



The Agricultural Engineer

Incorporating

Soil and
water

Volume 49 Number 4

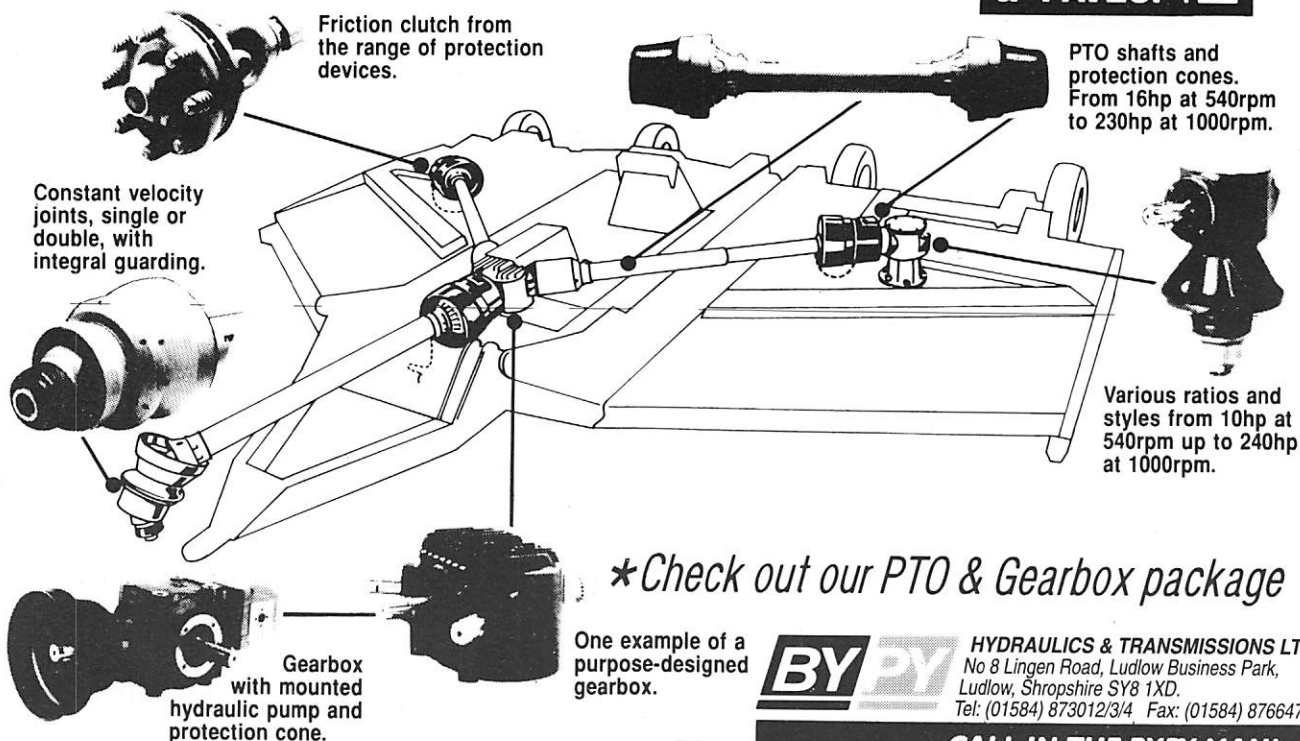
Winter 1994



*In this issue ...
Irrigation and Forestry Papers
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The Agricultural Engineer

Journal and Proceedings

Volume 49 No.4, Winter 1994

CONTENTS

A Profile of the New Editor	Mike Hurst	2
News Round-up		3
Company and Product Information		6
Rules, Regulations and Codes		9
Technical Articles		
Low Cost Unsurfaced Roads - Geometry	Brian Jones	13
Performance Evaluation of Paddy Irrigation		
G.C.L. Wyseure, Kwok Chee Yan, J.W. Gowing, and Abdul Aziz Zakaria		17
Local Solutions to Irrigation Needs in Semi-arid Africa		
J.W. Gowing, N. Hatibu, G.C.L. Wyseure, and D. Young		20
Irrigation Scheduling in Scotland	Martin Parkes	22
Who Pays for the MD's Porsche	Geoffrey Wakeham	25
Conference Information		29
Book Reviews		31
Training		32
Branch Diary		32
Events Diary		33

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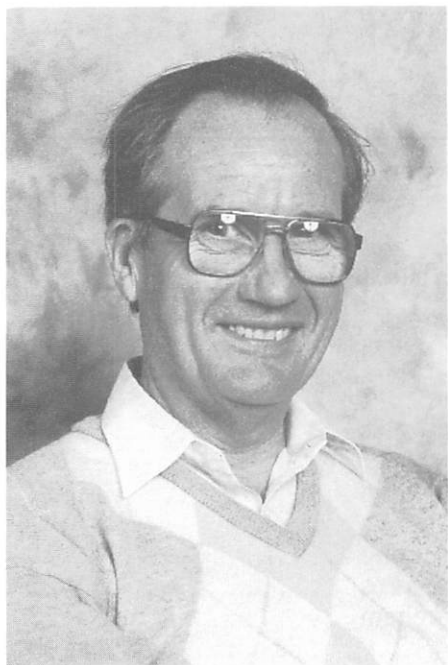
Front cover: Dowdeswell reversible match plough. See page 8



The
Institution
of Agricultural
Engineers

A PROFILE OF THE NEW EDITOR

Mike Hurst



This issue of the journal is the first one to be produced under the new editor, Eoin Martyn. He has taken over three jobs, those of Editor, Production Editor and Advertising Manager, previously undertaken by Allan Langley and Geoff Baldwin.

But who is Eoin and what qualifications does he have for the job? Eoin Bernard Hiscutt Martyn is a 50 year old Scotsman with some English and Cornish blood in him. He was born in Invergordon a town famous for a naval mutiny, a now derelict aluminium smelter, whisky and oil rigs. The name Eoin comes from the north being Gaelic for John. He started his schooling in Perth before the family moved south to Farnborough in Hampshire.

On leaving school Eoin worked as an assistant cowman on a dairy farm before going to the Royal Agricultural College, Cirencester, where he gained a Diploma in Estate Management. He joined the Agricultural Land Service, then one of MAFF's advisory bodies, at Llandrindod Wells, where he eventually became a Chartered Surveyor in the Rural Practice Division. He later moved to Maidstone and then to Oxford. During his period with MAFF he saw the demise of grant aid, the formation of ADAS and the start of charging for services. His work for MAFF comprised advising the industry on farm buildings and town and country planning, including mineral restoration.

After some 23 years with MAFF, Eoin was approached by Tom Worthington from Reading Agricultural Consultants, whom he joined for two years, giving very similar advice to a range of clients.

In 1991 he joined the staff of the Farm and Rural Buildings Centre, Stoneleigh as assistant manager becoming manager some 12 months later. Unfortunately due to the recession in the building industry sponsorship was reduced considerably resulting in the Centre running out of reserves. It was decided that the Centre should close at the end of March 1993, with its library being presented to Silsoe College and Eoin being made redundant. During the period he was at the Centre he edited the successful Farm Building and Engineering journal, which enabled him to develop his skills as an editor.

For some time he was part time lecturer in Farm Buildings at the College of Estate Management but just before redundancy the College invited him to become tutor on the postal course for a Diploma in Surveying. They also invited him to rewrite the course notes to replace Farm Buildings by N.H. Noton. He has now written nine of twelve papers with another almost completed. The hope is that these papers will be

published by the College for general use. Eoin also works part time as a lecturer at Harper Adams Agricultural College, where he is lecturer and examiner on the BEng, B.Sc Agricultural and HND Agricultural courses. He is also involved with a number of farm building consultancy projects for Reading Agricultural Consultants.

Eoin is a Fellow of the Royal Institution of Chartered Surveyors, a Companion of the Institution of Agricultural Engineers, a Member of the British Institute of Agricultural Consultants and a Member of the Royal Agricultural College.

In his spare time (which is precious little these days) he goes swimming at least twice a week and endeavours to solve the Daily Telegraph crossword. When he can he does some gardening, and he would like to follow his other hobby of philately but does not get the time to do so.

As new editor of the journal, he hopes to gradually introduce new features so that all members will find something of interest in each issue. The first changes that are being made in this issue are mainly to page layouts with new headings, headers and footers and changes to the contents page.

In the next issue there will be new front cover, which will carry advertising and it is hoped to carry more advertising generally in the journal.

The intention is to carry as much news as possible with any articles being topical and varied. There will be no fixed theme or themes for each issue. There will also be a letters page (assuming people write in), and Situations Vacant and Situations Wanted sections.

We hope you like the changes. If you have any comments or suggestions, please let us have them. Write to Eoin via the Secretariat at Silsoe.

NEW APPOINTMENT

The Engineering Council is to appoint a Director General of a new governing body for the profession. The role offers someone an excellent opportunity to have a high degree of visibility and to help unify the profession. The initial task will involve overseeing the transition to the new structure.

The role demands vision, a commitment to engineering and wealth creation, communication and management skills, and a leader with international awareness. The appointment is for five years, renewable, and the appointee will be a Chartered Engineer, aged 45-57, holding a position as a senior executive in engineering.

EDITORIAL PLEA

I now have sufficient copy, from research projects carried out in overseas countries, to fill the next two issues of the journal. I am sure that many of these articles are worth publishing, but to do so in one or two issues would result in journals of little interest to many members.

Normally there is no difficulty in persuading academics and researchers to write, but it would lead to a far more interesting journal if those members involved with the practical side of engineering could write technical articles. Full recognition would be given to authors and the company that employ's them. It would be easier to have volunteers than pressed men or women.

NEW YEARS GREETING



The Secretariat,
the newsletter
editor and I wish
all members and
readers a happy and prosperous
new year.

NEWS ROUND-UP

ENGINEERS' SALARIES INCREASING

The 1994 Survey of Engineering Functions shows that junior engineers under the age of 25 have seen their earnings increase by 8.6% during the last year, compared to a whole survey increase figure of just 3.7%. The resignation rate for junior engineers, at 7.8%, was also well above the whole survey level of 2.9%.

The survey also shows that there has been an all-round increase in recruitment activity together with a sharp increase in the number of companies with retention problems. There are signs that the recruitment market has started to move again, although salaries have not influenced this.

A number are changing company car policy in favour of car allowances, with company drivers down from 28.5% in 1991 to 18.5% today; while 5.3% of engineers now have a car allowance.

Overall, 4.4% of companies employ one or more females, the highest figure recorded, since details first published in 1980. But, only 2.9% of individual participants are female, down from 3.4% last year.

The survey, which is based on 26,039 engineers and craftsmen from 150 companies, covers details of salaries, bonus payments, company cars and allowances, etc., and is available at £220 inclusive of postage and packing from - Remuneration Economics Limited, 51 Portland Road, Kingston upon Thames, Surrey. KT1 2SH Tel: 0181 549 8726

NATIONAL FARM WASTE MANAGEMENT REGISTER

Each year many thousands of water pollution incidents damage rivers and watercourses. Pollution is caused by many activities including farming and although the number of incidents is falling there are still many problems.

Statistics show that pollution associated with the application of farm waste to land is on the increase. Many incidents can be avoided with some thought and professional planning.

The National Rivers Authority, British Institute of Agricultural Consultants, ADAS and Genus Management propose to form a register of competent independent consultants to assist farmers with waste problems.

The register will be available from NRA offices, participating professional bodies and the register. The Register will ensure that consultants carry adequate Professional Indemnity and work to a Code of Practice to ensure that clients get independent advice and have recourse to an independent body in the event of a dispute or dissatisfaction.

The compilation of the Register is being handled by the BIAC Farm Waste Management Division and information is available by contacting (0139 86) 326 or (01235) 851515.

SECOND INTERNATIONAL SYMPOSIUM ON ARTIFICIAL RECHARGE OF GROUND WATER 1994

The American Society of Civil Engineers' (ASCE) 'Second International Symposium on Artificial Recharge of Ground Water' offered an outstanding opportunity for international and interdisciplinary technology transfer.

The Proceedings include papers on artificial recharge by wells or spreading basins; with various qualities of potable water, surface water, and reclaimed waste water; into consolidated and unconsolidated, confined and unconfined aquifers. Papers also discussed are water quality changes occurring during recharge, soil-aquifer treatment processes, well clogging, modelling, and recent innovative technical developments and applications. Special discussion issues included regulatory, hydraulic, environmental, economic and other considerations that affect development of successful recharge projects. The proceedings can be purchased from -ASCE Publications, 345 East 47th Street, New York, NY 10017.

A special meeting of the ASCE "Committee on Standard Guidelines for Artificial Recharge of Ground Water" took place. For use in developing the standard, the committee has collected, by means of a questionnaire, information on; past, present and planned operating and research recharge projects. The committee discussed various means of publishing the worldwide information collected by the questionnaire. As a result of the meeting the committee recommended that an ASCE "Third International Symposium on Artificial Recharge of Ground-water" be organised for 1997 or 1998 in some country other than the United States.

Those interested in completing the Questionnaire on Artificial Recharge or in standards development activities of the committee should contact - Ivan Johnson, Chairman, ASCE Committee on Artificial Recharge, AIJ Inc., 7474 Upham Court, Arvada, CO 80003. - Tel: 303-425-5610

FURTHER ACTION AGAINST FARM WASTE POLLUTION

Farmers in selected river catchments in England are to be offered help in tackling the problem of water pollution from farm waste. Farmers in each area will be given free assistance by ADAS in the preparation of waste management plans.

The new areas are: the River Petterill, Roe and Ive in Cumbria; Woodplumpton in Lancashire; the River Manifold and Dove on the Derbyshire-Staffordshire border; the Rivers Cale, Stour and Loddon in Somerset; the Upper River Tamar on the Devon-Cornwall border; Slapton Ley in South Devon; and the River Deben in Suffolk.

Farmers will be encouraged to prepare plans for spreading manure and other similar organic wastes.

THE FUTURE OF ADAS

Agricultural Minister William Waldegrave announced that officials are looking into the possibility of privatising ADAS. They will have regard to financial aspects, competition policy and the need for any privatised body to avoid unacceptable conflicts of interest.

The expectation is that the privatised body will include the whole of the commercial consultancy and commercial R&D arms and some other work. Some functions presently located within ADAS would probably remain within the departments after privatisation.

"12th CIGR WORLD CONGRESS - THE AgEng'94 CONFERENCE

Agricultural Engineering must assist the world's farmers by, not only providing high technology, but by promoting problem-solving as a way of life.

This is the idea that emerged from the 12th CIGR Congress and AgEng'94 Conference, which was held at the University of Milan. The event covered three intensive days and saw a total of 700 experts from 54 different countries, participating in working groups and special sessions.

Reports are available, covering all aspects of agricultural engineering. The event's proceedings will interest international institutions and individual governments in formulating future agricultural policies around rational technology, practical economics and respect for the environment.

A limited number of copies of the Proceedings are available from the Institution Secretariat at Silsoe. Please send a cheque made out to IAgRE for £95.00 per set, including p & p.

MAKE THE MOST OF IT

Farm waste should be looked on as a resource rather than a problem. That is the main message being conveyed to producers at the National Farm Waste Management Demonstration, Muck '95, on 5th and 6th April, 1995.

The theme "Managing Waste - Making the Most of Muck" will emphasise the opportunities for utilising waste profitably. The potential will be illustrated in terms of its cash and nutrient values. Producers will find tips on how to minimise, handle and use waste safely and legally.

Nearly 150 companies will gather for this biennial event to be held at the NAC, which is organised by the Royal Agricultural Society of England and ADAS in association with "What's New In Farming" and supported by the NRA.

For further information contact:
Jayne Spence,
RASE Tel: 01203 696969

GUIDELINES ON ENVIRONMENTAL ISSUES

The Engineering Council formally launched on 1st. September "Guidelines on Environmental Issues" that complements the Code of Professional Practice - Engineers and the Environment, which came into effect on 1st. March, 1995. A very good explanation of the purpose of these guidelines is given in the Foreword, written by Sir John Fairclough FEng, Chairman, The Engineering Council and Professor Roland Clift OBE, FEng, Chairman, Engineers and the Environment Working Party, which states:

"The Engineering Council has published a Code of Professional Practice on Engineers and the Environment. It was issued under the provisions of The Engineering Council's Royal Charter for the benefit of 290,000 registered engineers and technicians from the 41 engineering institutions. By following the actions within the Code and by

reading the accompanying Guidelines, in conjunction with any relevant publications from their own institutions, registrants should be well placed to give a lead in proposing and implementing sound engineering solutions to safeguard the future.

The Guidelines should help engineers towards:

- * a fuller understanding of the Code and how it may be implemented;
- * an increased understanding of environmental issues;
- * an ability to identify possible future trends;
- * a clearer picture of the principles and the main techniques involved in various aspects of good practice;

- * an appreciation of the importance of partnership and cooperation with other interested groups and organisations; and
- * an awareness of the many examples of good practice currently available."

Guidelines are available free, from the Council, on receipt of an A4 envelope with a 61p stamp (second class). The Council are also prepared to send speakers to seminars or conferences.

For further information contact
Simon K. Morgan,
10 Maltravers Street, London WC2R 3ER Tel:
0171-240 7891

Mike Hurst says that he has a few copies available if any members are interested in obtaining a copy.

ISRAEL - THE GROWTH MARKET

In biblical times, according to Exodus, the price of slaves went from 20 to 50 shekels. This affected the inflation index of the time. Israel's leaders of those days fulminated against this serious economic instability! It is nearly a decade since modern day Israel had inflation. This was controlled in 1985/86. Israel's economic growth, from a poor agricultural based state, to today's economic superpower, has been miraculous.

Currently, the gross domestic product at \$70 billion, does place this small nation well up to full OECD standards of per capita income. Israel is among the largest of the world's trading nations and will export in 1994 over \$15 billion in visible goods while importing some \$20 billion of mainly investment inputs for their export drive, with the demand being in machinery, electronics, chemicals, processed foods and clothing.

Britain is well placed in comparison to our competitors and in relation to many other export markets. Our exports this year should be around £1 billion while we will buy around £600 million of Israeli goods. This makes the UK Israel's second largest customer after the USA.

Recognising the importance of this, the DTI is sponsoring a campaign of promotional events in Israel with British Pavilions being provided at many events. The support can cover over 50% of exhibition costs and £415.00 travel grant for two personnel travelling to events.

Of interest to engineers are two events being Technology & Industry '95 in Tel Aviv from 21st-25th May, 1995 with closing date for space applications on 3rd February, 1995 and Agritech in Tel Aviv in May 1996 with application closing date being January, 1996. For further information contact - British Overseas Trade Group for Israel, 14/15 Rodmarton Street, London. W1H 3FW Tel: 0171-935 4351

MINISTERIAL RESPONSIBILITIES AT MAFF

Minister - Rt Hon William Waldegrave MP

Responsibility for all food, farming, fisheries, the countryside, R & D and Citizen's Charter.

Minister of State - Mr Michael Jack MP

Overseas policies for agricultural commodities, fisheries and the food and drink. Covering negotiations on the CAP; production and trade in cereals, sugar, oils and fats, horticulture, tropical food; set-aside and extensification; food industry, including marketing and competition; the Common Fisheries Policy and fisheries matters; external trade and export promotion; relations with other countries and international organisations; Intervention Board Executive Agency; R & D in these areas. He deals in the House of Commons with European Community matters the responsibility of Earl Howe.

The Parliamentary Secretary (Lords) - Earl Howe

Oversight of all countryside matters including land use, farm woodlands, diversification, environment and conservation policy, rural affairs, structures policy, land tenure, agricultural grants; organic farming, plant health and the PHSE; plant variety rights and seeds; agricultural resources policy including labour, finance and taxation (excluding horses); forestry; regional administration; ADAS; flood defence; R & D in these areas; deregulation; economics and statistics; departmental central services.

The Parliamentary Secretary (Commons) - Mrs Angela Browning MP

Oversight of food safety; food science; animal health and medicines, meat hygiene, animal welfare; the horse industry; pesticide safety; biotechnology; R & D in these areas; emergency services; and equal opportunities.

UNIFICATION OF THE ENGINEERING PROFESSION

Sir John Fairclough FEng, Chairman of the Engineering Council, who started the unification initiative three years ago, presented a plan to unite Britain's engineering professions. The plan was prepared by a policy group set up after the publication of "Engineering into the Millennium". The proposals will now be considered by the two bodies concerned - The Engineering Council and the Council of Presidents with the hope that the new arrangements will be in place by mid-1995.

The policy group believes that the proposal will forge a partnership between those who seek to represent and promote the profession. The proposal provides the opportunity for leadership and vision for the profession as a whole.

A new body would be formed to bring together the views of the institutions, industry and academe and would provide a single voice for the profession. This would consist of an elected senate with 24 elected by institution councils from their past and present council members, 24 elected by the engineers and technicians registered with The Engineering Council and six members appointed by the Privy Council.

The senate would be the focal point for the engineering profession. It would discharge its responsibilities through two boards: one for the regulation of the profession (The Board for Engineering Regulation (BER)), the other for the promotion of the profession (The Board for the Engineering Profession (BEP)). Members of the two boards would be selected from the senate.

Sir John said "The new arrangements will provide the leadership needed to take engineering into the next century and I commend them to all those who are concerned about society and the role that engineering has to play in it."

