period was fully occupied in India, Waziristan and surveying in Nigeria. He gained an Honours Degree at Cambridge where he first met a fellow undergraduate who, in due course became the first Chairman of the Atomic Energy Authority—the present Lord Hinton.

After a Long E and M Course Jos served in the Directorate of Fortifications and Works (DFW), and will be remembered by his fellow specialists serving overseas for his helpfulness and tolerance when they expressed their frustrations more forcibly than official communications usually betrayed—no radio or even telex available in those days.

In 1940 he returned from a tour in Singapore accompanied by a wife to find himself in the RE Stores Inspectorate of the Ministry of Supply. He took the view that this was no job for a soldier in wartime and at the first opportunity transferred to the newly formed Corps of Royal Electrical and Mechanical Engineers. Going to France on D Day as CREME XXX Corps he went through to the Rhine and the end of the war, rising in rank until his appointment as DME in 1950, retiring from the Active List in 1953. Details of his REME service will be found elsewhere; but let the words of a contemporary suffice here: "Jos was greatly respected in REME: wherever I attended a function or paid a visit to a unit there was always an enquiry after him."

In the early "fifties" Jos was elected a Member of Council of the Institution of Mechanical Engineers, and on retirement joined the Atomic Energy Authority under Hinton at Risley in Lancashire. When, in 1954, it was decided to build an experimental fast reactor at Dounreay, Jos was given the spot job of Works Manager. Construction started in May 1955 and was finished in 1958, energy being delivered to the "Grid" in 1959.

Soon after this the organisation was altered and he resigned. But a third career awaited him. The Nuclear Installations Act (1959) provided for a Nuclear Installations Inspectorate (NII) within the Ministry of Power. Jos became the first Chief Inspector and held the post until he retired in 1964 to Maresfield Park in Sussex.

Jos was perhaps the most distinguished engineer in the E and M disciplines that the Corps produced between the Wars. Fortunately both the Army and the Government made good use of his abilities. He made a success of three careers, all of which demanded a combination of engineering skill and the flexibility to tackle completely new problems. The present high standing of the NII can be due in part to its firm foundation.

On his final retirement Jos took an active part in the life of Maresfield being at one time Churchwarden, Treasurer and Organist of St Bartholomew's Church. He was a man of deep convictions who on at least three occasions resigned rather than acquiesce in policies with which he disagreed. He carried on courageously after the tragic death of his wife Eve, continuing to give talks to local societies and play the organ until a few weeks before his death.

He leaves one daughter to whom we extend our deep sympathy.

KHT

A TRIBUTE TO LIEUT COLONEL R A TURNER DSO, MC

Born 25 July 1889, died 20 August 1982, aged 93

Sir,—It was with sadness that I read in the October Supplement of the passing of this gallant and extraordinary Sapper Officer. Just one of many stories about him should suffice to give a fleeting glimpse of his spirit.

He was CRE(Works) Eritrea in September 1942. At that time Engineer Works Services had a heavy work load stretching from the port of Massawa to the western borders of Eritrea. Road repairs, military camps, hospitals, and even dam construction! Obviously most of his time was taken up in travelling to and inspecting works sites, freely advising and directing Garrison Engineers and Clerks of Work with skill and insight. One extraordinary journey he took, and had us all gasping with admiration at its audacity, was between the port of Massawa and Asmara travelling in a shallow three-sided steel pan of the aerial ropeway that covered the fifty miles of the most breathtakingly mountainous country between the two points. At some midspans between the pylons the height from the valley floor was over 500ft. The steel pans travelled at about 6mph with considerable shaking, particularly when they passed over the pylon head pulleys.

The ropeway was used exclusively and strictly for the transport of cement and sacked goods from the port of Asmara. It was strictly forbidden for anyone to even

attempt to travel on it. But this did not deter our gallant CRE. Armed with a camera, he climbed a pylon a couple of miles out of Massawa, hauled himself into a moving pan, and calmly began taking snapshots of the panorama laid out below him.

Unfortunately after a couple of hours, he was spotted by a Military Police vehicle which was travelling on the mountain road far below. They contacted the winding gear house at Massawa and had the ropeway stopped. After some cajoling and threats, our intrepid CRE was persuaded to climb out of the pan—descend the adjacent pylon 50ft high, and confront the astonished Military Policemen down below. His explanation to them was, as ever, straight to the point. "How else would one get good aerial photographs of the surrounding terrain?"