IMPROVING GRAIN STORAGE IN THE UKRAINE

The Mouchel Group has been appointed by, the TACIS Programme of the Commission of European Communities, to undertake a grain storage improvement project in the Ukraine. Up to a third of the grain harvest is currently lost because of poor drying and storage. The project aims to introduce effective and practical means of reducing these losses.

Since 1990, agriculture in Ukraine has suffered considerable dislocation. Production and distribution networks are in disarray. Grain production has fallen to 1980 levels because of disruption in supply of inputs, such as fuel, seed, herbicides and fertiliser and the area under cultivation has shrunk. Much of the grain was used to feed cattle and this lack of corn has severely reduced livestock herds and flocks. Widespread spoilage of grain during storage has exacerbated the shortage.

Mouchel's team of 17 experts will assess the existing grain conservation systems. They will examine farm buildings and equipment used for drying, handling, storing and processing grain, and also management practices. The scope for short term and long term improvements will be identified. Specialists will demonstrate chemical preservation of wet grain, and a variety of low-energy methods for drying and cooling grain. Many of these techniques are derived from developments pioneered in the UK over the last two decades.

Selected farmers will be trained in commercial business management procedures, and be taught

entrepreneurial responses to market developments. Local engineers and economists will be shown how to prepare project proposals to attract investment by banks and other financial agencies.

The project, worth over £0.7 million, could provide huge benefits to Ukraine agriculture. Mouchel is the lead consultant, drawing experts from its British headquarters and from Mouchel-IRE (the British/Ukrainian joint venture, 50% owned by Mouchel). Other consultants will be drawn from ADAS in the UK and PCK in Greece. The project team will work closely with Ukrainians drawn from the Institute of Animal Feed and "advanced farming". Work started in October 1994 and will run for 12 months, catching the late wet maize harvest this year and the barley and wheat harvest in summer 1995.

It is hoped that this TACIS funded project will boost the revival of the livestock and grain sectors in Ukraine. The TACIS Programme is a European Union initiative for the New Independent States and Mongolia which fosters the development of harmonious and prosperous economic and political links between the European Union and these partner countries.

TACIS provides grant finance to support the process of transformation to market economies and democratic societies. Between 1991 and 1994 TACIS made available ECU 1,870 million to provide know-how and to cultivate links and relationships between organisations in partner countries and the European Union.

CONTROLS ON LIVE ANIMAL EXPORTS

New measures, including a new criminal offence, to improve the protection of farm animals during transport on long journeys have been announced.

The package, which was issued for consultation to animal welfare bodies and farming organisations, comprises:

- * A code of practice setting out high standards of care to be followed. This includes, a Standard Journey Plan Form to be completed for journeys over 15 hours setting out departure and estimated arrival times as well as plans for lairages or stagingposts. It will have to be authorised by a government vet. The code also details resting, feeding and watering provisions, together with vehicle standards and stocking densities.
- * A tightening of the law to create a new offence of submitting a false journey plan. Hauliers need to make a formal declaration about arrangements. They must obtain confirmation in writing of arrangements with staging post operators. This, combined with better checking of consignments, which have been established with other EU member states, should improve the chances of successfully prosecuting transporters who do not honour their commitments.

The finalised code will become a Statutory Instrument under secondary legislation. In the meantime transporters are being asked to treat the draft code as though it were already in place.

SPECIALIST GROUPS

Chairman of Specialist Groups Panel

Amenity & Ecological Engineering

Crop Drying & Storage

Precision in Farming

Forestry Engineering

Machinery Management

Overseas Development

Soil & Water Management

Vehicles

Young Engineers

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COMPANY AND PRODUCT INFORMATION

COMPUTER - CARIER

Carier are investing £250,000 in a new IBM AS/400 computer system which includes 'KNOWLEDGE BASE MANUFACTURING', the first software to fully capitalise on 'people based' knowledge of products, components and production processes. It is hoped to have the system operational by March 1996.

This software brings the efficiencies and cost savings of proven resource planning techniques to complex, variable and customised, made to order products such as screw conveyors. Previously this was confined to the manufacturing of stock items. This will provide faster and more efficient links between order-processing, design planning, shop-floor production and distribution. The company hopes to respond more quickly in terms of delivery and pricing of non-standard products.

For further information contact Russell Ward, Sales and Marketing Director, Carier Bulk Materials Handling Limited, East Street, Braintree, Essex. CM7 6JL Tel: 01376 321102

IS9001 (1994) - A WORLD FIRST

Nelson-Burgess Limited has revealed that it has gained approval to the new IS9001 (1994) Quality Standard, the first company in the world approved by Lloyds Register Quality Assurance (LRQA), who are the first Certification Body, accredited by the National Accreditation Council for Certified Bodies (NACCB). LRQA are also accredited by RvC (Holland) and TGA (Germany).

The international IS standard has been extensively revised, with the British Standard Institute (BSI) doing likewise to the equivalent BS standard, which has been given the same IS nomenclature. BS EN IS 9000 supersedes BS5750 in all respects. All companies currently with or seeking approval to BS5750, need to be assessed for compliance to the new IS9001 standard by 1st September, 1995.

The new BS is to a much higher standard. Products, systems and processes are examined, focusing attention on quality of finish, efficiencies in manufacturing and the user-friend-

liness of industrial procedures and production practices. Methods of manufacturing are examined in greater detail than under the previous British Standard.

The Nelson-Burgess qualified quickly because changes were pre-empted providing the company with an opportunity to advance their manufacturing procedures prior to the new revisions. Planned preventive maintenance to all production machinery has been in operation for some 18 months, with parts documented on installation, monitoring and then changed before they can default in use. Training procedures have also been documented through the Company's commitment to the 'Investors in People' project. In addition cross functional design reviews are routinely performed before production.

For further information contact Ken Hinde, Quality Manager, Nelson-Burgess Limited, Brookfield Road, Hinckley, Leicestershire. LE10 2LN
Tel: 01455 637701

CASTING A STRAW

Rushed A. Chaudry, Chairman of Pakistan Agricultural Development Corporation, Bhiri Shah Rehman, 37 km Hafizabad Road, Gujranmala, Pakistan has developed a straw cutter and binder for fitting behind a combine harvester. This enables the straw to be sold as Bhusa into the existing animal feed market so adding to the income, which can be derived from the crop.

The company wish to find a UK company who could invest funds and technical expertise on production to help commercialise the product in Pakistan. Some further details are available from J. Kilgour, Silsoe College, Silsoe, Bedford. MK45 4DT.

MARKETING DIY EQUIPMENT DIRECT

The ESAB Group Limited is offering a range of professional welding and cutting equipment by mail or telephone order, aimed at both the DIY and light industrial users such as farmers and small garages.

Seven BIG gas welding packages, one ESAB and one Murex MIG welding package and three Murex MMA (stick) welding kits, the latter including a scratch start TIG welding option, are being offered. All the electrical sets operate off 240V domestic mains electricity supplies, while the gas and MIG sets require commonly available cylinders that can be rented from any BOC depot. Full basic instruction manuals are included with all packages.

Full details are provided in a leaflet available from ESAB Group (UK) Limited on their sales hotline number of 01925 815700.

MODERN WAY TO CATCH FLIES

Sieve Services are now marketing a way to catch flies, that are not noticed, thus saving a (£) million for British livestock farmers. The fly catcher comprises a string about 1000 feet long, which is white, attractive to flies and is almost as thick as baler twine so that the flies can see it and land on it.

It is impregnated with a polymer, natural carbon resin and paraffin oil. It is attractive to flies but contains no harsh chemicals. Flies stick to it, at the rate of 150 per foot, 500 per metre or 155,000 per string. The length to be used depends on the size of the building being protected against flies. With this Swedish product, FLY-END, there is one spool of string, one spool with a crank handle to wind it across and three pulleys so the route of the string can be put over the heads of the livestock.

When the exposed piece of string is full, a few turns on the reel handle winds up the used string, and the flies, and exposes new string to catch more flies. Refill rolls of string can be supplied.

Once you have caught your flies the company state that whilst your marketing these you should consider the improved performance of livestock because the reduction in fly numbers reduces the amount of irritation and disease risk. FLY-END promises a vast reduction in the number of flies afflicting livestock in areas where they are brought together as in cattle yards, sheep houses, dairy collecting areas, pig buildings and many others.

For further information contact David Baggaley, Sieve Services, Fen Lane. Long Bennington, Newark, Notts. Tel: 01400 281506

HIAB CELEBRATES 50 YEARS

This year, HIAB (Hydrauliska Industri AB), celebrates its 50th Anniversary. The company, which is represented in the UK by GCM 600 Limited, a member of The 600 Group, has good reason to celebrate too. HIAB has revolutionised materials handling throughout the transport industry, and is the world's largest manufacturer of lorry loaders.

In the UK, many achievements stem from the efforts of GCM 600 Limited (formerly George Cohen Machinery Ltd.), being HIAB's sole UK distributor for over 30 years. This long association began in 1959. Up until then HIAB loaders were little known outside of forestry. To a large extent, it was the early pioneering work undertaken by GCM that helped HIAB to broaden its markets.

Today, HIAB loaders are internationally recognised to be one of the most versatile, efficient and cost-effective lifting aid ever devised. They are offered with a range of attachments, which allow a virtually limitless variety of tasks to be performed. There are over 50 basic HIAB models to choose from. Capacities range from 0.7 t/m (HIAB 007) to 84.1 t/m (HIAB 870-3) and out-reaches vary from 1.70 m to a massive 32.00 m including jib extensions.

A number of innovations have been introduced. These include the optional Combdrive, an advanced remote control system, and SPACE control, a revolutionary new safety system.

For further information contact, Malcolm Parkinson - Managing Director, GCM 600 Limited Tel: 01462 682360

CUTTING FURROWS IN JAPAN

BSD Tubes Midlands, part of the steel service centres arm of British Steel, is helping leading agricultural engineers Dowdeswell to cut a valuable furrow in the Japanese market with their reversible and conventional ploughs that are selling well in various parts of Japan's island chain.

Tubes Midlands supply Dowdeswell with Grade 50C hollow sections in a range of sizes from 120 mm x 80 mm to 200 mm x 200 mm that are used for the main frames, which can carry up to 4 pairs of plough mould boards suitable for the quite small tractors, which are used in Japan's light volcanic soils.

The company claims that the use of RHS allows them to simplify designs and satisfy the physical requirements. Using this material is a cost-effective solution compared with a completely fabricated assembly.

For further information contact Vernon Dodd, BSD Publicity: Tel: 0121 557 1831

ANOTHER RECORD GOES FOR THE CHOP

In the 22 years since Claas started building self-propelled foragers the company has made no less than 10,000 of this type of machine. To mark the occasion, the 10,000th machine, a Claas Jaguar 880 from the new 800 Series, rolled off the Harsewinkel factory line resplendent in green and white metallic paint, walnut dashboard, chrome strips and with the designation '10,000 Jaguar' under the signature of Chairman Helmut Claas. The Jaguar 10,000 is now part of the German demonstration team.

The Jaguar self-propelled forager has been a significant success story. It has given Claas a clear lead in Europe for this type of machine with every second self-propelled forager in Europe bearing the Claas name.

Contractors are almost exclusively the customers for these machines, which give them the high output in both grass and maize that they need to cope with huge annual work loads.

HEAVY DUTY GEAR COUPLINGS

Cross and Morse have introduced a range of heavy duty gear couplings for power transmission shafts, with rated torques from 600 Nm to 7500 Nm.

Type GFA allows angular and axial misalignment by using two geared hubs connected by an internally toothed sleeve. Type GFAS has the sleeve integral with one hub, giving stiffer design with lower inertia but less misalignment capability. Construction plant vehicles and agricultural machinery are among the anticipated applications. Technical details and selection procedures are given in a brochure available from the manufacturer: Cross & Morse, Birmingham Tel: 0121-360 0155



Mobile Packing Rigs

DUAL MODE TRACTOR TRANSMISSION

An optional electro-hydraulic transmission from Renault provides either a three-speed power shift or shuttle reverser. Using two hydraulic clutch packs and three shafts, the Tractonic transmission gives minimal power loss. In 'standard' mode, two buttons on the main gear lever select a 20% increase or decrease in forward speed under load. A column lever gives forward, neutral or reverse selection plus a declutch facility without use of the main clutch. Direction changes are automatically delayed until speed has reduced to below 5 km/h. 'Shuttle reverse' mode can be selected for buckraking or loader work. The power shift buttons are disabled, but direction changes are possible at up to 10 km/h using the column lever. Renault Agriculture Ltd, Tel: 01608 662727.

QUIET HYDRAULIC PUMPS

A range of hydraulic gear pumps has been developed to operate with low airborne and fluid-borne noise, without any sacrifice in performance. The SPQ range from Sauer-Sundstrand will be available in three sizes, which are interchangeable with other standard pumps from the company. Details are available from Sauer-Sundstrand UK Ltd, Swindon Tel: 01793 530101

Heavy Duty Gear Couplings



Developed by a Cornish cauliflower grower, the HarVegester is claimed to reduce labour costs and crop damage, especially in difficult or wet conditions. The machine is based on a specialist 4wd, 4ws, hydrostatically driven chassis with hillside levelling.

Cutters place produce on a 12 m wide continuous belt conveyor, suitable for a variety of crops and avoiding the hold ups caused by cup conveyors. A central rubber flighted conveyor feeds up to the packing area where there is ample room for four packing staff. In season long trials, the machine contributed to a saving in labour costs of 10p per box.

Further information can be obtained by contacting Leonard Old, Cornwall Tel: 01209 715645.

GPS DEVELOPMENT KITS

A range of design tools from Rockwell enables fast development of GPS applications based on satellite sourced positioning information. Development kits are supplied complete with antenna, cabling, a designer's guide and the GPS Monitor Program software on diskette. Kits are available for three systems: NavCore V is the original military specification five channel receiver with RS232 interface; NavCore MicroTracker is a smaller, battery powered version; NavCard is a five-channel receiver for use with PCs. All have differential GPS (DGPS) capability, giving accuracies better than 5 m within 200 miles of a fixed ground station broadcasting the appropriate correction factor. This overcomes errors including those deliberately introduced by the US Government.

Further information can be obtained from Telecom Design Communications Ltd, Basingstoke Tel: 01256 332800

PLASTIC TANK REPAIR KIT

A new tank repair kit for making permanent repairs in place on fibreglass, ABS, and other plastics is being introduced by Syon Corporation of Ashland, Massachusetts, and being distributed by Lurmark Ltd. of Cambridge, England.

The Seal-N-Place Plastic Tank Repair Kit features a permanent two-part epoxy resin system that is mixed neatly inside a pouch. Applied with a brush along with a fibreglass patch to the damaged area, this repair kit lets users make permanent repairs to any surface without removing the affected part.

Capable of fixing a 1" diameter hole in less than 20 minutes, repairs made using the Seal-N-Place Plastic Tank Repair Kit are strong. Tests have proven that a 1/2" hole repaired in a heavy tank will withstand over 600 psi internal hydrostatic pressure and the patch will not dissolve or soften in petrol, oil or water.

For further information contact: Tim Corner, Marketing Manager, Lurmark Ltd, Station Road, Longstanton, Cambridge. CB4 5DS
Tel: 01954 260097

LANDFILL WATER QUALITY

Landfill operators are required to install a minimum of three groundwater sampling boreholes, but many more might be needed to get a true picture. Regular on-site monitoring without lengthy laboratory analyses can save money as well as giving immediate warning of high pollutant levels. Solomat's WP803 portable water quality monitor with Sonde will measure temperature, pH, conductivity, NH₃, chloride, dissolved oxygen and depth. The Sonde will fit in a 4" borehole, but a flow-thru cell option is available for bleeding samples from smaller holes. An integral datalogger can be programmed either by a keypad or a PC. Data can be down-loaded to a printer, PC or modem, and the company offers a software package for data analysis and reporting. Solomat Ltd, Bishop's Stortford Tel: 01279 870182



Water Quality Monitor



MFT Multi-function Tractor

DUAL MULTI-FUNCTION TRACTOR

Irish company Moffett Engineering Ltd has ingeniously combined the attributes of a dedicated loader/materials handler with those of a conventional tractor.

The MFT (Multi-function tractor) is built on a 4wd MF skid unit based on the 390T, with a reversible driving position. It comes with rear mounted, parallel linkage 2 tonne loader with joystick control, powered by a dedicated hydraulic pump. With the loader parked on its stand and the driving position reversed to face forward, the vehicle becomes a conventional tractor with standard MF rear linkage and two speed PTO.

The standard 12 speed shuttle transmission from the MF 300 series is available to cover the full range of tractor tasks. Where draught or road transport operations are not envisaged, a 4 speed forward/reverse torque converter transmission can be specified.

For further information contact QMI Ltd, Dundalk, Ireland Tel: (International 353 42) 36610

THREE PHASE MOTOR CONTROLLER

An AC controller designed specifically for outdoor operation to IP56 is claimed to be unique in agriculture. Housed in stainless steel enclosures, the controllers provide 'soft start', efficient speed control and motor protection for three phase induction motors.

Versions for three phase and single phase supplies are available, the latter with a phase converter. A third version is a digital AC flux vector based controller, giving up to 150% starting torque overload for heavy loads like augers and conveyors.

For further information contact: Unico (UK) Ltd, Milton Keynes. Tel: 01908 260000

CHAMPIONS PLOUGH AVAILABLE

The Dowdeswell reversible match plough used by the winner of the 1994 European Ploughing Championship is now available commercially for the first time to other budding champion ploughmen and women.

Developed and built in conjunction with Dowdeswell service representative and European Champion, Peter Waters, the two furrow match plough is based on the company's 1- Series Delta-Furra MA range, which has manual furrow width adjustment and 36" point to point clearance as standard.

Known as the MM (Manual Match), the new plough incorporates a number of important features that will enable the operator to produce a tournament finish under the widest possible range of field conditions.

Unlike standard 100 Series Delta-Furra MA shearbolt-protected ploughs, which can be adjusted manually from 12" to 18" in 1" steps, the MM offers manual adjustment from 12" to 15" in 1/2" increments. Hydraulic parallel sideshift ensures precise setting of the front furrow width.

The plough can be specified with either DD or YCN bodies and there is a choice of the standard 'K' or the larger 'XL' skims. Discs are fitted to both furrows and there is a pneumatic depth wheel as standard.

The plough will be shown for the first time commercially at Smithfield.

For further information please contact:
Michael Alsop,
Dowdeswell Engineering Co. Ltd.,
Blue Lias Works,
Stockton, Rugby,
Warwickshire.
CV23 8LD
Tel: 01926 812335

RULES, REGULATIONS AND CODES

PHYSICAL AGENTS - IS ACTION NECESSARY

In September the Health and Safety Executive wrote to the Institution Secretary, enclosing a summary, concerning the revised European Commission proposal for a Directive on Physical Agents. This Directive could affect us all and in order to ensure that we are all informed of the latest position, reproduced below is the letter and summary.

The letter states that the Health and Safety Executive are still interested in comments. It is therefore essential that we carefully consider these proposals and make any suggested constructive changes before the process goes too far. Anyone wishing to comment should send them to the address shown at the end of this article.

Dear Mr Hurst

Summary of Revised European Commission Proposal for a Directive on Physical Agents

In early Spring last year, the European Commission formally published its proposal for a Directive on the protection of workers from exposure to physical agents. The Health and Safety Commission issued a press release asking industry and others for views about how the proposals might affect them. The comments we received will help us during negotiations on the proposal.

Since then, you will be interested to know that the EC has published an amended proposal for a Directive. This has been published in response to, and incorporates most of the amendments adopted by the European Parliament in April. However, the EC did not accept the amendment to exclude noise from the proposals.

The amended proposal contains a few significant changes to the original, the key ones being:

- * a redraft of the requirement to prevent exposure to any physical agents of workers belonging to particularly sensitive risk groups;
- * increased prescription in the requirement for health surveillance;
- * new requirements for exemption to be reported to the EC;
- * reductions in the exposure action levels for fields and waves non-ionising electromagnetic radiation, removal of the exemption for mobile telecommunications equipment and confirmation that the provisions are not concerned with preventing the risk of cancer; and
- * an explicit provision that other physical agent could be added later.

As you are interested in this EC proposal, I attach

a summary of its latest provisions for information. We are not formally asking for views on the revision although of course we would be interested in any comments you might like to add to your earlier ones.

The proposed Directive still has some way to go before even reaching a Common Position. Please do not hesitate to contact us for the latest position or keep an eye out for up-dates in health and safety journals.

PHYSICAL AGENTS

SUMMARY OF EUROPEAN COMMISSION PROPOSALS

- amended to take account of the European Commission's revised proposal, published on 25 July, 1994

1. The European Commission (EC) is proposing that the European Community should adopt a directive on "physical agents". This would add to the family established by an existing framework directive on safety and health of workers, Directive 89/391/EEC, which was implemented in Great Britain mainly by the Management of Health and Safety at Work Regulations 1992

2. The EC's aim is to add specific requirements on physical agents at work by creating a new legal framework applying initially to noise, vibration and non-ionising electromagnetic radiation. Other agents, such as work increased or reduced atmospheric pressure, could be added later. If the proposal is adopted new legislation will be needed.

3. The original proposal is published in the Official Journal of the European Communities (OJ, vol 36, No C 77, 18.3.93, pp12-29). The proposal, together with amendments (OJ, vol 37, No C 230, 19.8.94, pp3-29), is available from EEC Information Office, 8 Storey Gate, Westminster. SW1P 3AT (Tel: 071 973 1992).