I must say we were all proud of Colonel Turner and the Corps on that memorable day.

I'm sure that all the surviving Sappers serving in Eritrea under his command in those far off days, will join with me in a salute to his memory.

JHW

GENERAL SIR J NOEL THOMAS KCB, DSO, MC, D Eng

Born 28 February 1915, died 16 March 1983, aged 68

JOHN NOEL THOMAS was born in Northumberland and educated at the Royal Grammar School Newcaste-upon-Tyne and Liverpool University. He was commissioned into the Corps in August 1937. His YO Courses were completed on 1 September 1939 and he was sent to Shorncliffe to take part in the formation of 141 OCTU RE before moving to Aldershot in August 1940 where he served in 24 Guards Indep Bde Gp, 11 Armd Div and 9 Armd Div before taking command of 14 Fd Sqn, Guards Armd Div, in August 1942. After two years of intensive training the Division went to Normandy in June 1944 as one of the follow-up formations. The Division took part in *Operation Goodwood* (the break-out East of Caen), the pursuit following the break-out from the bridgehead, the liberation of Brussels, and the advance to Nijmegen following the drop of the Airborne Corps. At Nijmegen he succeeded Lieut Colonel (now General Sir Charles) Jones as CRE. He was awarded the MC and DSO in March and August 1945.

General Thomas went to Staff College in August 1945 and in March 1946 was posted to Palestine as Bde Major, 2 Infantry Bde Gp. In 1947 he returned to Camberley as an Instructor followed by a tour in AG7. After almost four years in Hameln as 2IC and the CRE of 26 Fd Engr Regt, 11 Armd Div, he spent two years in MO3 at the War Office (during which time the appointment was up-graded to Colonel GS) and two years as GSO1 of a division in Camberley before he returned to 2 Inf Bde, this time in command. In November 1961 he returned to Germany to command 5 Inf Bde Gp for a year before attending a course at the Imperial Defence College.

In December 1963 he was appointed GOC 42 (Lancashire and Cheshire) Div (TA). This was very much on his home ground, as his family had moved from

General Sir J Noel Thomas KCB DSO MC D Eng

Northumberland to Lancashire in 1931, and was delighted when they gave him an honorary doctorate.

In 1965 he returned to MOD as Director Combat Development (Army) and spent an interesting two and a half years attempting to forecast tactics for the 1980's, before being appointed Deputy Chief of the Defence Staff (Operational Requirements) until 1971 when he was promoted General and selected as Master General of Ordnance. He retired from the Active List in 1974.

He was appointed Col Commandant of both the Royal Pioneer Corps and the Corps of Royal Engineers in 1968, he was President of the Association of Service Yacht Clubs and, to his astonishment, of the Army Squash Association. From 1974-81 he was Vice-Chairman of the Commonwealth War Graves Commission.

General Thomas had a modest though very strong personality with a fertile imagination and a first-class brain. He was popular and approachable and was undoubtedly one of the outstanding Sappers of his generation. The extracts from some of the personal tributes which follow add colour to the broad picture of his career.

JB writes: "At the request of others in my Batch (No 2 UCO, 'Noble's' Batch) I have penned a few notes based on my knowledge of him when we first joined up. J N Thomas was one of seven officers accepted into the Corps in 1937 from Non-RMA origins. He was always cheerful, enthusiastic and showed considerable drive allied to modesty. His handwriting always impressed me and if it is an indication of his character then he was bold, straighforward and clear – these may well have been the essential qualities of his character which took him to the top."

AJHD writes: "Our paths crossed twice. In 1941 he was Adjutant 11 Armd Div RE when I commanded 13 Fd Sqn and in 1942 he commanded 14 Fd Sqn when I was CRE Guards Armd Div.

"In the first instance the situation was a bit tricky because the Divisional Commander insisted on being his own CRE! But Noel was a tower of strength; one could always discuss problems with him and get sound advice.

"In the Division during training, Noel showed himself a splendid unit commander who always gave me the most loyal support, and whose activities were, as one would expect, always well thought out.

"It was always a pleasure to serve with Noel".