It will now be reconsidered by the Council of Ministers, the European Parliament, and the Community's Economic and Social Committee (which represents various interest groups) before the Council finally decides whether it should be adopted as a directive and so become Community law. The Department of Trade and Industry publishes a free booklet "The Single Market: The Facts" giving more information on procedures. Call DTI's Business in Europe hotline, Tel: 01272 444888.

GENERAL PROVISIONS

4. The EC's broad aim is to specify a series of levels of exposure above which action has to be taken - the required action increasing with the exposure level. These zones are defined by:

- * A threshold level of exposure below which

continuous and/or repetitive exposure has no adverse effect on the health and safety of workers. This is intended as a lower cut-off to a general duty to reduce risk to the lowest achievable level. Above this level workers would have to be provided with information on risks.

- * Action levels of exposure for introduction of specified measures.
- * An exposure limit value above which exposure without effective personal protective equipment (PPE) is prohibited except where allowed by one of the annexes on special agents.

- * An "enhanced risk" level at which activities would have to be notified to the "authority responsible".

5 The annexes specify, for each of the agents, values for these levels and details which of the measures outlined below are triggered by them.

- * Assessing and when necessary measuring worker exposure. Results of assessments are to be provided to safety representatives and workers.

- * Programmes to reduce risk by technical or organisational measures - this would involve reducing the levels of the agents in the working environment and the duration of the worker's exposure. The proposal does not specify that the programme must be recorded, but some form of record is implied by a requirement that the workers' representative and workers "shall also receive the programme of measures".

- * Provision and use of personal protective equipment.

- * Information and training for workers on specific matters including:

Measures taken and where and when they apply.

The workers' obligations.

Use of PPE and the role of health surveillance.

- * Health surveillance by or under the responsibility of a doctor, with the objective of early diagnosis of ailments and allowing assessment of the worker's suitability for work involving exposure to the agents. Workers will have a right to see the results.

- * Choice of work equipment and design of workplaces taking into account emissions of physical agents.

- * Controlling exposure levels in activities

outside normal work but related to it (e.g. in canteen and rest facilities).

- * Controlling indirect hazards created by the agents (e.g. fire or explosion).

- * Where any European Community provisions applying to work equipment are intended to control physical agents, employers would have to make complying equipment "... available to workers whenever the type of activity permits".

6. Employers would have to provide measures to ensure that any particular sensitive groups of workers are prevented from being exposed to risk.

7. The Directive would set up arrangements for additional explanatory documents to be procedure established by Directive 89/391/EEC. The aim would be to help practical application of the directive and they might, for example deal with assessment procedures, special risk groups, personal protective equipment, and feasibility levels of protection.

8. Member States would have to submit reports on practical implementation to the EC which would pass information on them to the Council of Ministers, the European Parliament, the Economic and Social Committee, and the two sides of industry through the tripartite Advisory Committee on Safety, Hygiene and Health Protection at Work which advises the EC.

9 Member States would have restricted powers to grant derogations from some of the requirements; and would have to forward regular reports to the EC on what derogations had been agreed.

10. Specific provisions for the various agents are summarised below.

NOISE

11. The current directive on noise at work (Directive 86/188/EEC) would be revoked and replaced by a new directive, which would include the provisions on noise outlined in Table 1.

HAND ARM AND WHOLE-BODY VIBRATIONS

Details concerning recommended standards for vibrations can be found in Table 2 and 3.

OPTICAL RADIATION

12. This includes infra-red, visible and ultraviolet light.

Exposure limit value

13. The threshold limit values recommended by the American Conference of Governmental Industrial Hygienists (ACGIH) would be adopted as exposure limit values. Measures required include:

- * Employers to establish a programme of control measures. A record of the

Daily personal exposure	Peak pressure	Action when noise reaches either of the levels opposite
60 dB(A)	—	* This seems to be intended as a target level for sleeping areas. Other rest areas would have to be reduced to the lowest level compatible with their purpose and conditions of use.
75 dB(A)	—	* Threshold level. * Risks to be reduced to the lowest achievable level. * Information for workers on risks.
80 dB(A)	112 Pa	* Workers to have the right to surveillance of the hearing function, if they want it. * Supply of personal protective equipment to workers who ask for it. * Information for workers on protective and control measures.
85 dB(A)	112 Pa	* Training for workers on protective and control measures. * Noise assessments and when necessary measurements. * Employers to establish a programme of control measures. A record of the programme is not necessarily required but the need to provide the programme to safety representatives and workers suggests a record would be a practical necessity. * Workers' representatives and workers to receive results of the exposure assessments and the programme of measures for control.
90 dB(A)	200 Pa	* Ear protectors must be used. * Systematic health surveillance by or under the responsibility of a doctor must be carried out. * Marking hazard areas.
105 dB(A)	600 Pa	* Activities to be declared to the "authority responsible" which must take appropriate measures to control the risk.

Table 1 - Noise Provisions

programme is not expressly required but the need to provide the programme to safety representatives and workers suggests a record would be a practical necessity.

- * PPE would have to be used. If the PPE still does not adequately control exposure the duration of exposure would have to be restricted.

- * Marking of hazard areas, and restricted access to them where the risk justifies it (man-made sources only).

- * Workers' representatives and workers to receive the programme of measures for control.

- * Systematic health surveillance must be carried out.

Action level

14. An action level is set at ½ the exposure limit values for:

- * Information and training.
- * Provision of PPE on request.

- * Probable assessment of exposure (this is not clear). Workers' representatives and workers are to receive results of assessment.

- * Workers entitled to health surveillance, which includes an eye check.

15. All lasers would have to be labelled with their classification according to IEC 825, 1990.

16. Any man-made source likely to cause damage similar to a Class 3B or 4 laser would have to be notified to the "authority responsible" which would have to ensure that appropriate measures are taken to control risks. The operators of such sources would have to be trained and their competence checked.

17. Indirect hazards which optical radiation might cause, e.g. by decomposition of materials, fire, or dazzle are to be controlled.

Outdoor workers

18. Member States would be able to grant derogations for outdoor workers, but only from the requirement to prohibit exposures above the ACGIH recommendations. The derogations could not extend to the other measures. When

Daily exposure A(8)* (except where indicated)	Action required
1 m/s ²	<ul style="list-style-type: none"> * Threshold level. * Risks to be reduced to the lowest achievable level. An unclear requirement specifies that as long as adequate PPE is not available provisions are to be "complemented by measures reducing the hazard". * Information for workers on risks.
2.5 m/s ²	<ul style="list-style-type: none"> * Vibration exposure assessments and when necessary measurements. * Information for workers on protective and control measures. * Training in implementation of measures. * Workers entitled to regular health surveillance. * Employers to establish a programme of control measures. A record of the programme is not expressly required but the need to provide the programme to safety representatives and workers suggests a record would be a practical necessity. * Workers' representatives and workers to receive results of the exposure assessments and the programme of measures for control.
5 m/s ²	<ul style="list-style-type: none"> * Systematic health surveillance must be carried out. <p><i>Note: The conditions under which surveillance becomes mandatory are unclear, but this might logically follow from Articles 5(3) and 11(3).</i></p> <ul style="list-style-type: none"> * If vibration levels cannot be adequately reduced, exposure to be controlled by restricting exposure time. For 5 years, from implementation, Member States may grant derogations from this requirement if the state of the art does not allow this limit to be respected.
10 m/s ² (short term level)	<ul style="list-style-type: none"> * If the vibration over a period of "a few minutes" reaches this level "increased efforts" must be made to reduce vibrations. An unclear provision seems to require that where the efforts do not succeed in reducing the average to this value sufficient breaks must be introduced in the work to bring down the average level.
20 m/s ²	<ul style="list-style-type: none"> * Equipment to be marked. * Activities to be declared to the "authority responsible" which must take appropriate measures to control the risk.

* Daily exposure (A(8)) for hand-arm vibration is as defined in British Standard BS 6842:1987. This is to be determined from frequency-weighted values of the vector sum acceleration, except that the vibration along axis where the level is less than 1/2 of that on the dominant axis can be ignored, so highly directional sources would need to be assessed only on the dominant axis.

Table 2 - Hand-Arm Vibration

deciding whether to grant derogations Member States would have to take into account local climatic conditions and the sensitivity of the population to solar radiation.

FIELDS AND WAVES

19. This applies to electric and magnetic fields with frequencies up to 300 GHz, so includes static magnetic fields, fields around 50 Hz electrically powered systems, and radio and microwave frequencies. It does not cover the potential carcinogenic effects due to exposure to time varying electric and magnetic fields.

20. The proposed exposure limit values are similar to the basic restrictions recommended by international expert advisory bodies. However, a lower threshold limit is also introduced along

with other action levels at which employers must take additional measures.

Exposure limit value

21. A table sets out exposure limit values of induced electric currents and specific absorption rate of energy in the human body, and contact current. Mobile radio equipment is no longer exempt from the exposure limit value.

Threshold level

22. The "threshold level" is set at one fifth of the exposure limit value. The factor has been taken from recommendations by the scientific advisory body the International Commission for Non-Ionising Radiation (ICNIRP), for the relationship between occupational and general

public exposure limits because the latter takes into account hazard from uncontrolled exposure.

23. Above this level there is a general requirement for risk to be reduced to the lowest achievable level and a requirement for workers to be provided with information on risks.

First action level of field strengths

24. A second table sets out the number that provide the basis for the Action Levels. The first Action Level is set at 1/2 the values in this table. Exposures to fields at these levels would trigger requirements for:

- * Assessment and measurements.
- * Provision of information and training for workers.
- * PPE for those workers who want it (for electric fields only - the proposal acknowledges that no PPE is effective against magnetic fields).

25. At some frequencies the EC proposed Action Level may be as little as 1/8 of the investigation levels recommended by the UK National Radiological Protection Board.

Second action level field strengths

26. The second Action Level is set at the values of magnetic and electric field strength in the second table. At exposures to fields above these levels, further measures would be required, including:

- * Employers to establish a programme of control measures.
- * Marking hazard areas, and restricting access to them where the risk justifies it.
- * Training operators and checking their competence.

Third action level of field strengths

27. If the magnetic or electric field strengths exceed 1.6 times the values specified in the second table those activities would have to be notified to the "authority responsible". The authority would have to ensure measures are taken to control the risks. Equipment generating fields at these levels would have to be marked.

Other provisions

28. The proposal recognises that measuring exposure to non-optical NIEMR is difficult and commits the EC and Member States to "coordinate definition of suitable metrology".

29. Other requirements include:

- * Use of PPE would be mandatory for workers exposed to "electric fields in which exposure limit values would be exceeded".
- * Health surveillance by or under the supervision of a doctor, (though it is not

clear which workers would have to be included in these programmes).

- * The information for workers exposed to electric field above 5 kV/m must include advice that "apparently harmless perception effects" may occur.
- * Indirect hazards, particularly fire or explosion hazard due to induced currents and voltages would have to be controlled.

30. The proposal does not specifically mention risks to users of pacemakers, though action to protect them might be needed to meet a general obligation to adapt measures "to the requirements of particularly sensitive groups"

HSE CONTACT POINT

31. Comments on the proposal should be sent to:

Robert Wlosinski,
Health Policy Division A3,
Health and Safety Executive,
7th Floor South Wing,
Rose Court,
2 Southwark Bridge,
London.

SE1 9HS

Tel: 0171-717 6225

Fax: 0171-717 6199

Daily exposure A(8)* (except where indicated)	Action required
0.25 m/s ²	<ul style="list-style-type: none"> * Threshold level. * Risks to be reduced to the lowest achievable level. An unclear requirement specifies that as long as adequate PPE is not available provisions are to be "complemented by measures reducing the hazard". * Information for workers on risks.
0.5 m/s ² or 1.25 m/s ² (1-hour average)	<ul style="list-style-type: none"> * Employers to establish a programme of control measures. A record of the programme is not expressly required but the need to provide the programme to safety representatives and workers suggests a record would be a practical necessity. * Information for workers on protective and control measures. * Training in implementation of measures. * Vibration exposure assessments and when necessary measurements. * Workers entitled to regular health surveillance. * Workers' representatives and workers to receive results of the exposure assessments and the programme of measures for control.
0.7 m/s ²	<ul style="list-style-type: none"> * Systematic health surveillance must be carried out. <p><i>Note: The conditions under which surveillance becomes mandatory are unclear, but this might logically follow from Articles 5(3) and 11(3).</i></p> <ul style="list-style-type: none"> * If vibration levels cannot be adequately reduced, exposure to be controlled by restricting exposure time. For 5 years from implementation Member States may grant derogations from this requirement if the state of the art does not allow this limit to be respected.
1.25 m/s ²	<ul style="list-style-type: none"> * Activities to be declared to the "authority responsible" which must take appropriate measures to control risk.

* Daily exposure (A(8)) for whole body vibration is to be established from acceleration levels as defined in ISO 2631. This is to be determined from frequency-weighted values of the vector sum acceleration, except that the vibration along axis where the level is less than 60% of that on the dominant axis can be ignored, so highly directional sources would need to be assessed only on the dominant axis.

Table 3 - Whole-Body Vibration

CUTTING THE GRIM TOLL

"The grim toll of agricultural accidents involving potato harvesters cannot be allowed to continue year after year", said Greg Bungay, head of the Health and Safety Executive's (HSE's) National Interest Group for Agriculture, Crop and Pesticides, at the launch in York of a new information sheet on potato harvesting safety.

He went on to say: "During the past six years HSE has investigated a total of 106 accidents involving potato harvesting machinery. Eight people died including five who were run over by the harvester. Seventy-three serious injuries were the result of entanglement in the haulm or cleaning rollers. Injuries are often severe with the accident victim suffering the amputation of arms or legs. Last year the number of accidents investigated increased despite the fact that the causes are known and remain the same."

He commented: "The accidents represent at best many months lost work, pain and suffering. For some the injuries are so severe that a full return to work is not possible. Serious injuries regularly occur when access to moving parts is made while cleaning the machine or removing blockages."

Mr Bungay warned: "Inspectors are looking critically at the guarding of haulm and cleaning rollers on all potato harvesters whether manned or unmanned. Guards must be fitted or improved and for some machines guarding kits are available from manufacturers. Experience has shown that guards should prevent access from the top, bottom and all sides and should stop contact with moving parts by fingers, arms and legs."

The information sheet has been prepared by the HSE in consultation with the industry, the NFU and the TGWU. It identifies the hazards and provides information on guarding, training and safe work systems for using this machinery safely.

It is hoped that this leaflet will raise awareness, be helpful to users and stop the appalling toll of accidents. The information sheet 'Safe Use of Potato Harvesters' is available free from all HSE area offices or from:
HSE Books,
P.O. Box 1999, Sudbury, Suffolk. CO10 6FS.

CHAINSAW SAFETY

HSE has published a revision of 'Chainsaws' (AS20). The leaflet is aimed at all chainsaw operators and occasional non-professional users.

Revised guidance is given on fuelling and lubricants, on how to pre-assess the job and an update on personal protective equipment that needs to be worn to comply with the Personal Protective Equipment at Work Regulations 1992.

In the last three years inspectors have investigated 160 accidents from chainsaw use. Just over half involved lacerations from the saw chain. Such injuries are invariably serious and often cause long periods off work. The remainder of cases involved falling branches or trees. This resulted in major traumatic injury, paralysis and in eight cases, death. It is hoped that this leaflet will remind chainsaw users of important procedures they need to follow. However, the key to safe use is proper training.

Copies of AS20 (Rev) 'Chainsaws' are available free from HSE Books, P.O. Box 1999, Sudbury, Suffolk. CO10 6FS. Tel: 01787 881165

LOW COST UNSURFACED ROADS - GEOMETRY Brian Jones

Before setting off down the road to explain about the Geometry of roads it is necessary to get back to basic engineering and the world of Telford and Macadam. It seems right to begin by defining the difference between a road and a track.

A road has a drainage system and a durable surface, while a track almost never has a drainage system and usually no surface. A road is built for longevity and a track is not. There are those who believe that if a road does not have a blacktop then it is a track - not so.

STANDARD OF ROAD GEOMETRY

Any geometrical standards provided are for the use of the road by 38 tonne gross vehicle weight articulated trucks. If you wish to build a road for use by smaller vehicles then the following should be remembered:

- a. The surfacing material must be run out along the road and it is generally brought in 30 tonne gross vehicle weight rigid trucks, which are the same width as 38 tonne articulated ones and require almost the same geometrical standards. These vehicles, however, do not require the same widening on bends and have better performance on steep gradients particularly when running empty. Reducing to smaller vehicles, such as 16 tonne rigid trucks, makes little difference in design standards as they are as wide as 30 tonne trucks, have the same axle loads and may increase overall construction costs by using more driver's time/tonne moved. Bringing stone to site in large trucks and transferring to dumpers, to take it along the road being constructed, is very expensive.

- b. Someone will want to use it for a large vehicle some day.

RECOMMENDED CRITERIA FOR DESIGN

PUBLIC ACCESS ROAD

The road will generally start from a public road and permission, in the case of a new road, is needed from the local Highway Authority and the local Planning Department before the access can be built.

When trying to obtain consent keep expense to a minimum by avoiding any survey work, and submit only a diagrammatic drawing of the layout, a location plan derived from the OS Map and a simple specification. The access that I find is generally acceptable to Local Authorities is shown in Figure 1. This is not a motorway but is what is required for a 38 tonne truck to turn off or onto, usually slowly and fully loaded, a busy public road.

If the local Highway Authority is less than understanding about the low number of vehicles, which will use the access and produces a publication from the Department of Transport called 'Roads in Rural Areas' (as amended in Circular TA 28/82) longer visibility splays than those shown in Figure 1 may have to be provided. On very minor roads they may have to be less than the basic 11 m radius. Other work that may almost certainly have to be done is:-

- a. Piping of the roadside drainage the full width of the bellmouth.
- b. Careful protection of any services such as water or telephone lines that may be in the

road verge. This can be time consuming and expensive.

- c. Blacktop the width of the bellmouth to a depth set by the Highway Authority. This is to protect the edge of the public road and reduce the stones and mud carried on to it.

The road bellmouth must be 6.0 m to allow two vehicles to pass if they meet in the access. The public road must not be obstructed. That is also why the gate should be set back far enough to enable a truck to turn in off the road completely before the driver stops and gets out to open the gates.

ROAD WIDTH

On Figure 1 the road tapers to its recommended width, which is 3.2 m. A low cost road is usually single track with passing places. If two lanes are needed then probably, in the UK, so is blacktop. Figure 8 shows the size of a passing place for trucks. If the visibility is good, a spacing of 300 m will do. If visibility is poor, then the passing places should preferably be intervisible.

The recommended road width of 3.2 m is a minimum because it has to be realised that a truck is approximately 2.5 m in width, which is effectively the outside of the tyres. The driver has little margin for error. It should also be understood that 3.2 m is the width of the full depth of the surfacing.

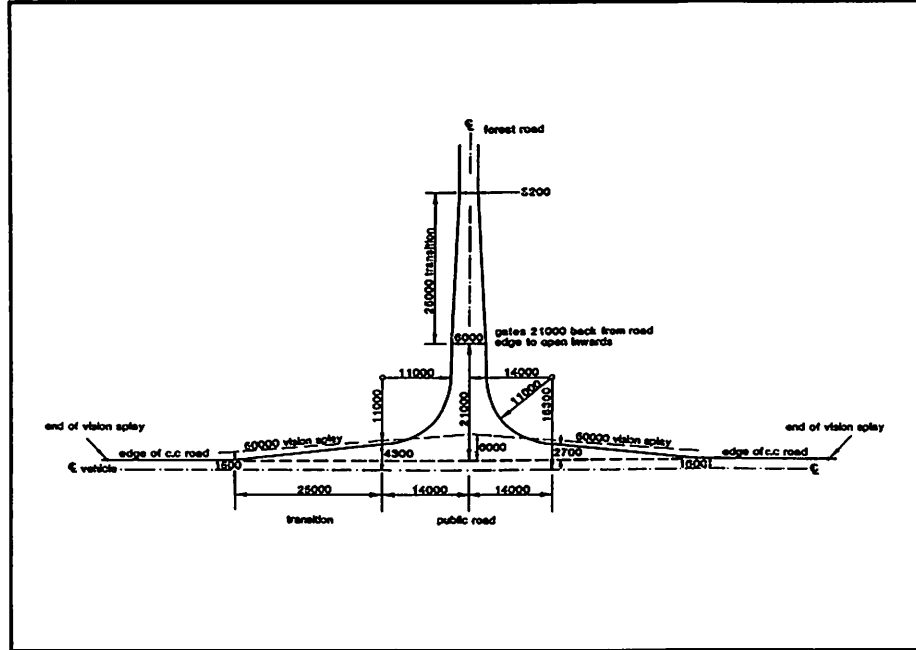
The sides of the full depth section must be supported usually with more stone, which gives a greater, but false, apparent width. This does away with the use of concrete haunches.

To cater for the cut in of the trailer on articulated trucks it is necessary to widen bends in the road. This widening should be carried around the whole of the arc. The transition lengths given later bring the road back to standard width.