CPJ writes: "Our paths crossed only during WW2. I joined the Guards Armd Div in the second half of 1942 as CRE, John was OC 14 Fd Sqn and, as the senior Sqn Commander, was my 2IC. I was drawn to him at once.

"We trained together in E Anglia and Yorkshire before moving to Sussex in preparation for the invasion in 1944. We worked hard and John was most successful in bringing his Squadron to a high pitch of efficiency in addition to being my strength and stay in the Div RE; a wonderfully able, imaginative, active and loyal Sqn Commander.

"14 Sqn normally supported 5 Guards Armd Bde and saw some stirring times after we landed in Normandy – in *Operation Goodwood* round the East of Caen, in the gallop for Brussels and in the advance then to Nijmegen, successfully building the bridge at Son overnight, thus enabling the Armour to cross the canal at first light and press on without delay.

"John having proved himself in action, very properly won promotion and succession to me as CRE. So our ways parted, but I know that he commanded the Sappers of the Guards Armd Div with distinction until the end of the hostilities in Europe.

"John was a proper soldier and a distinguished Field Engineer."

JAC writes: "I first met him in 1953. I was an inexperienced Captain and he was my CO, commanding 26 Fd Engr Regt in Hameln and doubling as CRE 11 Armd Div. He always gave advice and encouragement and in the two and a half years I served under him I never saw him lose his temper. However great the mistake, he always explained quietly how the job could be done better next time.

"In later years I turned to him for help and advice many times. Even when he was a Member of the Army Board it was always, "John here; what can I do to help?" When he and Jill hosted for the first time at the Colonel Commandants' Garden Party, they invited all the ex-members of 26 Regt that they could contact in England, which lent weight, if such were needed, to his often expressed view that the two highlights of his career were to command a Regiment and to be a Colonel Commandant of his Corps."

RWML writes: "I worked for General Thomas for a year in 1954, when I came to know him and his family very well, and he remained a good friend until he died. Working for him was a joy: his brain was fast and logical, he sought perfection in all he did, he drove himself hard, and he always assumed that, given encouragement, everyone else would give of their best. He led by inspirational example, a warm heart, a marvellous clarity in making his wishes known and a great capacity to teach those less knowledgeable or experienced than he. As CRE 11 Armd Div he was immensely respected by his own fine Regiment and also by the divisional staff for whom he did an enormous amount of work. He was, in addition, rightly loved by all for his deep interest in people, his warmth of character and his humour. His rapid rise to high rank, and ultimately to the Army Board, surprised no one. It never affected his modesty or his attitude to the friends he had left behind in his rapid progress to the military heights. A small point illustrates what was so typical of him; when very senior his telephone calls to friends came direct from him and not through his secretary. He always retained that warm, personal touch.

"I knew little of his work for the War Graves Commission, but he told me that he loved it. In particular he enjoyed the travel and his dealings with such a wide variety of people from ambassadors to those dedicated gardeners he admired and liked so much.

"I shall remember General Thomas as a warm-hearted, understanding, stimulating, amusing, and immensely modest friend; it was always a joy to be with him and invariably great fun with a lot of laughter.

"His family meant everything to him, and I share their sadness and loss, for he was one of the truest men I ever knew".

JB, JAC, AJHD, CPJ, RWML and others

LIEUT COLONEL F L BARR MBE, FRICS

Born 31 March 1909, died 19 December 1981, aged 72

Lieut Colonel F L Barr MBE FRICS

FRED BARR enlisted as a regular soldier in the Corps in 1927. After recruit training at Chatham he was posted to the Survey Battalion RE in the Ordnance Survey, which provided the Warrant Officers and NCO's for the formation of the RE Survey units in September 1939 to go to France with the BEF. Fred Barr was among the first of those to be commissioned and he then served with distinction in the Western Desert.

Colonel Douglas Burnett writes: "I was sorry to learn of the death of Fred Barr. I first came in contact with him before the war in 19 Field Survey Company RE at Fort Southwick. Together we did the reconnaissance for a secondary block of the re-triangulation in Wales, and I saw at once that he was an excellent practical surveyor with an acute sense of direction and of distance. When I went to 514 Field Survey Coy RE in the Western Desert on 1 January 1942, Fred Barr was my second in command. Knowing his capabilities I placed him in charge of the two topo-

graphical sections which were carrying out a programme of astro-fixes well ahead of our own front line. I well remember receiving from him in the middle of the night an astro fix at a *Bir*some 10km in position from where it was shown on the existing maps. The 1/250,000 sheet *EL AGHEILA* was due to go to print that night (the printing machines were on shift-working). Summoned by the members of the night shift, I called for a pair of scissors and cut up the drawings to re-fit them to the new position determined by Fred Barr. We labelled the point "Fred's Spring" and the sheet went to print.