For radii to centre line less than 90 m the width of the pavement should be increased as follows:

Radii (m)	Total Width for Deflection 15° - 90° (m)	Total Width for Deflection 90° - 180° (m)
90	3.2	3.2
60	3.8	3.8
45	4.0	4.0
30	4.4	4.4
25	4.8	4.8
20	5.4	5.4
15	5.9	6.4

Figure 1 - Junction of Forest Road with Public Road



A hairpin bend is often quite difficult to construct and expert advice should be sought. The preferred minimum radius is 30 m with 15 m the minimum. The widening is done on the inside of the bend with a straight transition of 20 m. Bends of 20 m radius or less should have a transition of 25 m length. Super-elevation is not used because the recommended speed limit is 25 km/hr to avoid loss of road surface and for safety. The road is uniformly cambered as shown in the cross sections.

Figure 8 shows a turning point. Do not forget that the size of vehicle that can use a dead end road is restricted by where it can turn. Reversing a large vehicle, particularly an articulated one, a long distance on a narrow road can be hazardous. On a long road it saves time and unnecessary use of the road to provide intermediate turning points, if access is not needed every time to the end.

ROAD CROSS SECTIONS

A wet road is a soft road. The road must be drained. The function of drainage is not only to take care of surface water but more importantly to drain the ground under the road. The drawings appended at Figures 2-7 show proven cross sections for various soils and cross slopes.

The cross sections show how water is thrown off the road into the roadside ditch. The ditches must be carefully planned and there must be frequent cross-drains on steep ground say at 100 m intervals to avoid a large volume developing in the uphill ditch.

The water must then be carefully dealt with so that it arrives eventually at a natural watercourse in a clean state which will cause no environmental harm. The best way is to end with a blind ditch so the water has to percolate through the ground before it reaches the watercourse. See "Forest and Water Guidelines", published by the Forestry Commission and available through HMSO, for more details.

There is the question of how steeply the uphill batters should be cut. Past practice reduced the construction costs by having these as steep as possible. To minimise erosion it is necessary to encourage grasses and other vegetation. This requires a less steep slope say 60% and for the upper edge to be smoothed with the natural ground slope. On steep cross slopes this may not be practical.

GRADIENTS

The gradient is important. Basically the gradient should not be less than 1% to allow water to drain longitudinally. Pot-holes form very quickly on a level road. The maximum for sustained gradients should be 10% and even then unloaded articulated trucks, having the drive to the rear wheels of the tractor unit, may have problems.

Steeper gradients can be used with discretion but a 200 m length at 14% gradient will be

Figure 2 - Road Formation in Cuttings and Embankments

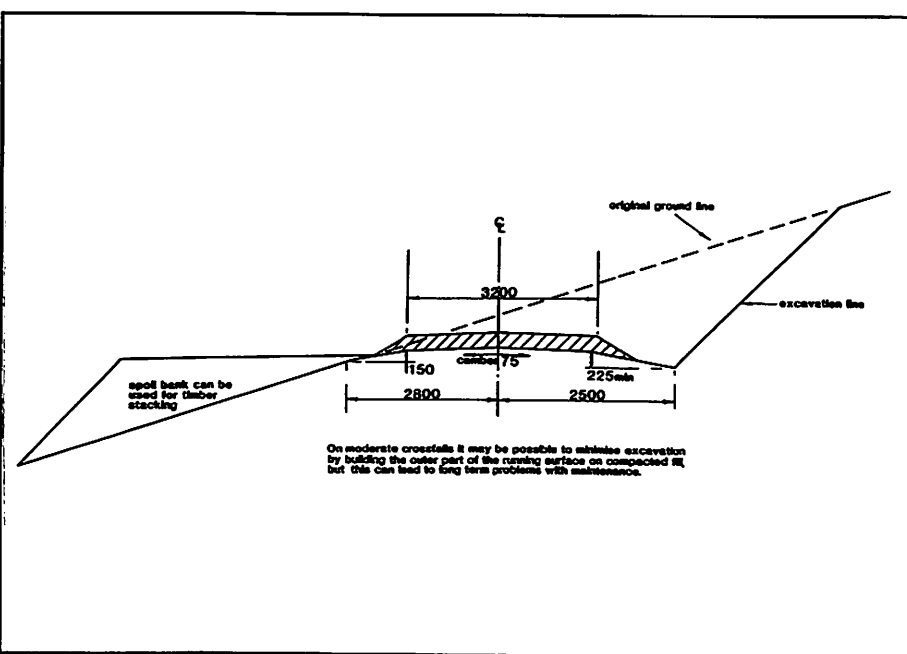
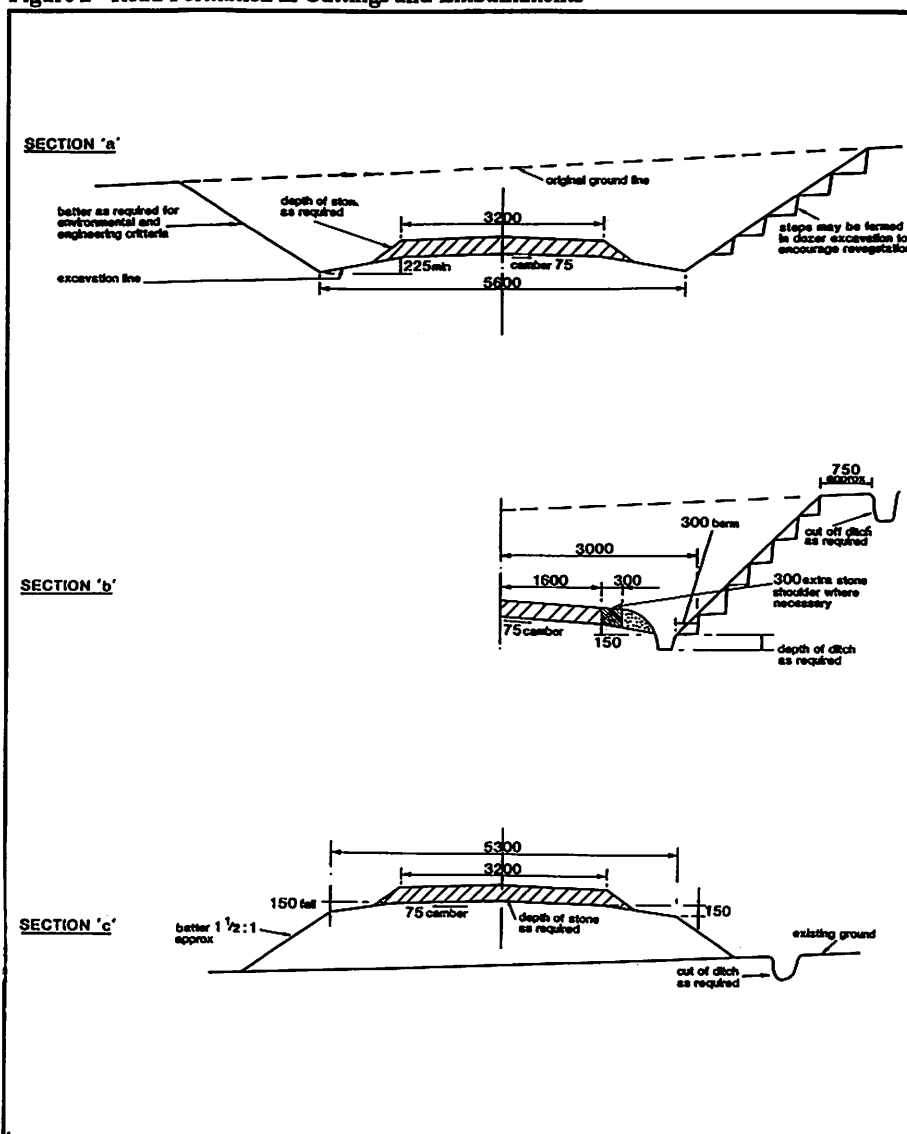


Figure 3 - Road Formation on Steep Crossfalls

Figure 4 - Road Formation in Cuttings and Embankments - Rock & Chalk

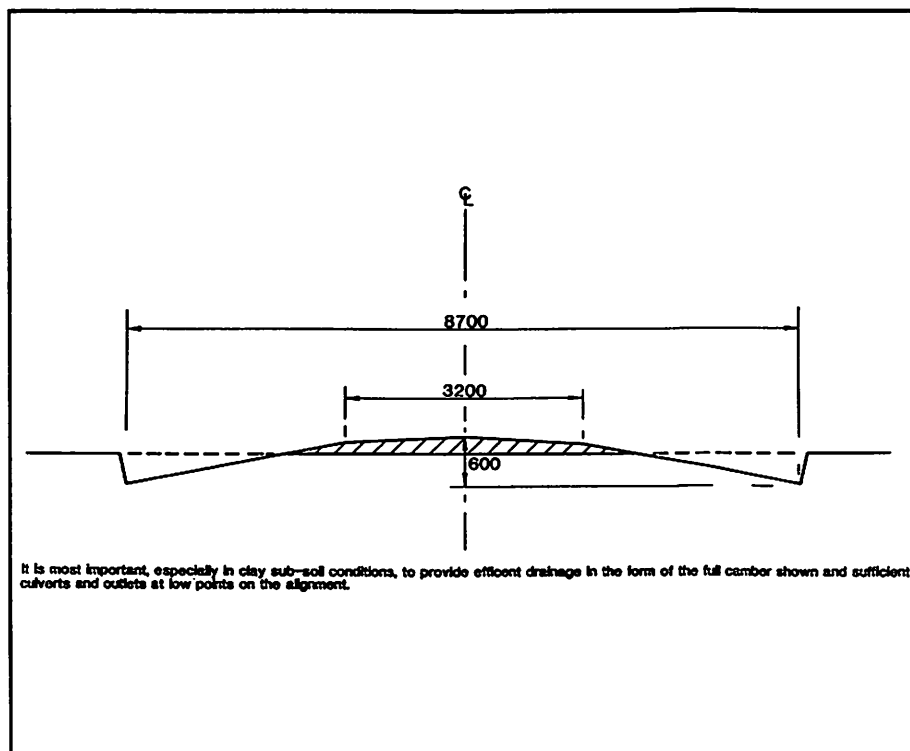
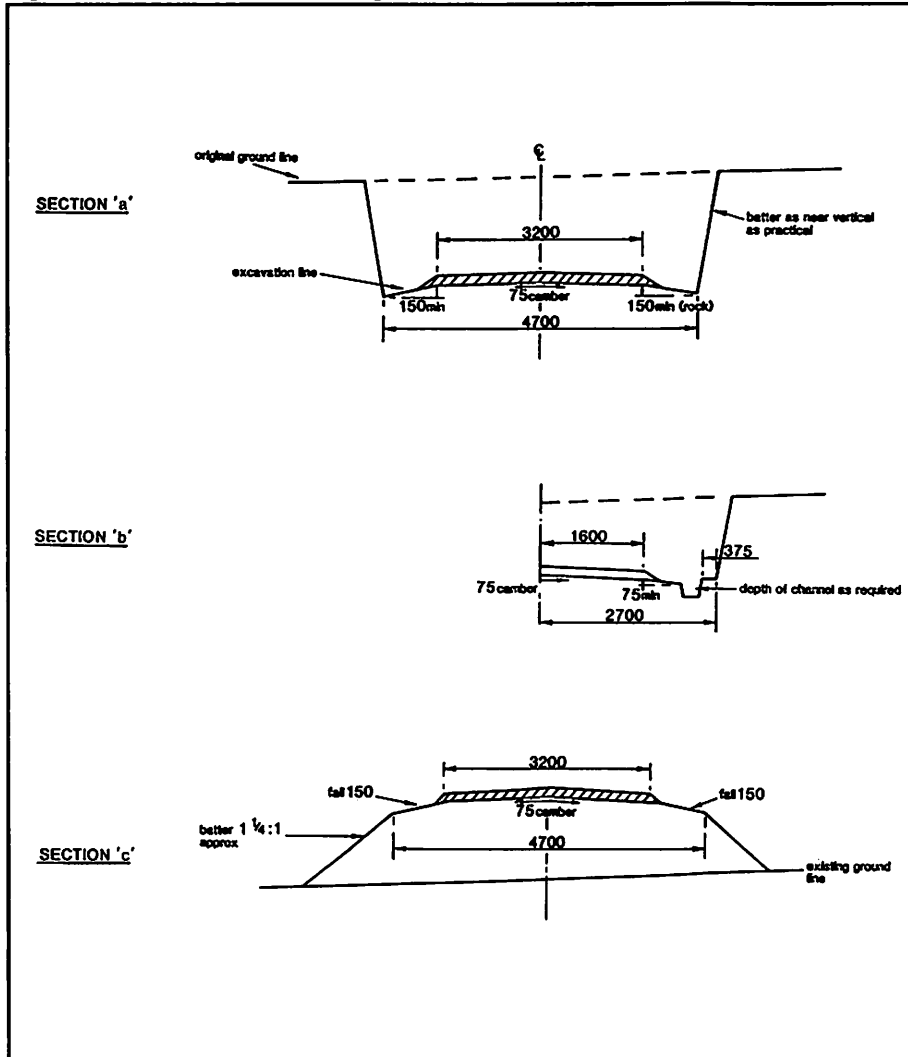


Figure 5 - Road Formation in Flat Country on Clays, Silts, Sands, Chalk, Etc

about the maximum. There is one school of thought that for maximum longevity and safe use the gradient, preferably, should be 5-7%. This should be reduced to 5% on bends of less than 100 m radius.

BRIDGE APPROACHES

The road must be straight for not less than 20 m before a bridge to allow the vehicle to approach in a straight line. If the turn must be completed on the bridge then the deck must be wider than usual to accommodate this.

ROAD LOCATION AND SETTING OUT

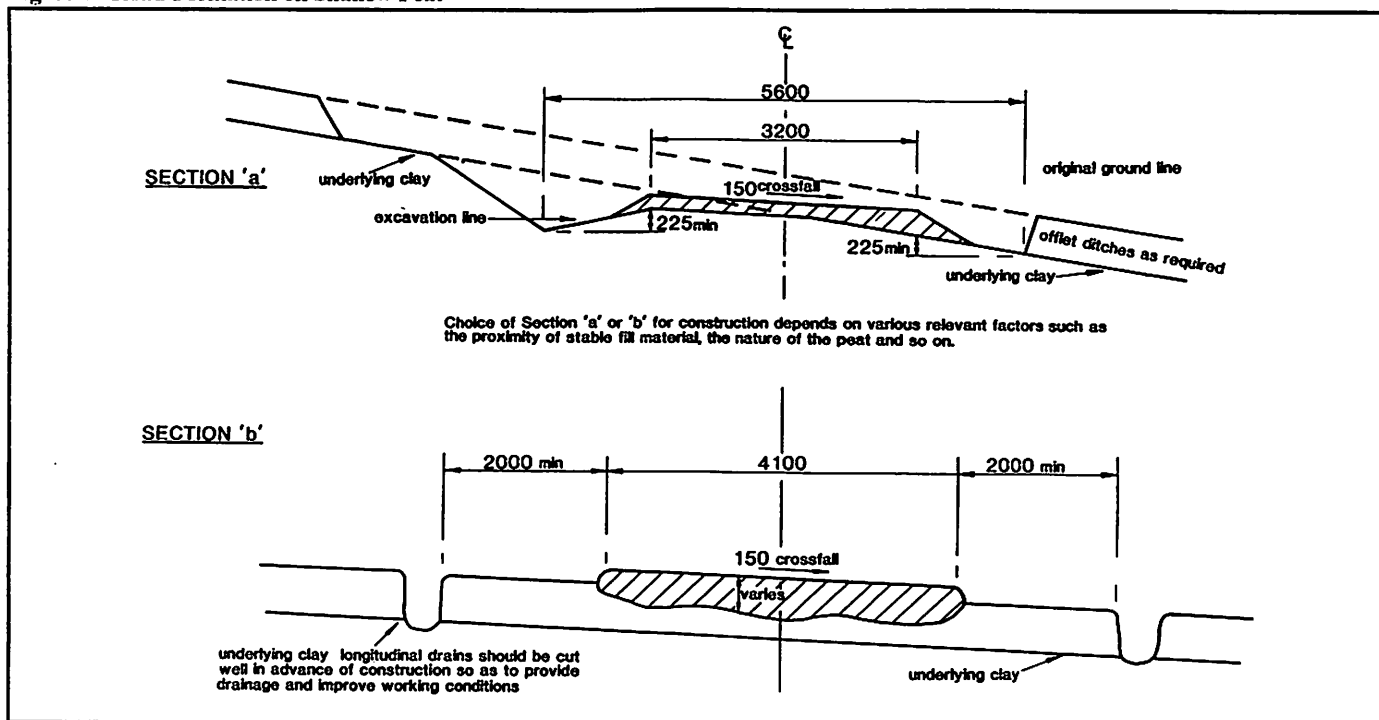
There are constraints on the road location due to design criteria such as gradients, the reasons why the road is being built or the pattern of land ownership. However no matter the constraints the basic principles set out below should be followed.

- A low cost road means a low cost survey. To locate the road position detailed surveys at 1:500 scale will normally only be done for difficult access onto the public road, bridge sites and hairpin bends. If land must be purchased then a detailed survey of the road as it is built would be necessary.
- 1:10,000 scale maps are available for most of the UK and 1:10,560 for the rest. Even 1:25,000 will do and is often more use than the 1:10560 because it has contours. Aerial photographs may be useful but real skill is required in their use.
- Mark on the map where the road must start and finish. Then mark on the "pinch points" on the way such as points that must be passed for operational reasons; passes or saddles in a range of hills; bogs, which should economically be avoided; steep ground and hard rock areas. Mark economical bridge locations and possible quarry sites. Try to identify ground types and pavement design. Walk the ground. Remember that the Romans, the canal builders, the turnpike builders and the railway builders did it this way and they did it well. Finally mark the probable lines on the map and check from the contours if the gradients are anywhere near reasonable. Walk the lines by trial and error with compass and Abney level. Peg out the centre line or the grade line. On flat ground the centre line, on steep ground the grade line.

This is all an experienced contractor will need to build the road. Only if the land take is extremely critical will the full setting out of pegs be necessary.

When checking in the field exactly where the road will go it is often necessary to walk long distances, which can sometimes be increased if lines have to be changed. The best markers are four feet long (1.2 m) pea canes split at one end and about 300 mm of fluorescent tape, with its centre pushed into the split in the cane. This allows the tape to wave in the wind and be

Figure 6 - Road Formation on Shallow Peat



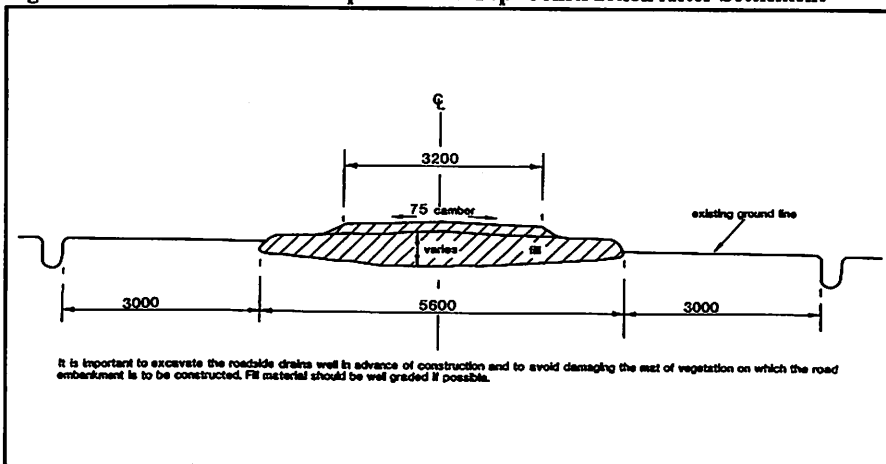
easily seen. This has several advantages over the traditional 50 mm x 50 mm wooden peg and one disadvantage.

- (i) They are very light, and 2 people can carry hundreds using a sling or rucksack.
- (ii) With push they will penetrate most ground enough to be firm. No need for a hammer.
- (iii) The tape stands out and, with binoculars, can be seen for hundred of metres, making it a very practical method of checking the line aesthetically from the other side of the valley.
- (iv) The cane is long enough to protrude through all but the thickest ground vegetation, thus it can still be seen. If the vegetation is taller than the cane then tie two canes together with a piece of tape or tie the tape to the vegetation particularly if it is of the woody type.
- (v) The bad news is that people will steal the canes so carry a spray of marker paint to mark stones, trees or even the turf at the end of each days work.

Laying out a low cost road which is functional and aesthetic is a pleasure. It almost always blends well into the landscape because earthworks are minimal and no sooner have you finished but nature starts to claim it back. This makes maintenance essential but if the road has been well laid out in the first place this should be no problem.

Brian Jones Bsc CEng MICE is the Regional Engineer, Forest Enterprise in South and West England. This article is a paper presented by the author at a Forestry Engineering Specialist Group Conference held in March, 1993

Figure 7 - Road Formation on Deep Peat - 'On Top' Construction After Settlement



PLAN OF TYPICAL TURNING PLACE

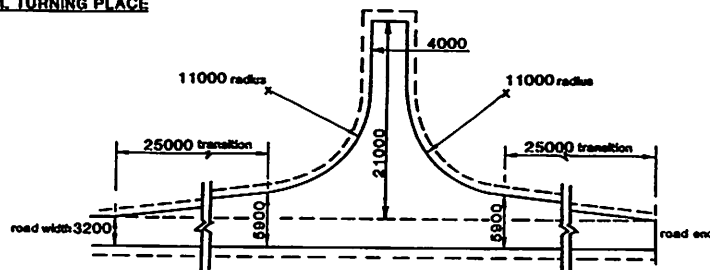


Figure 8 - Road Turning and Passing Places

Membership matters....

THE NEWS LETTER OF THE INSTITUTION OF AGRICULTURAL ENGINEERS

ACHIEVING YOUR GOALS - AN EXCITING INSTITUTION INITIATIVE

Professional career development should be an essential part of every engineer's life. With this in mind the Institution's Council is preparing a major initiative to be known as THE PROFESSIONAL CAREER DEVELOPMENT (PCD) FOCUS. The intention of this initiative is to:

- * help existing members of the Institution in their work and to develop their personal careers;
- * seek and encourage others to join the Institution for assistance with their work and personal career development; and
- * collaborate with organisations and companies concerning the relationship between personal career development of staff and business performance.

The Benefits

For the individual the benefits of PCD Focus will be:

- * personal improvement of knowledge and skills;
- * maintenance of professional contacts;
- * personal recognition through registration;
- * enhancement of career and employment prospects; and
- * exchange of ideas and information.

The Next Steps

Over the next six months each committee, within the Institution, will be examining ways in which all the Institution's activities can be directed towards PCD Focus. In this way we will obtain the maximum impact at least cost. Council approved the principle of the initiative on the 10th November, 1994, with detailed proposals to be placed before Council as developments take place.

In order to keep members informed, future issues of the journal will carry articles providing details of various aspects of PCD Focus.

An Institution with a Purpose

It is anticipated that PCD Focus will quickly become a major feature of the future work of the Institution. The aim is that this initiative will enable our Institution to play a leading role in developing and enhancing agricultural engineering and related activities, both nationally and internationally.

Statement from Professor Brian May, Silsoe College

Membership

GOLD AND DIAMOND

W.G Cover CEng, FIEE, FIAGrE, MASAE has had a double celebration this year. The first to mention, and the most important, is that on 28th July he and his wife, Nancy, celebrated their Diamond Wedding Anniversary. The second, and perhaps not quite so important, is that Bill has been a member of the Institution for 50 years.

He joined the Institution as an associate member in 1944 and in 1966 he became a Fellow. He was an active member of the East Anglian Branch, a member of the Institutions Council, Chairman of the Finance and General Purposes Committee and a Vice President.

In 1924 Bill joined the General Electric Company where, later, he helped form and develop their agricultural department. In the mid-fifties he became a director of Simplex Cambridge Ltd when that company became part of GEC. He retired in 1973 when he spoke to colleagues saying: "I hope many of you will be able to follow in my footsteps and make a successful career from a very ordinary beginning. A thirst for knowledge, hard work, attention to detail and a real desire to progress will stand you in good stead."

I am sure that you would all like to join me in wishing Bill and Nancy many more happy years together.

INSTITUTION MEMBERSHIP CHANGES

Admissions - A warm welcome to the following new members:

Member: R J van Bentum (Wiltshire).

Associate Member: E A Awak (Ukraine); Md A K Azad (Bangladesh); A G Boateng (Ghana); J Brown (Scotland); G H Fletcher (Kent); P M Young (Bedfordshire).

Associate: I S Barrie (London); G Basil (Yorkshire); D G Bennett (Essex); G H P Ramage (Scotland).

Student: M C W Home (Shropshire); D J Montgomery (Surrey); L N Storey (Shropshire).

Transfers - Congratulations on achieving a further phase of their professional development:

... to **Member:** J F Favier (Tyne and Wear); T E G Lee (Devon); K Leung (Tyne and Wear); A Tzivanopoulos (Greece).

... to **Associate Member:** I S Barrie (London); J A Blake (Surrey); A L Fernandes (Essex); S G May (Cheshire); I J Sayers (Suffolk); S A Thomas (Cheshire).

... to **Associate:** R C C Archer (Shropshire); L C Ashmore (Ireland); N V Askew (North Yorkshire); C D Barclay (Cumbria); R W Birkbeck (Cumbria); S R Briggs (Oxfordshire); M A Choudhary (Tyne and Wear); K Devine (Scotland); B O Donohoe (Ireland); K Doran (Cumbria); O M E Elshami (Tyne and Wear); M D Fallon (Bedfordshire); A L Fernandes (London); D W Finney (Worcestershire); M J Fishwick (Lancashire); K D Grist (Cornwall); J A Hogg (Gloucestershire); T E Horlock (Hertfordshire); E J Hughes (Bedfordshire); B J Magee (Northern Ireland); R J Merrall (Dorset); J M Muriithi (Shropshire); L Mwale (Shropshire); T P Roddy (Tyne and Wear); I J Sayers (Suffolk); J L Smith (Warwickshire); W B Smith (Worcestershire); D A Steven

(Scotland); T R Taylor (Worcestershire); S A Thomas (Cheshire); R J Todd (Cumbria); A R Wheatley (Cornwall); J R Woods (Sussex).

Reinstatements

K A Gadir (Oman).

Deaths - with great sadness we report the death of:
S J Parish (Humberside).

Movements - members who have changed their addresses except where they remain in the same English county or, elsewhere, in the same country. We hope the move has proved beneficial.

J U Attah (Bedfordshire to Nigeria); S R Briggs (Oxfordshire to Scotland); P M de la Haye (Channel Island to Scotland); G E Diggins (Qatar to Kent); B O Donohoe (Ireland to West Midlands); B N E Ewang (Cameroon to Bedfordshire); A L Fernandes (London to Essex); J E Gregory (Surrey to West Sussex); J C A Henry (Scotland to Devon); D S Hood (France to Staffordshire); T A Ijir (Nigeria to London); A-G A Jimoh (Bedfordshire to Nigeria); J Livingston (Scotland to Wales); P S Kinlock (Scotland to New Zealand); H M Lockwood (Essex to Pakistan); D J Purdy (Devon to Nottinghamshire); G P Wardle (London to Portugal); K-L Weiner (Surrey to Germany); A Wilson (Northumberland to Lancashire).

Gone Away - The following members' mail is being returned to the Secretariat. If anyone knows of their present addresses would you please inform the Secretariat. Their names and last known address are:

C R Boon, 7 Duck End Lane, Maulden, Bedford MK45 2DL

J M Muriithi, Harper Adams Agricultural College, Newport, Shropshire. TF10 8NB

L Mwale, Harper Adams Agricultural College, Newport, Shropshire. TF10 8NB

M A Neale, Silsoe Research Institute, Wrest Park, Silsoe, Bedford. MK45 4HS

J Tregenza, 24 Towyn Road, Pensarn, Abergele, Clwyd. LL22 7PY

Products and Services

"ENERGY AGRICULTURE"

CIGR (Section IV) have made the first announcement of a conference entitled "Energy Agriculture" to be held at Hohenheim University, Stuttgart on 25th-28th September, 1995. Subjects will cover energy production and management. For further information contact Prof. Dr. T. Jungbluth, Institute of Agricultural Engineering, University Hohenheim (440), D-70 593 Stuttgart.

SAFETY MATTERS

The Agricultural Industry Advisory Committee have produced a newsletter "Safety Matters" (first published July 1994). The purpose of this publication is to increase the level of knowledge of, and concern about, health and safety in our industry. They have also published a HSE report "Fatal Injuries an Investigation by HM Agricultural Inspectorate 1993-94". It could make a valuable contribution in heightening awareness of black spots and potential hazards within the industry. AIAC can be contacted at the NAC, Stoneleigh.

WHERE ARE THEY?

Yes, where are the horticultural engineers? So far, by delving into the records, it has only been possible to identify a handful of members who are directly related to this important sector of agriculture.

Are there others within the Institution who have an interest, but it is not recorded? Are there engineers engaged in horticulture who are potential members of the Institution? The quick answer is we do not know.

Whilst agriculture is the dominating factor within the Institution's interests, there is a handful of horticultural members who believe that their sector needs fostering and encouraged.

Horticulture is arguably more technical than agriculture because of the greater complexities involved in modern glasshouses, automatic transplanting, robotic fruit picking, etc. and therefore potentially there should be a reasonable number of engineers involved.

The aim is to establish a Horticultural Engineering Group and at the same time to recruit interested engineers. Could any member who is involved in horticulture (even in part) or anyone who is interested please contact:

Geoff Lawson,
19 French Mill Lane, Shaftesbury, Dorset. SP7 8EU Tel: 01747 53804, or

John Weir,
9 Arlesey Close, Lytton Grove, Putney Hill, London SW15 2EX

"AGRICULTURAL AND BIOLOGICAL ENGINEERING - NEW HORIZONS, NEW CHALLENGES".

Many readers will be aware that Newcastle University is hosting an international conference from 20th-23rd September, 1995 entitled; "Agricultural and Biological Engineering - New Horizons, New Challenges". While the theme of the conference is forward looking, agricultural engineering at the University of Newcastle upon Tyne will be 50 years old next year and we thought it an appropriate time to celebrate. A reunion of former undergraduate and postgraduate students has been planned to coincide with the conference. The conference will also include the institution's annual convention on Friday 22nd September, 1995, so we are hopeful that we can attract a large number of institution members to both events.

A number of activities have been planned for the reunion including a barbecue on the Friday night and a dinner to be held on Saturday evening. A programme of social events is being planned for both the Saturday and Sunday. It is hoped that there will be plenty of opportunity to catch up with old friends and re-establish contact. Undergraduate students from both the engineering and mechanisation degrees are most welcome as well as all former postgraduates.

If you are interest in attending the reunion then please write to:

Ian Yule, Department of Agricultural and Environmental Science, King George VI Building, University of Newcastle upon Tyne. NE1 7RU Tel: 0191 222 76874 Fax: 0191 222 5228 e.mail Ian Yule@newcastle.ac.uk

Even if you do not wish to attend the reunion please send the above your name and address and details so that files can be updated in order to be able to keep in touch. If you have any news about former students this would also help as it is difficult to track down former students when work has taken them to the four corners of the world.

AGRICULTURAL ENGINEERING TOWARDS 2000 AND BEYOND

The Scottish Conference is to be held on 22nd February, 1995 and six experts in their own field will speak for approximately 40 minutes on the development of agricultural engineering over the next 10-15 years.

These are changing times, legislatively, with the imminent full integration with Europe, mechanically, with constant development and in business, with many different forms of purchase and ownership of assets. The speakers will be ably looked after by our Chairman for the day D. Bell MD of JCB Landpower, a company fully

committed to the future development of our industry.

The first speaker, Paul Makin, will detail the current position and the outstanding requirements of the EC Machinery Directive. He will discuss the primary legislation already in force and point out what CEN documents are currently to come. He will discuss the value of this legislation to the industry rather than the time-consuming hindrance it is often seen to be.

With ever increasing care demanded by the environment anything that can be done must be done. Biodegradable oils and fuels are BATNEEC (Best Available Technology Not Entailing Excessive Cost). They will therefore be used on all land machinery very soon. Our speaker from Shell Oils will point out the problems and future developments of these products.

Advanced crop handling is carried out on increasingly sophisticated fixed machinery to clean, cut, package, etc. The public demands complex development and rigorous maintenance and Rob Herbert will explain how important this area of engineering is becoming.

Electronic control of equipment has revolutionised the land engineering industry and now diagnostic and measuring devices are continuing the trend. The speaker will discuss the new machines that will check the quality of the crop or indeed diagnose a fault in a tractor engine.

With the recession, the pressure on capital increases and alternatives to outright ownership of equipment are studied. Mr Stewart Elder of the Bank of Scotland will point out the advantages of lease or hire of equipment or contracting out work as more economic ways to complete a task. He will give an insight into the next 15 years on capitalisation of equipment.

Finally, JCB will discuss the future of dealership networks. Who will provide the machines and maintain them in the future. The traditional dealer is being undercut by direct traders who give no after-sales service and cannot support guarantees. Can manufacturers spread themselves widely enough or will the old dealership evolve into something new for the next century?

Everything to do with machinery has changed a lot over the last 30 years but the next 15 are liable to see an acceleration and into unknown territory. The Conference aim is to give delegates a little insight into these changing times.

For further information contact :

G. Freedman, Forest Enterprise, 231 Corstorphine Road, Edinburgh. EH12 7AT Tel: 0131 334 0303

MINIATURE TRACTOR PULL COMPETITION

Rules

- Aims:** To construct a model tractor with the highest power to weight ratio. This will be measured over a fixed distance pulling weights on a sledge. Two classes of entry are allowed, students up to degree level and professional engineers. An award is only given to the winner of the student class.
- When and Where:** The competition will take place during the Institution's Annual Conference to be held at Silsoe College on 16th May, 1995. Entry forms are available from John Kilgour at Silsoe College: Tel 01525 860428 and Richard Green at Harper Adams Agricultural College: Tel 01952 820280.
- Test Track:** This will be constructed from plywood measuring 4.8 m long by 1.2 m wide, with it being horizontal in all planes.
- Sledge:** The sledge is 500 mm long x 300 mm wide and 4 mm thick. The base of the sledge has a rubber coating. The front edge is bent up slightly with a single pivot point mounted on it. The tractor is attached to the sledge via a 300 mm long link and 5 mm "D" shackle. The drawbar link must not be restrained in any direction. A full engineering drawing can be obtained from John Kilgour.
- Tractor Design:** The tractor must comply with the following criteria:
1. mass in the 'ready to pull' state must not exceed 20 kg;
 2. the tractor must pass through a gap of 350 mm;
 3. tyres may be made of any material, of any width and may be pneumatic;
 4. tyre diameters must not exceed 320 mm;
 5. the length of the tractor excluding drawbar must not exceed 1000 mm;
 6. power to be provided by batteries;
 7. drive motor to be a car windscreen wiper motor (only one motor);
 8. transmission to be based on bicycle parts;
 9. steering must be either electrically, pneumatically or hydraulically powered;
 10. control of the vehicle may be by trailing lead, infra-red or radio control;
 11. tractors must not leak battery fluid or oil; and
 12. the drawbar hitch point must not be more than 50 mm in front of the centre of the rear axle.
- Steering Test** Before taking part in runs on the test track the tractor must take part in a test to show that it can zig-zag between four cones set in line at 2.0 m intervals.
- Test Runs:** Each entrant will be allowed three test runs when the following will apply:
1. all the tyres of the tractor must remain in contact with the track during a run;
 2. weights must remain on the sledge throughout a test run;
 3. the weights for each run to be selected by the competitor;
 4. manual changes to the steering geometry will not be allowed during the competition;
 5. before competing, tyres must pass the cotton wool test for stickiness;
 6. the maximum speed through the timing marks must be less than 0.75 m/s;
 7. the running order will be decided by means of a lottery; and
 8. entrants must not start a run until the judges signal their readiness.

The judges decision is to be final

Letter to the Editor

SKYE BARN SONG!!!

Following the article on page 1 of the Autumn Newsletter - "Gaelic Mystery Solved" a letter has been received from Malcolm Kennedy who sets out further clarification and answers the question "What is the Great Barn?" His letter states:

Sabhal Mor Ostaig translates from the Gaelic as "The Great Barn of Ostaig". This Ostaig is a place in the South of Skye near the community of Armadale. It is not the Ostaig on Uist with which, I suspect, Mrs. Pigott may have been thinking about.

Sabhal Mor was, some ten years ago, converted into the beginnings of a university college dedicated to the Gaelic language and culture by the Merchant Banker, landowner and Gaelic enthusiast Sir Ian Noble. More recently it has considerably expanded and attracts students from a number of different countries.

A copy of Mrs Pigott's translation was sent to the College and it was they who suggested the possible confusion with Uist and confirmed that the poem was in fact Scottish not Irish Gaelic, the

author being a well known Gaelic poet from the Island of Lewis.

I suggested that an English translation on this years Christmas cards would increase awareness of the college among those who are not familiar with Gaelic!

Malcolm Kennedy
3 Upper Harropool Road
Broadford
Isle of Skye. IV49 9ASQ

IRRIGATION DEVELOPMENT:

International Research Collaboration

It is almost 50 years since teaching and research in Agricultural Engineering began in the University of Newcastle upon Tyne. During that time the particular circumstances and needs of developing countries have not been neglected and important links with universities and research institutes in the Third World have been promoted. Irrigation development is one area in which particularly strong international collaboration has been established and the two articles that follow provide a brief outline of some aspects of this activity.

The first describes work in Malaysia and reflects the urgent need there to mechanise and modernise paddy irrigation systems in the face of the drift of labour away from rural areas. The second deals with a quite different set of circumstances in Tanzania, where the focus of attention has shifted away from formal irrigation systems and towards farmer-managed irrigation and indigenous water conservation practices.

PERFORMANCE EVALUATION OF PADDY IRRIGATION

A CASE-STUDY AT KERIAN IRRIGATION SCHEME, MALAYSIA

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INTRODUCTION

The Kerian Irrigation scheme is one of the oldest schemes in Malaysia. However, the fast economic development in industry has led to an exodus of the small farmer using traditional irrigation and traditional methods of rice growing. This has resulted in an urgent need to modernise and enlarge the scale of individual farms, but the variety of soils and traditional practices of the scheme hampers this transition. Mechanization using machines such as broadcasters and combine harvesters is difficult because of a reluctance to drain the rice fields and of the low load bearing capacity of soils.

There have been great disappointments with modernizing the irrigation infrastructure, with costs often escalating. Studies (An., 1991) have shown that the rice yields remained at the same level and have not significantly increased after rehabilitation. The effect of large scale comprehensive improvements often fail to have an impact at the field level. A better infrastructure allows a better management but does not automatically induce improvements. Comprehensive rehabilitation can increase.

- the flexibility for farmers, who might wish to irrigate at any moment, and
- the limited channel and storage capacity of the irrigation infrastructure.

Traditionally large schemes are operated with staggered schedules and rotational supply. The farmers operate within an overall schedule and tend to maximize their water intake. As a consequence the head-end farmers often take more than their rightful share at the expense of the tail-enders. This inequity is predominantly caused by sociological factors, although capacity bottlenecks also occur.

It is important to identify all factors limiting the economic productivity and to put irrigation into a holistic context (Wyseure and Gowing, 1992). During the transition from the unsustainable small scale to viable medium-size enterprises the



Constant Head Orifice (CHO) controlling the inflow into the tertiary canal.

irrigation managers and the policy makers need performance indicators, which must be relevant to the operation of a modernizing system. Most performance indicators in irrigation are targeted at primary and secondary canals. They lack relevance for the tertiary canals that deliver the water to the fields. However, the field scale is where the actual production occurs and where the water-users operate. Measurement structures are normally not available at the level of individual plots, as the price of installation and operation would be prohibitive.

In order to apply performance indicators at the right level use was made of a balance model for a rice-field, this was then applied to a tertiary block and finally to contrasting parts of the irrigation scheme. A detailed short term test of one field was executed in order to validate the field balance model. Before considering this model, it is necessary to provide some details

about the Kerian Irrigation Scheme and the management of the paddy-irrigation.

KERIAN IRRIGATION SCHEME

In 1906 a small dam was built on the Sungai Kurau near Bukit Merah. The catchment area of 480 km² supplies the 34 km² reservoir. The command area downstream of the headwork consists of eight compartments, with a total irrigated area of 23,800 ha. A pumping station ensures that there is an adequate supply to the four lowest compartments. The capacity of the station means that water can be pumped up to four times the distance the station is from the Krian river at a rate of 5.3 m³/s.

The scheme has a complex variety of physical features. The higher compartments have an alluvial riverine clay while the lower compartments consist of marine clay and in some

parts organic clay. Tidal gates prevent seawater intrusion into the irrigated area. Kerian receives an annual rainfall at the coast of 1800-mm and towards the dam site 2500 mm, with the catchment area receiving much higher falls. Another problem is that the location on the West-coast of mainland Malaysia and the vicinity of Penang State makes it an attractive area for well-paid factory jobs.

The upper part is largely mechanized for broadcasting and combine harvesting, while the lower half still practices transplanting and manual harvesting. In the coastal area the drains are normally blocked and the water is kept in the rice fields. Transplanting requires seeding in a nursery and a labour intensive planting in the flooded field. A major problem is that the part-time farmers do not adhere to the irrigation scheme. Involvement of the farmers in the planning has not resolved this problem. The cropping intensity or average number of crops per year is currently around 170%.

Modern mechanized rice cultivation has its implications for the irrigation and drainage schemes. The mechanized method of planting and harvesting is wet broadcasting and combine harvesting respectively. The field is presaturated during a period of two weeks before broadcasting. The land is then drained and soaked before pregerminated seeds are sown. Approximately one week later the water table is gradually built up. Initially the young rice plants are small and therefore the level in the field is limited to 5 cm of ponding. The correct water level is maintained until one month before harvest, when the field is drained. The combine harvester can only operate on a soil with sufficient bearing capacity.