"It was then that the Germans began their advance from the El Agheila area which took them to El Alamein and Fred remained with the topo sections for some time behind the enemy lines blissfully ignorant of the enemy advance. We were relieved to see Fred and the topo section's return to Company HQ a few days later in time to help us produce a brand new large scale map based on a triangulation by the topo sections. The triangulation, field survey, drawing and printing of this sheet were completed in 72 hours and the sheet was distributed in time for the tank battle of "Knightsbridge", a track junction which we beaconed and showed on the map".

After the war there was a continuing need to maintain the likes of Fred Barr within the RE Survey Service, which gave use to the creation of the Survey Executive Officer commission to attract the post-war regular soldier to remain in the service to fill NCO, Warrant Officer and some officer appointments with men of quality and experience. Fred Barr was one of the first to receive the SEO commission, which his example has helped to justify. He continued to serve with distinction until he retired as a Lieut Colonel from his last appointment in the Directorate of Military Survey in 1964. A sterling character.

LJH, DIB, RMS

LIEUT COLONEL J G O WHITEHEAD MC*

Born 27 February 1897, died 10 June 1983, aged 86

Lieut Colonel J G O Whitehead MC

JOHN (JACK) GARWAY OUTRAM WHITEHEAD was born in Pembridge, Herefordshire. The son of a vicar, he was educated at Colwall and Rossall. "JGO", "Hooker", "Walrus", "Jack" joined the Royal Engineers from the Shop in 1915 and served in the trenches in France where he was wounded. In 1917 he was awarded his first MC at Ypres working on a track under heavy fire before relief could be sent in.

After attending St Catharine's College, Cambridge, he went to India and from 1919 served most of his military career with the Bengal Sappers and Miners on the North West Frontier. In 1921 he received the Bar to the Military Cross. While in temporary command, half of 55 Company were engaged in a furious struggle with 800 *Mahmuds*, and did not withdraw until their ammunition had run out. This engagement at Black Hill has been described in Colonel Sandes' Book (p590) where Captain JGO Whitehead was "severely wounded in the fight". Although left for dead, the bullet hit him on the left side of the chest, ricochetted off his pocket book, and left him badly winded. He rejoined the fight.

While superintending the wiring of the camp defences, in 1920, after the column had struggled through the Ahnai *tangi* he was wounded in his right thigh. This left him lame for the rest of his life.

There are scant details of the rescue he made of the wives of three high ranking Indian officials, held captive high up a *khud*. The task was judged to be impos-

sible—all previous attempts had failed, as each man had been picked off ascending the narrow track. Jack, with the help of one fellow officer, and his *bedruggah* holding onto the end of a very old rope, descended the khud, and, overcoming the tribesmen guarding the women by throwing a grenade into the mouth of the cave, he led them to safety down the narrow track. For this he received the censure of his senior officer, and the gratitude of the husbands.

While posted as 2IC London District he married Marjory, in 1934, youngest daughter of Colonel Astley Terry IASC. In 1936 they sailed once more for India, where he served until recalled home in 1942. His last posting was CRE Meerut District.

He served as CRE Maidstone District, until a posting to Orkney in 1945 where he retired in 1947. This gave him the opportunity to pursue his hobby of writing on ancient history, as well as military subjects.

He won the RUSI Trench Gascoigne Prize Essay on Measures to Counter Communism in 1957. His book *Guardian of the Grail*, published in 1959, was the culmination of many years of research. He continued writing up until the last day of his life, and has left a wealth of knowledge and research behind him.

His diffidence hid a very warm and generous personality, and his stoicism was demonstrated on many occasions during his life.

He is survived by his three daughters and their families.

CMG-T

MAJOR GENERAL J F D STEEDMAN CMG, CBE, MC

Born 30 November 1897, died 14 May 1983, aged 85

JOHN FRANCIS DAWES STEEDMAN, often known as Jack and popularly as "Tich", was educated at Bradfield and The Shop. He was commissioned into the Corps in February 1916 and from 1917 to 1918 served with 12 Field Company in Salonika. During this campaign he was wounded, awarded the MC and Mentioned twice. In 1919 he joined 14 Fd Coy QVO Madras Sappers and Miners and took part in the Afghanistan and Waziristan campaigns and was then appointed Adjutant of the S&M in Bangalore.

Between 1926 and 1929 he commanded 13 Fd Coy QVO Madras S&M in the Manzai Brigade in S Waziristan. Indian Infantry Regiments were inclined to regard the Madrassis as poor soldiers, coming from the "Sloth Belt" or "Deep South". Little did they know what a man of Jack Steedman's character, knowledge and experience could do to produce a "Piffer" (Punjab Frontier Force) Madras Sapper Company. They executed all the Sapper tasks expected of them and more and in addition did their own picketing and guards and manning their share of the perimeter posts at night when on column with the Brigade. Their last job with the Brigade was the construction of the Alexandra Ridge Picket, a Mediaeval crenelated castle to hold 200 men, overlooking the Razmak/Rezani road. All the stone had to be quarried, limestone burnt to produce building lime, sandpits had to be developed and all stores carried to the ridge. The work was completed in four months, with the help of the workshop facilities of 10 Fd Coy Madras S&M stationed in Razmak, a remarkable achievement. An

Major-General J F D Steedman CMG CBE MC

athlete himself, a brilliant hockey player in the land of hockey (he also played cricket and soccer for the Corps) he saw to it that his Company also took part in every sporting event in the Brigade with considerable success. This rather detailed account of 13 Coy's activities is included as it illustrates his strength and powers of leadership as a Captain.

He returned to UK in 1936 and was Fieldworks Major in the Training Battalion at Chatham before returning to Bangalore as CO of the Trg Bn in 1939. He was appointed CRE 11 Indian Division in Malaya and stayed with them until the fall of Singapore in 1942. Throughout the final retreat he was calm, steadfast, quickly sizing up each situation and giving clear orders which kept up the Sapper morale when all around was panic and confusion.

He was appointed Commandant at Bangalore and in 1943 became Chief Engineer XXXIII Indian Corps, then in Bombay, and was with them throughout the Assam/Burma Campaign until they reached Rangoon in 1945. His knowledge and understanding of the Indian soldier and the deep affection in which he was held was almost legendary.

From 1945 to 1946 he was Chief Engineer Twelfth Army in Burma before being appointed CE Southern Command India and then Engineer-in-Chief, India, from Independence Day until January 1948. This period, which was extraordinarily difficult, tasked his powers of leadership to the full. His last appointment before his retirement from the Active List in 1951 was as CE Southern Command in UK.

In 1951 he took up the task of Director of Works, Imperial War Graves Commission. His duties and responsibilities took him to many places all over the world and he played an important part in the setting up of the war cemeteries after WW2. He finally retired in 1963 and was soon fully involved in the life and affairs of the community in and around East Knoyle.

It is an indication of the affection and respect in which he was held when the Editor had to select some personal tributes and found he had to omit so many. Those that follow are typical of the many submitted:

"He was a very human person with a very practical approach to problems. At all times his appearance on the scene would give a feeling of confidence."

"An outstanding soldier, leader and a great administrator".

"He was truly one of the great soldiers of his generation and influenced the thoughts and deeds of many, many men, particularly the Madras Sappers. That influence and example will remain an inspiration for those who knew him."

"If ever I had to choose anyone to serve under it would have been him."

"A great Madras Sapper whose heart was with the *Thambis*."

"He epitomised the very best characteristics of the British; ruggedly steadfast, utterly reliable, shiningly honest and blessed with a most delightful, almost puckish, sense of humour."

To his wife Olive, his daughter Susan and the grandchildren we extend our deepest sympathy.

PAE, JLN, DCTS, WT and others

A TRIBUTE TO BRIGADIER J S W STONE CBE, MC

Born 14 August 1895, died 12 February 1983, aged 87

Sir,—John Stone's death removes another friend from my contemporaries. Everyone who worked with him liked and admired him but perhaps the best tribute came from an American Colonel, a Westpointer, on my Airfields staff, who attended one of John's Conferences as Chief Engineer Second Army in the bridgehead at a time when Engineer resources were stretched to the limit and everybody wanted more, including us in Airfields. The Colonel told me that what impressed him most was the feeling of total co-operation that John inspired. What better tribute to a leader?