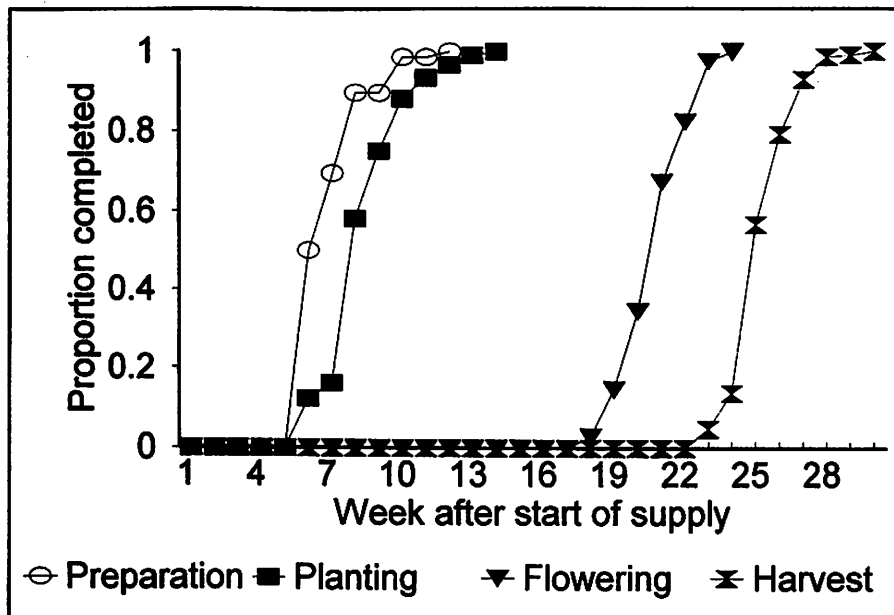


Figure 1. - Field Operations in Tebok-block

The modern mechanized farming requires somewhat less irrigation but a more reliable source, especially for young plants that need a gradual and well-timed build-up of water to reduce the competition by weeds.

There is now a tendency for large private farmers to take on more land by renting it. Ironically the worst land, which was abandoned by the small farmers was the first to change into larger operating units. Mechanization does require more timely scheduling and the larger units can

solve most of these problems by operating their own pumps for irrigation and drainage.

The operation of private pumps is more costly than the virtually free water supplied by the irrigation department, but the timeliness and reliability of irrigation and drainage is the major attraction. Water can be pumped from and to the field or to and from irrigation or drainage canals as required. Mechanisation also requires better levelling of the fields and a proper network of farmroads.

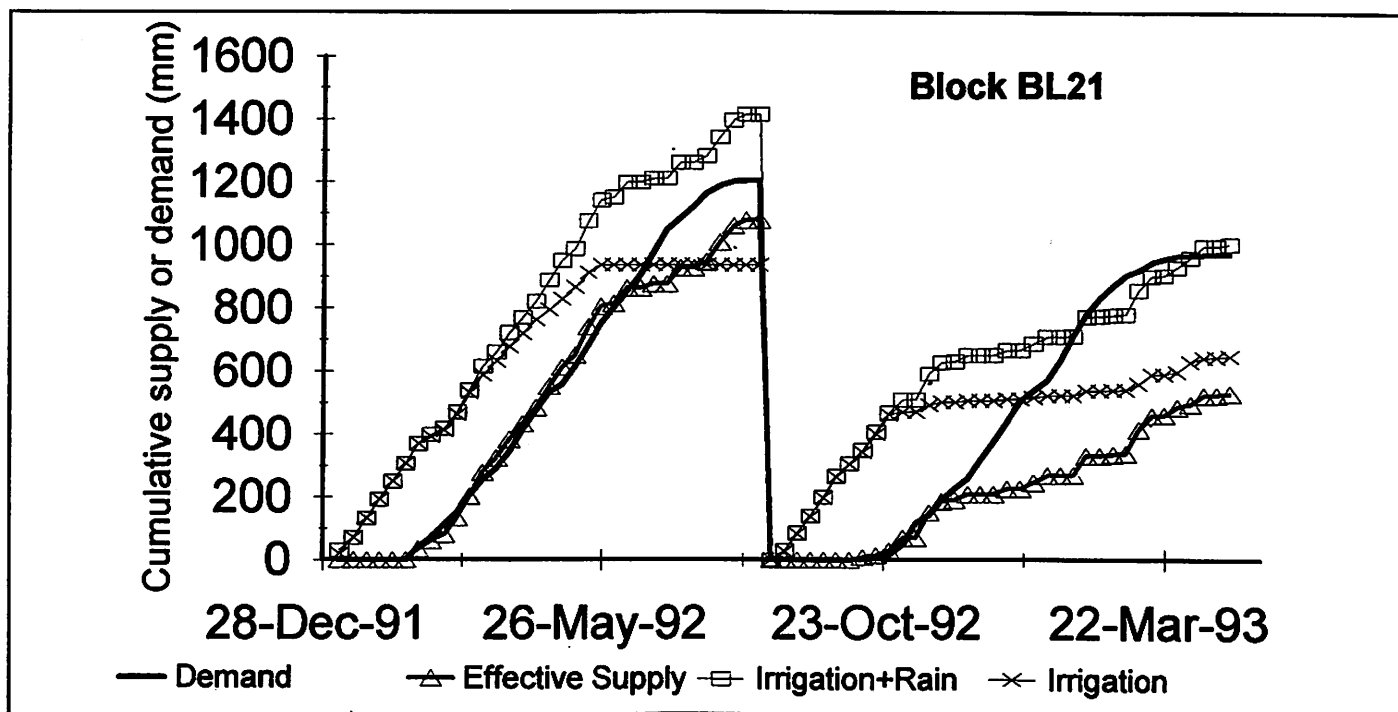


Figure 2. - The Cumulative Supply and Demand (mm) for Two Consecutive Seasons (data compiled by Morris, 1993. Effective supply is the irrigation and rainfall used or stored in rice fields. Irrigation is the total irrigation into the block. Rain is the total rainfall. Demand is based on cropping pattern.

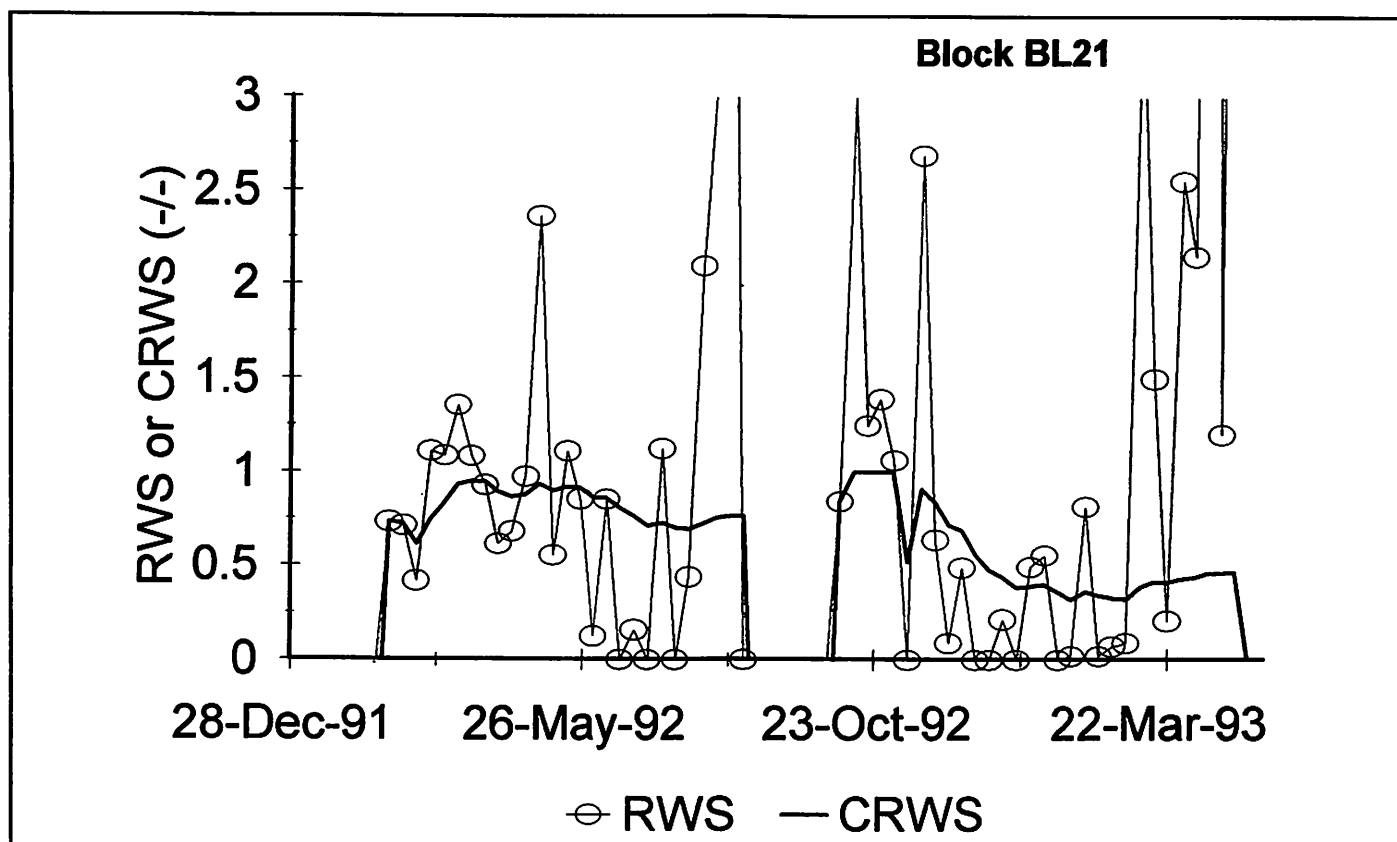


Figure 3. - Cumulative Relative Water Supply (CRWS) and Relative Water Supply (RWS) for Block BL21

PERFORMANCE INDICATORS AT THE FIELD LEVEL.

In applying performance indicators to paddy-irrigation two important types of problem exist. The first is related to the fact that the smallest level of flow measurement is at the entrance of the tertiary canal. In the case of the Kerian irrigation scheme a Constant Head Orifice (CHO) allows the estimation of the off-take from the secondary into the tertiary canal (Photo 1).

A tertiary unit consists of 150 to 750 ha. It is not practical and/or economical to have any measurement structures at a smaller scale. Therefore, the most practical approach consists of observing the field operations within the tertiary block.

At weekly intervals a record is kept of the proportion of area not irrigated, under presaturation, planted, flowering, drained and harvested. This is useful information for the irrigation management. It also involves keeping in touch with the farm operations. An example is shown in Figure 1. The example clearly illustrates the late start and the time-distribution of operations.

The second type of problem is linked to the nature of paddy fields. Bhuiyan and Undan (1990) provided a good review on the water requirements for rice irrigation and yield response. The fields can be unused, in presaturation, non-irrigated but freshly broadcasted, irrigated during vegetative and grain-initiating growth, drained before harvesting

and harvested. Each class of land occupation and crop status has its own demand.

The demand for water to be supplied by irrigation and rainfall is either for presaturation or for maintenance irrigation.

Presaturation fills the soil to saturation and builds the layer of ponding water up. The intake from the tertiary canals into individual fields is controlled by small structures like guillotine valves. The maintenance demand in a flooded rice field during vegetative growth consists of the evaporation, vertical percolation and seepage to adjacent fields and canals. In Kerian the presaturation setting allows for 2.31 l/s/ha while the maintenance irrigation is 1.16 l/s/ha.

Wet rice is mostly cultivated in humid climates, with rainfall being an important contribution to the rice fields. The rainfall is only effective if it can be stored or used by the rice-fields. A running balance of the average level of the standing water layer is required. The water stored as ponded water is based on a balance of rainfall, irrigation, percolation, seepage and evaporation.

Rainfall which cannot be stored drains off. In this way the effective rainfall can be estimated as the rainfall minus the drained excess rainfall. Only the presaturated and irrigated land can have ponded water. The rainfall on unused area drains off and is not stored or used. Because of the weekly update of crop and land status, the most practical time step for the balance is weekly.

The supply into the tertiary unit is based on the observations of the gatekeeper, who regulates the CHO. The intake into the fields is limited by the number of active field intakes and their capacity. It is often observed that the tertiary canal is at full supply capacity while no fields are irrigated. The intake into the fields is then zero. Under these circumstances all the irrigation water drains off. The demand of the tertiary unit is composed of each proportion of field occupation times its field water use.

Our studies in Malaysia resulted in an approach that looked at each tertiary block, its supply data from the recorded inflow into the tertiary canal and its demand-estimation from the cropping pattern and status within the block.

A balance model was then produced using the relative water supply (RWS), which is the ratio of the supply to the demand, and cumulative relative water supply (CRWS), which identifies long-term shortfalls in the supply. The RWS can be defined as the proportion of supply, which is the field intake and the effective rainfall, and the demand, which is evapotranspiration, percolation/seepage losses, and presaturation deficit spread over the presaturation time.

The effect of a possible water layer deficit is not included in the indicator. The upper limit of the water level in the field interacts strongly with the effective rainfall. The use of the reserve will at later stage render the rainfall more effective.

Short-term deficits in the RWS are often unimportant. The standing water layer acts as a

reserve and as a consequence, the CRWS is more appropriate. Simultaneously excess supply can only be stored into the water layer. Once the water layer is at maximum height the extra supply drains off. A cumulative balance of supply and demand is shown in Figure 2. Sometimes the effective supply exceeds the demand. This means that the difference is stored in the standing water layer.

When evaluating the CRWS the values of RWS, which are summed up are constrained to one. Occasional RWS values, higher than the limit, are not carried over in the CRWS. The RWS provides instantaneous detail of the current week, while the CRWS an integrated indicator from information obtained over previous weeks. Throughout the growing season both variables show the performance of the irrigation. The RWS will help to identify acute excess or shortage while the CRWS gives the integrated value. The two seasons illustrated in Figure 3 clearly show how the two parameters reflect the short-term and the integrated performance.

The CRWS is also useful at the end of every season as part of the evaluation of the irrigation campaign. The crop-yields are the most obvious parameters. From a water resource point of view the yields from supplied irrigation water and the

efficiency of the rainfall is crucial.

CONCLUSIONS

When the RWS and the CRWS are applied to tertiary blocks along with information of the cropping pattern and based on a simple water balance of the block performance indicators can then be produced. These indicators provide useful information for the management, particularly mechanised management, of paddy fields and their associated irrigation.

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REFERENCES

Anonymous, 1991, Rice irrigation in Malaysia; economic change and the choice of irrigation technology. OED-precis no16, World Bank, Washington. 4 pages.

Bhuiyan S.I. and R.C. Undan, 1990, Irrigation for tropical areas. In 'Hoffman G.J, T.A. Howell and K.H. Solomon (Eds). Management of Farm Irrigation Systems. American Society of Agricultural Engineers Monograph' pp 581-628.

Morris K.A. 1993. Evaluation of selected performance indicators at Kerian Irrigation Scheme, Perak. Malaysia. Unpublished dissertation. MSc Irrigation, University of Newcastle upon Tyne.

Wyseure G.C.L. and J.W. Gowing. 1992. Field Studies in Malaysia: a joint programme by University Pertanian Malaysia and University of Newcastle upon Tyne. In 'Feyen J.E. Mwendera and M. Badji. Advances in Planning, design and management of Irrigation Systems as related to sustainable land use. Centre for Irrigation Engineering, Leuven, Belgium'. pp 853-858

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LOCAL SOLUTIONS TO IRRIGATION NEEDS IN SEMI-ARID AFRICA

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This paper describes a collaborative programme of field research on water harvesting in Tanzania supported by development of the THIRST model.

Two years have passed since the 'Earth Summit' in Rio de Janeiro in which the linkages between environment and development received much attention and the importance of 'sustainability' was firmly established. This has particular resonance in the context of irrigation development, because there is abundant evidence to show that too many past efforts have not met any set of sensible criteria for sustainability.

We see that irrigation systems are widely reported to be performing far below their potential and extensive areas of land have been degraded by salinisation and waterlogging. Yet continuing development of irrigated agriculture must remain a key component of future policy on food security. (see Figure 1)

We must also recognise that water demands are increasing rapidly as populations and economic activities grow. As a result, many countries are reaching conditions of water scarcity and competition between urban and agricultural needs are increasingly serious problems.

Agriculture (i.e. irrigation) is frequently the major user (see Figure 2) and can expect to come under increasing pressure to pay the true economic price or to release water for reallocation to other users.

Figure 1.

Water for sustainable food production and rural development

Sustainability of food production increasingly depends on sound and efficient water use and conservation practices consisting primarily of irrigation development and management....

Agenda 21, Chapter 18, Clause F
UN Conference on Environment and Development
Rio de Janeiro, 1992.

The key issue then is not whether irrigation is needed, but rather whether it can be made more efficient and more sustainable. Given the appropriate circumstances we can go some way towards meeting both objectives if we relax our definition of 'irrigation' and consider opportunities for developing and promoting techniques for water harvesting.

This implies local collection, concentration and conservation of rainfall runoff. Instead of uncontrolled runoff being left to cause soil erosion, it is harvested and utilised.

This can be seen as a rudimentary form of

irrigation in which there is no control over timing, since runoff can only be harvested when it rains. This is a serious limitation when contrasted with conventional irrigation, but in the appropriate circumstances it offers significant advantages over conventional dry-land farming.

The technique is receiving increasing recognition as an appropriate means of assisting resource-poor farmers in semi-arid Africa (Critchley & Siegert, 1991). Such farmers habitually live in marginal environments with poor soils and meagre, unreliable rainfall; therefore they cannot afford to take risk and may be reluctant to adopt practices with perceived long-term benefits (Hudson, 1991).

Work currently being undertaken by University of Newcastle upon Tyne in collaboration with Sokoine University in Tanzania is aimed at evaluation and promotion of rainwater harvesting in semi-arid areas of Africa. A three-pronged approach has been adopted which includes:

- investigation of indigenous soil/water management practices in Tanzania;
- demonstration of alternative techniques on three experimental sites and in on-farm trials;
- development of a simulation model, which can be used to guide decisions on 'best-bet' options for any particular site.

There are many alternative systems for water harvesting falling into two main types.

- (i) within-field methods in which the transfer of water takes place over a short distance (maximum 50-100 m). This category includes microcatchments, contour ridges, furrow dyking, contour benches and strip planting.
- (ii) external catchment methods in which runoff is collected from a catchment area at a considerable distance from the receiving area and is transferred by channel flow. This category includes terraced wall systems, hillside conduit systems and dams for recession planting.

The Newcastle-Sokoine programme is focused on within-field methods at three experimental sites which are representative of different agro-ecological zones within Tanzania. Differences in their rainfall regimes can be seen from the data presented in Figures 3 and 4. A preliminary analysis of the potential benefit of water harvesting is also presented in Figure 4, which shows the effect on length of the growing season. More extensive investigation with the simulation model is required in order to confirm the apparent advantages for Same and Dodoma. In contrast, the results for Morogoro highlight the potential for damage due to excess moisture.

Initial results from the field trials during 1993 long rains provide support for this analysis. For Morogoro the benefits were minimal and waterlogging was apparent. However, for Same grain yields were three times higher with water harvesting when compared with low water management regimes. It is interesting to note the response of local farmers to these early results as there is clear evidence that some have already begun to modify their practices.

Establishing and maintaining a substantial field experiment on three sites has been a major undertaking. These sites provide the opportunity to test and demonstrate alternative techniques under field conditions, but they also provide the experimental data which is required to develop a simulation model. This is seen as an important end-product which will greatly enhance the value of the field research. The key to the successful introduction of improved practices (indeed to all aspects of agro-technology transfer) is how to

Figure 2. - The use of the world's freshwater in the 1980s: broad geographical regions

Geographical region	Annual withdrawals		Percentage distribution of water use		
	Cubic metres per caput	As % of 'available' water*	Domestic	Industry	Agriculture
World	660	8	8	23	69
Africa	244	3	7	5	88
North & Central America	1692	10	9	42	49
South America	476	1	18	23	59
Asia	526	15	6	8	86
Europe	726	15	13	54	33
USSR	1330	8	6	29	65
Oceania	907	1	64	2	34

NB Estimates refer to various dates in the 1980s
 * Available water includes internal renewable water and river flows from other countries
 Source: World Resources Institute (1992) *World Resources 1992-93*. Oxford University Press.

Figure 3: Median and Percentiles of Monthly Rainfall

MONTHLY ANNUAL RAINFALL	SAME	DODOMA	MOROGORO
20%	187	207	430
Median	461	467	800
80%	1010	794	1286

extrapolate experimental results from one site to other sites and to other seasons. How do we match the conditions and resources of an individual farmer with the available technologies? It is not acceptable to adopt a 'suck-it-and-see' strategy but with the aid of the simulation model we will be able to identify 'best best' options.

REFERENCES

- Critchley, W. & K. Siegert (1991) *Water Harvesting*. FAO Publication AGL/MISC/17/91.
 Hudson, N.W. (1991) A Study of the Reasons for Success or Failure of Soil Conservation Projects. FAO Soils Bulletin 57.

Figure 4. - Lengths of the Growing Seasons for the Three Sites

	Rains					
	First			Second		
	Start	Finish	Length	Start	Finish	Length
SAME	337	40	69	74	165	91
DODOMA	340	121	147	-	-	-
MOROGORO	325	74	115	75	175	100
Simulated Rainwater Harvesting (2:1 Catchment: Cropped Area - Threshold = 5 mm)						
SAME	282	40	122	41	176	135
DODOMA	324	129	170	-	-	-
MOROGORO	262	72	176	73	217	144

IRRIGATION SCHEDULING IN SCOTLAND

Martin Parkes

The Irrigation of potatoes and horticultural crops is essential in most parts of the UK. It is also very necessary to obtain irrigation advice and quite a number of farms obtain irrigation advice from the Scottish Agricultural College (SAC) each summer.

It is in the dry coastal strip from Berwick on the English border to the Black Isle north of Inverness where this irrigation is practised. Annual rainfall totals are around 650-750 mm. Typically soils are of sandy loam to loamy sand texture.