HdeLP

Book Reviews

MYSTERIES—ENCOUNTERS WITH THE UNEXPLAINED

JOHN BLASHFORD-SNELL

(*Published by Bodley Head, London. Price £8.95*)

THE title is something of a misnomer as much of the book is concerned with descriptions of adventures on expeditions organised by J B-S or undertaken whilst he was serving in Sapper units. A few unexplained mysteries, such as the possible existence of a Loch Ness Monster are touched upon, but only briefly. The famous fight between the Junior Leaders Regiment and the "monster" of the Kent fish pond is also included.

Nevertheless there are several very interesting and exciting adventures vividly described, particularly, those concerned with the crash of a US Air Force B24 Liberator in the Sahara Desert in 1943 and the clash between members of the Author's Blue Nile expedition and Ethiopian bandits in 1968. The latter, in particular, the Author describes superbly well, and often in very moving terms, when one of his party drowned.

The book does highlight the fact that young people can still experience real adventures and exploration in the world today. That they can experience them, is due mainly to the Author's boundless imagination and enthusiasm. It is good to see that young people are still prepared to take risks and suffer considerable hardships. Fortunately the Author's hardships are sometimes eased for him; "I sat sipping a glass of cold Keo" he says on one occasion in the warm Cypriot sunshine. On another he sips his claret whilst discussing the *Op Drake* patrol into the Strickland Gorge; and when things are bad there is the comfort of the mysterious J & B. An explorers lot is not always an unhappy one!

FRB

WRONG AGAIN DAN!—KARACHI TO KRAKATOA

DAN RASCHEN

(*Published by Buckland Publications Ltd, London. Price £8.50*)

COLONEL D G Raschen's book only covers that period of the Author's life up to the age of twenty-two, so it can be assumed that there is much more to come. Let us hope so.

The writer of this note can barely remember what happened last week, let alone events forty years ago, yet Dan Raschen has the ability to recall, with great clarity, the smallest detail of practically every happening in his early Sapper years. I assume he kept voluminous diaries! The Author will stir great waves of nostalgia in anyone who served in the late 1940's. The picture Dan Raschen presents would be unrecognisable to the modern day young Sapper officer, not solely because the Author was serving with the Royal Bombay Sappers and Miners, but also because the way of life of the young officer has changed so much.

General Sir Hugh Beach, in his foreword, writes "He is a reconteur *sans pareil*, with a rare gift of dry self-depreciation . . . . . Through all this there shines Dan's huge enjoyment of life."

There is, in reading the book, a growing sense of inevitability that every episode will end in disaster. Surely the Author also had his triumphs? I suspect that non military readers might be a bit bemused by the wealth of military detail in the story. Nevertheless, for the Sapper reader this book will provide a very interesting and enjoyable read.

FRB

SAPPER BEFORE SUNSET

MAJOR E ODELL and J MOUNSEY

(Published privately and obtainable from Major E Odell, Sardhana, 19 Drewery Drive, Wigmore, Gillingham, Kent. Price £6.00)

"ERNIE" Odell, with his collaborator John Mounsey, has produced this very readable story of his life and experiences. Gifted with a remarkable memory and determination to make full use of opportunities for new experiences, Ernie Odell takes us through his boyhood on the estate where "Alice" of *Alice in Wonderland* lived, his enlistment in the RE in 1915, and his life on the Barrack Square at Brompton Barracks, Chatham.

We read of his experiences in France and Flanders in 1917/18, and after the Armistice his drafting to India, where he was to spend the next twenty-six years, mainly with the "H" Company detachment of the KGVs Own Bengal Sappers and Miners. It was in his service and life in India that his determination to make the most of his opportunities for fresh pursuits and interests was most evident, and we can enjoy his stories of *shikar* and of his happy contacts with Indian people, soldiers, villagers and even Rajahs. Even if you have not been to India you will enjoy accompanying him on his adventures.

Brigadier Sir Mark Henniker had done much to encourage and help Ernie Odell in his ambition to write his story, and he has contributed the Foreword.

EFEA

BOOK NEWS FROM INSTITUTION OF CIVIL ENGINEERS

All books in this section are published by Thomas Telford Ltd and are obtainable from the Marketing and Sales Dept, 1–7 Great George Street, London SW1P 3AA

ENGINEERING STRUCTURES: DEVELOPMENTS IN THE TWENTIETH CENTURY

Edited by P S Bulson, J B Caldwell and R T Severn: Price £15·00

ENGINEERING structures, and our understanding of them, have developed enormously in the 20th century. In this book acknowledged experts on the various aspects of structures in Aeronautical, Civil, Marine and other forms of Engineering summarise those developments in a way which provides a useful reference book and a valuable starting point for consulting engineers and post graduate engineers about to begin a new project. Whilst also celebrating the 80th birthday of Alfred Pugsley by recording engineering achievements made throughout his lifetime, the contents reveal the pathway by which we have travelled from the robust rule of thumb methods of the Victorian era to the present and possible future state of the art. *For graduate engineers only.*

SHORELINE PROTECTION

Proceedings of a Conference in Southampton September 1982: Price £22·00

BECAUSE of the complexities of coastal and estuarine processes there are considerable inadequacies of knowledge and even the significant advances of recent years have not enabled science to supersede the art. This volume presents the latest information on concepts and techniques; including design and construction. *For graduate engineers only.*

REPAIR AND RENEWALS OF BUILDINGS

Proceedings of a Conference in London November 1982: Price £16·00

AN increased interest in historical buildings has meant that more renovation work is being undertaken. This volume discusses aspects of building repair and maintenance in terms of remedial work for listed buildings, the conversion of existing structures for other purposes, complete removal of a structure to another location and repairs to 20th century buildings. *Of interest to all who are heritage minded but a bit pricey!*

HYDRAULIC FACTORS IN BRIDGE DESIGN

R V Farraday and F C Charlton: Price £15·00

A HANDBOOK for the design engineer which identifies the hydraulic aspects that characterise a river and provides guidance on assessing their influence on bridge design. *For specialists only.*

ICE WORKS CONSTRUCTION GUIDES

Falsework, C J Wilshere: Price £2·75. This book examines the application of falsework in projects of all sizes using varied materials. Giving consideration to design concepts and standard solutions, it is concluded with a valuable checklist to help the reader search for potential faults. *Of interest to all engineers.*

The Resident Engineer, J K Ballantyne: Price £2·50. This guide gives a description of the role of the Resident Engineer on site in terms of his duties – record keeping, tendering, compliance with the specification, communicating with the contractor, payments, keeping to the programme and health and safety. *Of interest to all "Works" officers and Clerks of Works.*

OTHER BOOKS OF LIMITED AND SPECIAL INTEREST

GUIDANCE ON THE PREPARATION, SUBMISSION AND CONSIDERATION OF TENDERS FOR CIVIL ENGINEERING CONTRACTS: *Price £3·00*

CONDITIONS OF CONTRACT FOR GROUND INVESTIGATION: *Price £4·00*

WORK OF THE ROYAL ENGINEERS IN THE EUROPEAN WAR 1914–1919

THESE books present a series of records of works, prepared by those who had taken part in them and whilst the memory of them was still clear. As such they are of tremendous interest and value and are very readable.

The titles are self explanatory, except for "European War" and "Miscellaneous", when one remembers that they were written in the early '20s. Although the concentration is on Europe other theatres are not completely neglected and the term "European War" would now be "World War I". "Miscellaneous", the last book of the series deals with Organisations, Engineer Intelligence, Camouflage etc, including the Training Schools set up in the BEF.

The books are not a "set", in the sense that Corps History is a set, and can only be sold as individual books. However a 10% reduction on listed prices will be made for orders of 4 or more books.

Members only rates:

Supply of Engineer Stores and Equipment	£1.00 p&p UK £0.80, O/seas £1.71
Geological Work on Western Front	£1.50 p&p UK £1.67, O/seas £3.79
Water Supply—Egypt & Palestine	£1.50 p&p UK £0.80, O/seas £1.71
Water Supply—France	£1.50 p&p UK £1.67, O/seas £3.79
Work Under DFW France	£2.00 p&p UK £1.67, O/seas £3.79
Miscellaneous	£2.00 p&p UK £1.67, O/seas £3.79

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