Irrigated crops include seed and maincrop potatoes, carrots, calabrese, cauliflower, strawberries, raspberries and occasionally grass. Besides being required during the summer months, irrigation may also be called for in a dry spring, when it helps potato growers to control common scab at deficits of only 18 mm. It should be noted that this is the only time when cereals might be irrigated. So in a typical year the majority of an average 35-60 mm total application will have been applied to potatoes (Figure 1). All our advice is currently concerned with potatoes.

Returns are posted the same evening or sent by Fax. In order to provide such a good service, which keeps an account of water losses and gains from the root zone for up to three individual fields, a number of aspects have to be considered and these will now be discussed.

APPRAISING SOILS

Soil water properties vary spatially between soil series and vertically between horizons. It is essential to obtain information regarding these if meaningful scheduling is to take place. Information can be obtained from farmers who should know their fields, which can be ratified by looking at soil profiles. However, in the roller coaster fields that can often be encountered, with variations in soil type, some negotiation is needed over the ground conditions that should be targeted. Generally this means identifying areas of fields that have the least available water storage.

A problem that arises is that although farmers are aware of differences in crop growth between north and south facing slopes our water balance software does not suggest what

Soil textural differences often cause problems with insufficient and excess water. For the potato crop two diseases could be found together in the same field being common scab as a result of insufficient water and powdery scab from excessive amounts. Such differences have been verified by field-measurement of soil water storage, which reflects the variation of laboratory determinations of available water. Coefficients of variation (CV's) of around 10-25% have been obtained from for laboratory estimates of available water in horizons within a 0.5 ha block. It should be noted that soils with CV's of 10% or less would be said to be uniform.

The use of a mobile water concept and available water defined by texture, packing density and stone content (Bibby et al, 1982) was found to be the best method to describe data, with texture being defined by feel (MAFF/Soil Survey, 1984), packing density by difficulty in digging and stone content from the tables in Soil Survey Field Handbook (Hodgson, 1976). On farms in eastern Scotland, different soil series can often be found within single fields and the variation in stone content can also be as great within a small area as is to be found throughout an entire farm.

DRAINAGE

Only 2-3 different types of profile drainage are identified, depending on what can be seen in the two soil pits dug to represent each field. Many of the fields inspected have existing under-drainage, even on sites with either sandy loam or sandy clay loam subsoils. Different conditions include deep, typically loamy sand, profiles with no obstruction to root development and fine-textured sandy loam/sandy clay loam soils, overlying coarse sands, which are described respectively as slowly and rapidly drained soils. These drainage parameters have been inferred from validation exercises to verify computer water balance predictions. They describe the pore space contributing to slow drainage of a profile, once any rapid internal bypass flow stops.

There is, justification for ignoring spatial variability of infiltration and internal drainage behaviour (Schuh et al (1992)), as the variation of drainage flux at the base of the root zone is most dependent on the relative land surface elevations and the area of micro-watersheds supplying water to micro-topographic low positions. On sites with slopes of less than 0.4% infiltrating water builds up as it reached the existing water table and redistributed laterally for distances up to 12 m. Inspection and research suggests that a similar behaviour is common on fields that require scheduling. Practical scheduling calculations only relate to relatively flat fields.

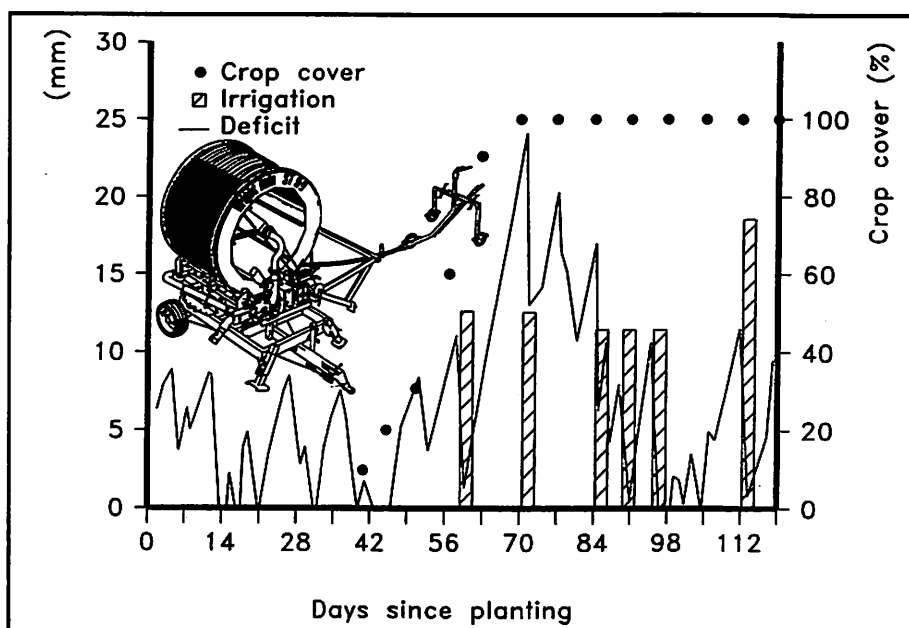


Figure 1. - Seasonal potato soil water deficits

The irrigation scheduling service provided by SAC started in 1987 but with support from local agricultural advisors the service spread eventually. An agreed day of the week for calculations and rapid turn round of data proved important. Initially we agreed to contact all farmers each Monday for weekly records of rainfall, irrigation and crop ground cover. Now a third of customers send their data in by Fax.

the likely differences might be. Such variations in micro-relief are therefore kept in context by appreciating the potential variability of water applications, with the average raingun. This average was obtained by recording 15-49 mm depths of water collected in catch cans within a single travel lane, as a result of wind affecting the water distribution from a raingun.

ESTIMATING EVAPOTRANSPIRATION ETo

Throughout all development and advisory work, actual evapotranspiration has been determined by adjustment of a potential evaporation value (Penman, 1963), using a crop coefficient following Jensen et al (1971). Figure 2a shows the method of estimating crop coefficient from the stage of crop growth and percentage ground cover. Figure 2b illustrates further reduction of transpiration promoted by increased removal of available water. Validation of evapotranspiration, bypass and slow drainage estimates have been made by comparison of predictions and neutron meter measurements on research and commercial farms. Surface runoff was judged to be insignificant in the exercises (Parkes et al 1989, 1995).

In 1990 and 1992, comparisons were made between deficits determined by MORECS (Thompson,1981) and those predicted by the Penman Monteith formula. Measured winter deficits, and observations of limited transpiration due to low temperatures limiting growth in spring, suggest to us that winter and early spring transpiration estimates are better based on the original Penman equation.

FORECASTING RAINFALL

Since 1989 the Meteorological Office has provided, at a cost, their 5 day forecasts of future rainfall. An aspect that farmers thought necessary. It is interesting to note that requests for information have been for other reasons besides irrigation. One required information for the timing of the first silage cut and another to ensure that the lack of rain meant that the going would be good at Ayr, thus enabling "Bonnie Prince Charlie" to do well in the 3.30!

Experience with this aspect of the service shows that there are 2 areas for which different forecasts must be provided, being firstly the Moray Firth and secondly from Montrose to Berwick. In order to help farmers judge the relevance of the forecast for their site, the daily rainfall forecasts are coded as frontal, showers or thunderstorms, which represents reducing levels of probability.

MOBILE AND IMMOBILE WATER STORE

Water storage must be divided in any capacity model to represent water changes in freely-draining soils. The division corresponds to soil water amounts for an entire root zone, being classified by function rather than by depth. Stores are therefore identified as containing mobile and immobile water. The definitions of these can be summarised as:

Mobile Water Store

This type of store has losses by evapotranspiration ETo and slow drainage, with drainage from maximum rooting depth occurring in prescribed amounts; and ETo

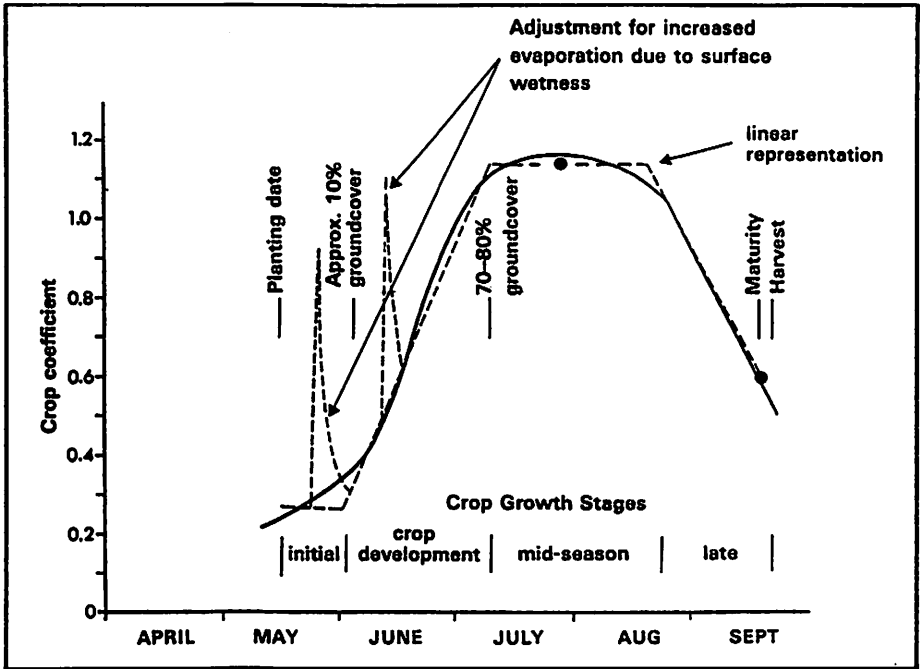
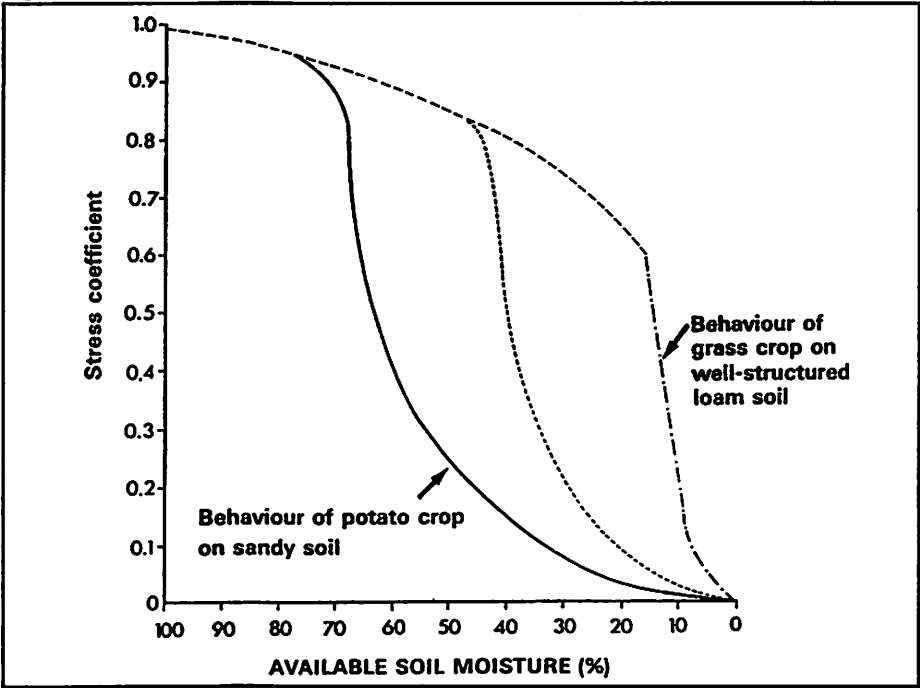


Figure 2a. - Variation of crop coefficient with time

Figure 2b. - Variation of soil stress co-efficient with available soil water



losses reducing slow drainage if crop cover is greater than 10%. If time since saturation is less than 3-6 days; the time since saturation must be recalculated whenever the mobile water store is partially re-filled; and bypass flow, beyond the root zone, occurs when 24 hour rainfall causes the mobile water store to overflow.

Immobile Water Store

Has ETo losses only; is filled first by rainfall; has the balance taken from it when ETo losses exceed drainage being

intercepted, with ETo losses applying to current rooting depth, depending on crop cover %; and has water availability for ETo depending on crop, current rooting depth and soil type.

Such concepts are needed, since, using the neutron meter to validate water balance predictions, necessarily includes changes in both stores. Losses of 18 mm from an immobile water store might be expected to trigger the need for irrigation to control common scab but accompanying losses from a mobile water store could be of almost comparable size.

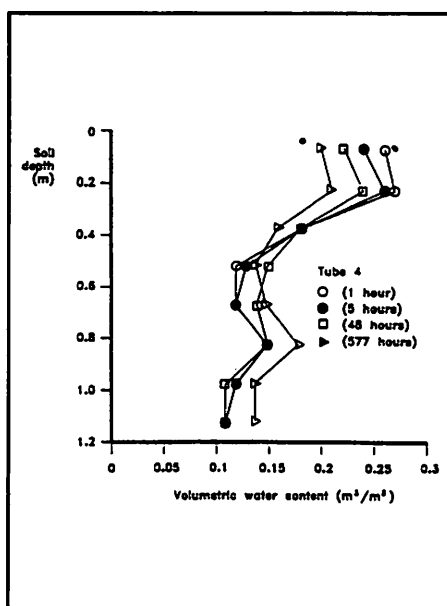


Figure 3. - Soil water changes during drainage of uncropped land

Neutron meter data from a PMB trial at Gleadthorpe Research Centre provided confirmation of the basic principles of our water balance calculations (Parkes et al, 1995). A typical drainage pattern for this uncropped sandlands site with cultivated loamy sand overlying brown sand is shown at Figure 3. This confirms existence of transient water storage, in the top soil to the subsoil, of approximately 3% volumetric water content for a period of 25 days after the land is thoroughly wetted. Soil water changes, occur to a greater degree as the result of root water uptake, which is illustrated in Figure 4. It is necessary to know this likely demand in order to calculate the amount of irrigated water required.

MEETING CUSTOMER REQUIREMENTS

Weekly contact with farmers over the growing season maintains a continuing focus for improvements to any scheduling and advisory service. For instance the wet spring of 1993 focused attention on our recommendations for additional nitrogen as a result of heavy rainfall between planting and tuber initiation and during 1993 and 1994, agronomy notes were incorporated with scheduling calculations, in order to improve coordination of potato crop inputs.

By 1994 we felt more confident in ranking priorities for watering of individual varieties. Positive feed back from growers confirmed that they would use these for blocking varieties of irrigated seed potato. The dry spring also provided greater debate over the need or otherwise for irrigation between emergence and tuber initiation. We needed to define the circumstances when irrigation was essential to the uptake of nitrogen to ensure maximum canopy development for greatest interception of solar radiation. It is this, rather than concern over water abstraction charges,

which appears most directly concern to growers.

CONCLUSIONS

In order to carry out successful irrigation scheduling there is a need to assess, collect and collated information concerning the soils, crops in the climatic conditions so that correct, practical and useful advice can be provided to the end user. It is also essential to know what the customer requires so that the advice provided is realistic thus enabling both grower and adviser to continuing dialogue over what represents best practice.

REFERENCES

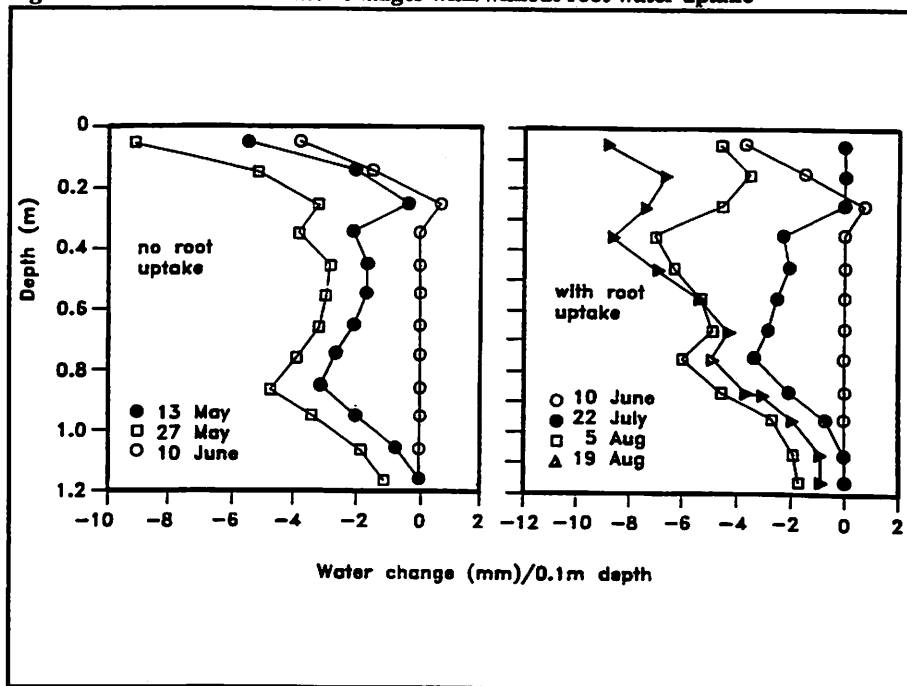
- Bibby J S, Douglas H A, Thomasson A J and Robertson J S 1982 Land capability classification for agriculture. Soil Survey of Scotland, Macaulay Institute, Aberdeen
- MAFF/Soil Survey 1984 Soil texture Leaflet No 895
- Hodgson J M 1976 Soil survey field handbook. Tech. Mono.No 5 Soil Survey, Harpenden
- Jensen M E, Wright J L and Pratt P J 1971 Estimating soil moisture depletion from climate, crop and soils data. Trans ASAE 14,954-59
- Parkes M E, Naysmith D B and McDowall M A 1989 Accounting for slow drainage and hysteresis in irrigation scheduling. Irrig Sci 10:124-7
- Parkes M E, Vinten A J A and Armstrong S 1994 Characterising slow drainage. Aspects of Applied Biology 38:279-294
- Parkes M E, Bailey R J, Williams D and Li Y 1995 An irrigation scheduling model combining mobile water changes. In press in "Proceedings of Workshop on Crop Water Models" of ICID 15th Congress, The Hague, September, 1994, Wageningen Press
- Penman H L 1963 Vegetation and hydrology. Comm. Bur. Soils, Harpenden, Tech. Com.53
- Schuh W M, Meyer R F, Sweeney M D and Gardner J C 1993 Spatial variation of root zone and shallow vadose-zone drainage on a loamy glacial till in a sub-humid climate. Journal of Hydrol 148:1-26.
- Thompson N Barrie I A and Ayles M 1981 The Meteorological Office Rainfall and Evaporation Calculation System: MORECS Hydrological Memo 45, Met Office, Bracknell

The Author is involved in providing Irrigation advice in Scotland and further information can be obtained by contacting him at:

Scottish Centre of Agricultural Engineering,
Scottish Agricultural College,
Bush Estate,
Penicuik,
Edinburgh
EH26 0PH

Tel: 0131 535 3000
Fax:0131 535 3070

Figure 4. - Measured soil water changes with/without root water uptake



WHO PAYS FOR THE MD'S PORSCHE?

G.F.D Wakeham

In the past we have been told that British industry has failed to retain its position in the world because it has failed to produce world class designs, its manufacturing investment is inadequate, management is living in the dark ages, marketing is run by the old boy network and the company is overrun by accountants. If industry puts in J.I.T., BS 5750, M.B.O., M.R.P., F.M.E.A., Q.F.D. etc., all will be right, but the evidence is that all may not be right.

Is the problem more simple? Are we missing some basic point? Do we know who pays for the managing director's Porsche? Without a true knowledge of what our costs are and where they are being incurred it is impossible to know what to sell, what price we can sell at, what to make in house or buy out or where to invest money. The designer is working at a major disadvantage and more than likely producing designs that are more expensive than necessary. Manufacturing goes blindly into the fray led by some brainless computer, unaware of how costs are being built up.

Is what we need a revolution in the costing department? The days of taking the material costs and multiplying by three or weighting the prototype and comparing it to the current product range should have passed. Computers may be mindless but they are very good at doing "sums".

Table 1. - Effects of Basic Costing Errors

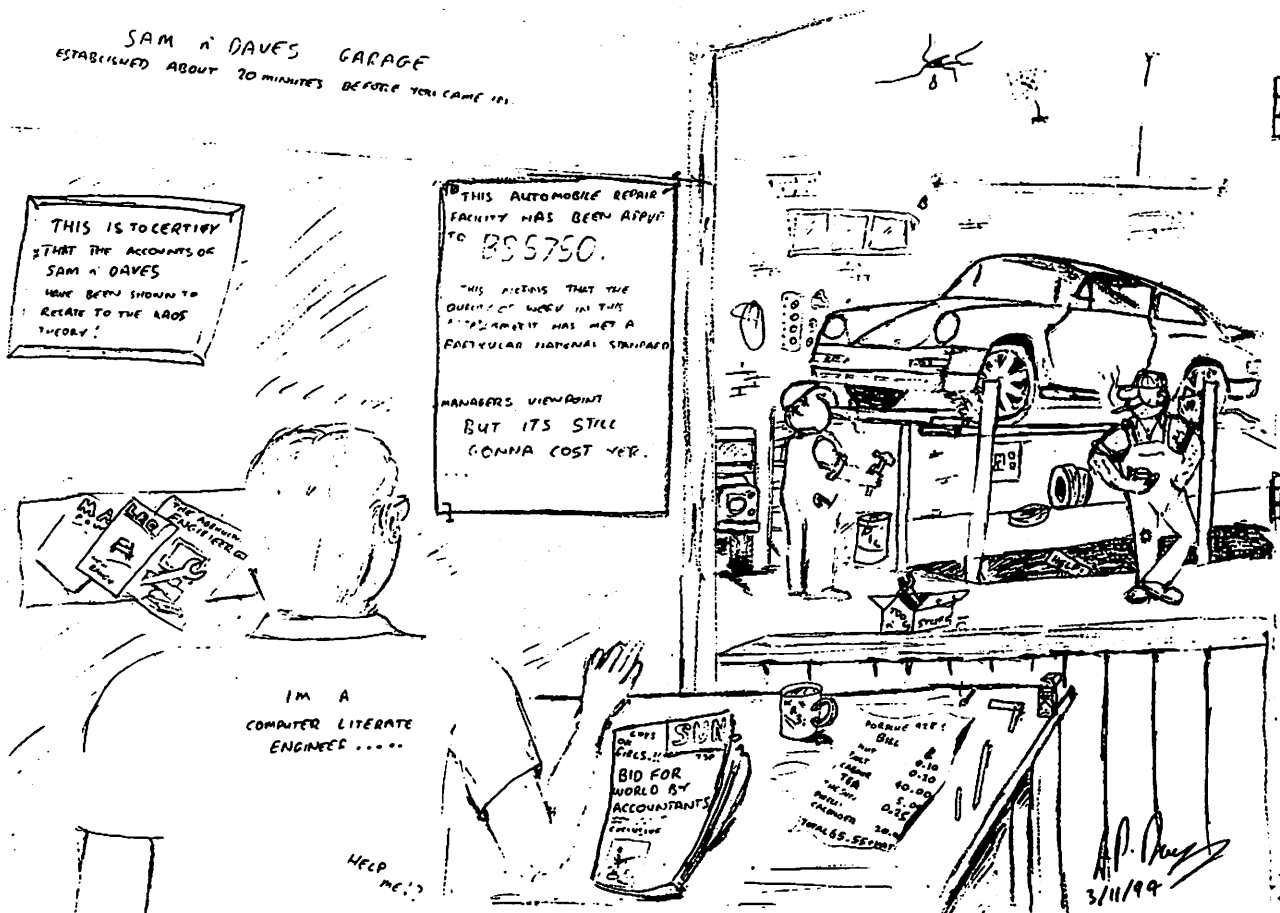
	Selling	Potential	Expected	Actual
ACTUAL WORLD	Price £	Sales day	Profit £	Profit £
Sugar at £1 true cost per unit	1.15	1000	150.00	150.00
Salt at £1 true cost per unit	1.15	1000	150.00	150.00
IMAGINED WORLD				
Sugar at £1.10 <u>indicated</u> cost	1.265	100	16.50	26.50
Salt at £0.90 <u>indicated</u> cost	1.035	1900	256.00	66.50

They do not forget and most competent engineers can build a costing system that can capitalise on the silly beast's strengths. With a long memory and the right in house software, a computer literate engineer should be able to tell you the effect of the current price changes of a pound of flesh on your cost of production in Venice.

Some would argue that as long as income exceeds outgoings then what does it matter. If costs start to exceed revenue from sales then cut costs. Down size, rationalize, stop investing, cut the operation by 10%.

What a super way to make a company grow. We don't know where the costs are incurred so the chances are that the profitable bits are cut and we retain the dross. The staff who have any market value will take the opportunity to take the money while it is there. At least the next time 10% is cut the chances are that all the good staff will have moved on and only dead wood will be lost.

Most companies must have a costing system, and few can be left with systems as described above, but are they designed to provide relevant information and is that information correct?



It might be worth looking at the effect of a weak costing system. Take two products selling against identical competition with a fixed total market. If all things are equal then our product should take half the market. If, however, there are price differences due to cost differences then the larger share of the market is likely to go to the cheaper product. If our costing system is wrong then our selling strategy will be wrong too.

Let's assume we make and sell sugar and salt and look at the effect of costing errors. Selling price will be all important as there is nothing else to choose between the product. Assume a profit of 15% over all indicated costs is all that can be added to get the selling price. Table 1 shows the possible effects on sales and profit of getting our costings wrong.

up their management time in a worthless enterprise, we will concentrate on where the money is." Suddenly we are half the size we were, the capital raised on the sale is lost in restructuring costs and the competition has sales and profits three times ours. They will use their strength to squeeze our sales of salt, invest in new plant when we cannot afford to and reduce us to supplying salt to the remains of our old market that is unaware of any alternative.

If this scenario seems unrealistic then why not look at the effect on buying policy. Everyone knows that one must not compare our total costs with the price of buying out when making a decision. You must remove non-works costs first then compare. This, however, gives a false comparison. It is easy to see that the costs of the

man, what is the relative capital cost between the two machines, how much floor space at £150/m² is required and have we got the highly paid staff to maintain and set up the more sophisticated machine. These costs are all covered in the £30 but this fails to differentiate between the two machines. We may make the wrong investment decisions.

To produce meaningful results costs must be ascribed to the correct unit of production. With direct labour being only 5-10% of production costs then piling all other costs on to a unit of labour would seem unreasonable. In modern production facilities it is the machine tools that do the work and it is the materials that demand space both for storage and transport round the works. It is space that requires lighting and heating, not the man.

Table 2. Traditional Labour Based System

LABOUR	POST PRODUCTION OVERHEADS	MACHINE TOOLS	MATERIALS (BASIC)
Direct Wages	Tax	Capital	Cost
Indirect Wages	Insurance & Legal Costs	Power	Scrap
Managerial Costs	Interest on Capital	Maintenance	Packaging
Welfare & Pensions			
Factory Space	Storage Costs		
Heat & Light	Office Costs		
Quality	Tooling		
Design & Dev.	Transport		

Table 2 and 3 show alternative areas for ascribing costs. If one of the prime cost centres is considered to be the machine tools, then hours worked per year by the individual machines become important as does capital but a blanket charge for large groups of production machines is not valid. By changing where costs are ascribed we get very different costs at different stages of production. This will lead to quite different decisions of what we make and how we make it.

If one takes the unit of labour as the sole carrier of costs as in the local garage then the distortion of the costing system is extreme as mentioned earlier. The example shown in Table 4 illustrates the point.

This shows little difference in production cost between the two situations and differences in scrap levels may determine investment policy. If, however, we use the local garage costing system of putting all the charges on to the labour we end up with a labour cost of approximately £27.50/hour and items made on machine 1 costing £27.50/8 = £3.44 and Machine 2 costing £27.50/1 = £27.50 each.

In the "actual world" where real costs and those used for pricing products are the same the profit expected is the profit realised. In the "imagined world" because we are working on erroneous costings we end up with small sales on sugar because we over price. Profit is in fact more than expected but unknown or of much value. Errors in costing of salt lead to a low selling price and the profit expected is not in practice realised.

Whatever the costing system it will soon be obvious that the cost of producing sugar has risen steeply and that it will be impossible to meet the demand for salt. The best action will be to stop production of sugar and borrow money to invest in new plant to make salt. Profit, however, is illusory and it will not be possible to service the loan. The only option is to sell out to the competition.

The alternative is to stick to selling our products at the same price as the competition. The accountant will soon say it is not worth producing sugar at such a poor return on capital and advise selling the plant to the competition. "Let them tie

buying department must be included in the bought out costs. (In fact, these may increase as you move from buying half a dozen types of steel to buying hundreds of different components). Remember it will still be necessary to pay the factory rent, heat and light the space, and service the capital. The goods inwards and stores will still cost. Maybe the only savings will be direct labour and material and direct machine running costs. When the economy picks up our subcontractor will no longer provide the service we need and we will no longer have the skills to bring the product back in house. For a false saving we have weakened our competitive position. An accurate and transparent costing system may have protected us from adopting an unsound buying policy.

Just to make the point let us look at a third area. If our costing system says labour costs £30/hr it must be cheaper to use a semi-automatic machine requiring only half a man over a machine that requires full time manning. If the two machines work at the same rate then costs will be halved. BUT will there be other work to do for the half a

The easy part of analysing a situation is to highlight the problems. It is far more difficult to clearly define what is wrong. If the problem can, in fact, be clearly defined then a solution is often easy.

The production of an accurate and usable costing system is hampered by:

- the size and complexity of the total production process,
- the fact that much of the data available is produced by and for accountants, and
- the tradition in many small companies of seeing labour or material as the core unit of cost.

The size of the problem may be reduced by thinking on the lines of cell manufacture and building up costs from small blocks of information.

The complexity may be handled by the ability of the computer to retain data and carry out large

Table 3. Alternative and More Valid System

LABOUR*	POST PRODUCTION (THE PRODUCT)	MANUFACTURING PROCESSES	MATERIAL INCLUDING PACKAGING
Direct wages	Tax	% Factory Space	% Factory Space
Welfare & Pensions	Insurance & Legal Costs	Heat & Light	Heat & Light
% Managerial Costs	Design & Development	Tooling	Buying
	% Marketing costs	Indirect Labour Costs	Storage
	% Managerial Costs	Capital	Transport
		Power	Capital
		Maintenance	Cost
		Scrap	
		Quality	
		% Managerial Costs	% Managerial Costs

*This cost is allocated to individual manufacturing processes.

Table 4. Machine Based Costing

	MACHINE 1	MACHINE 2
Value (CAPITAL)	50,000	10,000
Use/hour/yr	250	1,000
Labour Req'd.	½ man	1 man
Floor Space	15 m²	10 m²
Output	4/hour	1/hour
<u>Fixed costs</u>		
Capital charge	10,000	2,000
Rent & Rates	2,250	1,500
Heat & light	30	20
TOTAL FIXED COST	12,280	3,520
Fixed Cost per Running Hour	£49.12	£3.520
<u>Variable Costs/ HOUR</u>		
Management & Service Charge	5.00	5.00
Direct labour	2.50	5.00
Running charge	4.00	1.00
Maintenance	2.50	0.50
TOTAL VARIABLE	14.50	11.50
TOTAL COST/HR	£63.62	£15.02
COST/ITEM	£15.905	£15.02

numbers of calculations on that data. By building up the data over a period of time the value and accuracy of resulting information will be increased. As this data is built up the reliance on accounting information will be reduced.

Information regarding hours of use of various facilities may be derived from planning data. A more realistic estimation may be made by carrying out periodic Activity Sampling exercises. The most accurate alternative is to continuously log facility acreage but this is beyond most small companies.

This sounds all very easy but it is not. It requires time and effort and software developed to handle the available information and produce meaningful outputs. The software must be adaptable and easily updated. As long as the problem is contained within a manageable size it is time and commitment that are required rather than any great leaps of intellect. Once a local system is working it may be cloned and used as a building block to develop a full costing system for engineers.

When you have got this part of your business right you can then go on to deciding where efforts should be put to reduce costs and so increase profits. This is what business is about, quick fixes are not the answer. They need their own solutions not hand me downs from big business accountants.

The Author is a Senior Lecturer at Harper Adams Agricultural College, Newport, Shropshire. He is a senior member of the Engineering Department at the College and is a member of the Membership Committee of the Institution.

CONFERENCE INFORMATION

AWRA 1995 ANNUAL SUMMER SYMPOSIUM

The annual AWRA symposium for 1995 is to be held in Honolulu, Oahu, Hawaii from 25-28th June, 1995 and is entitled 'Water Resources and Environmental Hazards: Emphasis on Hydrologic and Cultural Insight in the Pacific Rim'

The main subject areas are:

Island hydrology
Natural hazards and hydrological consequences
Global change
International contrast and comparison
Coastal zone hydrology
Water management in coastal zones
Remote sensing and GIS modelling
Pacific rim regional hydrology
International treaties
Transboundary issues

The deadline for the submission of papers is 13th January, 1995. Papers, subject to acceptance, peer review, and editorial standards will be published in a Proceedings. Authors must submit three copies of their draft paper to the Program Technical Chairperson -

Raymond Herrmann
National Biological Survey
Colorado State University
Ft. Collins, CO 80523
(303) 491-7825

FIFTH INTERNATIONAL SYMPOSIUM ON LAND SUBSIDENCE

The Fifth International Symposium on Land Subsidence will take place in The Hague, Holland during 16-20th October, 1995. It is being organised by the International Association of Hydrological Science (IAHS) Commission on Ground Water, Netherlands Geodetic Commission (NGC) and the United Nations Educational, Scientific and Cultural Organisation (UNESCO) IHP-IV Working Group on Land Subsidence.

Information can be obtained from -

F.H. Schröder, Secretariat FISOL 95,
c/o Netherlands Geodetic Commission,
P.O. Box 5030, NL-2600 Delft
The Netherlands
Tel 31-15-782819

CORSET SYMPOSIUM 1995

The Fifth International Symposium and Field Seminar organised by the International Research and Application Center for Corset Water Resources will be in Antalya, Turkey from 10-20th September, 1995 and is entitled 'Corset Waters and Environmental Impacts'

Details from - Prof.Dr. Gültkin Günay
Corset Symposium '95
P.O. Box 357 Kizilay, 06420 Ankara
Turkey Tel: (312) 235 2543

UTILITY TECH 95

The United Kingdom Society for Technology and Institution of Water and Environmental Management is organising a conference and exhibition to focus on the interaction of Legislation, the Environment and Trenchless Technology from 6-7th June, 1995 to be held at Chateau Impney, Droitwich Spa, Worcestershire.

The organisers consider that 1995 will be a significant year in the UK and this conference will be an ideal opportunity to consider and discuss early experience of the New Roads and Street Works Act 1991. The first tranche of secondary legislation under the Act will have been effective for more than a year. The future pattern of Local Authorities in the UK will be discernible and the initial spate of EU Environmental Directives will have been digested. This conference will be an excellent forum for discussion of the interaction of these circumstances and policy changes of many organisations arising from them.

For further information contact -

Joan Carey
UKSTT, Department of Civil Engineering
UMIST
P.O. Box 88
Manchester
M60 1QD
Tel: 0161 200 4608

AMENITY & ECOLOGICAL ENGINEER SPECIALIST GROUP

Engineering Progress in Sports Turf Maintenance Seminar

The expansion of outdoor sports/leisure facilities and increasing pressure on existing facilities to maximise their use, has resulted in the machinery industry responding to the demands of the amenity market. This seminar's aim is to examine some aspects of turf management machinery. Experts will review:

- (i) Compaction relief is essential for aeration and drainage, being a problem if the playing surface is to be maintained. Performance of various alternative machines will be considered.
- (ii) Spraying application innovations to meet health and safety will be considered with performance assessment of systems.
- (iii) Environmental concerns like noise and phytotoxicity are important considerations in selecting and managing maintenance machinery. The response to these and other such concerns will be reviewed.

INSTITUTION OF AGRICULTURAL ENGINEERS AMENITY & ECOLOGICAL ENGINEERING SPECIALIST GROUP

Symposium

ENGINEERING PROGRESS IN SPORTS TURF MAINTENANCE

Hotel St. George, Harrogate
Thursday, 26th January, 1995 from 2.00 - 5.00 pm
in conjunction with the British & International Golf Greenkeepers
Association (BIGGA) Turf Management Exhibition

FEATURING

The path to environment-friendlier turf equipment
Sprayer developments for the turf industry
Relieving compaction beneath fine turf surfaces

Marvin Jaques; Ransome
Bill Oliver; Hardi Ltd
David Jenkins; Charterhouse

Fees (including tea)

IagRE & BIGGA Members £12.00 + VAT

Non-members £20.00 + VAT

Further information: John Gowing, Dept. Agricultural & Environmental Science,
King George VI Building, Newcastle upon Tyne. NE1 7RU Tel: 0191 222 6811

INSTITUTION OF AGRICULTURAL ENGINEERS

1995 SCOTTISH BRANCH CONFERENCE

AGRICULTURAL ENGINEERING TOWARD 2000 AND BEYOND

Wednesday, 22nd February, 1995

at 10.00 am

Isle of Skye Hotel, 18 Dundee Road, Perth. PH2 7AB

FEATURES

Machinery Directives
Bio Degradable Oils
Future of Fixed Equipment for Crop Handling
Information Technology in Arable Farming
Future Procurement of Equipment
Future Developments in Tractor/Machinery Dealerships

Paul Makin; Consultant to G.E.N.
Roger Davies; Shell Oils
Rod Herbert; R.J. Herbert Engineering Ltd
Simon Blackmore; Silsoe College
Stewart Elder; Bank of Scotland
John Cameron; Balbuthie, Fife Tractors

Fees (including lunch)

Members £38.00

Non-members £49.50

Retired member £28.00

Student £7.00

Supper at 7.00 p.m. £12.50

Information from:

G. Freedman, c/o Forestry Commission, 231 Corstorphine Road, Edinburgh. EH12 7AT

Tel: 0131 334 0303

Fax: 0131 334 0498

INSTITUTION OF AGRICULTURAL ENGINEERS

Conference AGM & Annual Dinner

PRODUCTION AND PROCESSING OF CROPS FOR INDUSTRY

Tuesday 16th May, 1995

Silsoe College, Silsoe, Bedford

Currently there is much interest in producing new crops for industrial use and in finding non-food uses for existing crops. This interest has been stimulated by the food surpluses in the developed world which have led to set-aside, and to increasing consumer demand for "green" products and processes. The conference will provide a platform for experts in the production and processing of crops for fuels or industrial feedstocks to illustrate the latest technology developed for these areas, and will encourage discussion on the way forward.

After the conference, the Institution will hold its AGM, Annual Dinner and Awards ceremony.

For further details, contact: Yvonne Miles, Institution of Agricultural Engineers, West End Road, Silsoe, Bedford. MK45 4DU
Tel: 01525 861096 Fax: 01525 861660

BOOK REVIEWS

AN ENGINEERING TEXTBOOK FOR STUDENTS

by C.J. Studman

Today, textbooks on most subjects areas involving Agricultural Engineers can usually be found. However, there has not been a textbook for students majoring in Agriculture or Horticulture, who are taking only one paper in engineering as part of their course? Often these students have a relatively poor physical science background, yet most Agricultural Engineering textbooks assume at least a basic understanding of physics principles.

A book published in New Zealand in 1990 attempts to deal with this problem by giving a broad overview of Agricultural Engineering. It starts with basic physical principles and moves into a series of specific topics which give a broad overview of the subject. The book, Agricultural and Horticultural Engineering, contains worked examples of problems, as well as a set of questions, which can be used as assignments.

Chapters include an overview of the Engineering approach to problems such as;

surveying;

basic mechanics and physics, presented in a novel fashion using the idea of equations as simplified models of the real world (which in the end is all they are, of course);

workshop methods;

a major section on water supplies, which includes trickle irrigation systems;

a section on basic electronics, with an inevitably dated section on computers; and

followed by chapters on:

power systems,
buildings,
fencing,
milking machines,
post-harvest systems, and
the environment.

At a first glance the absence of farm machinery and tractors as specific topic seems a major oversight; however, for the agriculturalist or horticulturalist these topics are well covered elsewhere.

This book attempts to solve the problem of a textbook for those first year agricultural or horticultural students majoring in areas other than engineering.

"Agricultural and Horticultural Engineering: principles, models, systems, techniques" is

Published by:

Butterworths,
Wellington 1990
500 pages,
ISBN 0 409 604690

ALTERNATIVES TO BATTERY CAGES

In Switzerland the use of battery cages for the keeping of laying hens has been forbidden by law under the Swiss Animal Protection Act 1981. After a transitional period, which expired on 1st January 1992, the ban on this method of keeping hens has now been totally implemented.

The Swiss Society for the Protection of Animals' poultry working group along with other poultry experts and scientists has issued a brand new report entitled "Laying Hens - 12 years experience with new husbandry systems in Switzerland". The report summarises the results of the change in the housing of laying hens systems in that allow appropriate behaviour to occur.

The press notice claims that the alternative systems have shown good results and that all aspects of the problem (legal, ethological, veterinary medical and technical) are discussed carefully in the report.

A letter sent with the report states that the Society regrets that at an international level there has been a conscious or unconscious failure to take note of the successful hen husbandry methods practised in Switzerland; and it also claims that research being carried out elsewhere is now starting where their Society started 30 years ago. This, they say, has induced them to produce this report setting out their experiences in the hope that they will finally bring about a worldwide ban on the practice of keeping hens in battery cages.

Copies of the report can be obtained for Sfr 15. from:

Schweizer Tierschutz STS,
Birsfelderstr. 45,
CH-4052 Basel,
Switzerland
Tel: 061 311 2110
Fax: 061 311 2201

INTELLECTUAL PROPERTY RIGHTS FOR ENGINEERS - THE LEGAL PROTECTION OF INNOVATION

By Vivien Irish

Engineers are essential remunerated to innovate, that is to create intellectual property, which will result in saleable goods and services. If the innovator and/or his employer are to continue their professional activities they must, therefore, ensure that their intellectual property rights are

protected so they can be profitably exploited and their misuse by competitors prevented.

The author feels strongly that the protection of intellectual property rights should not be left to experts such as lawyers who swim comfortably in the turbulent sea of patent law but believes that it is essential that engineers should have some knowledge of how their intellectual labours should be protected and rewarded.

"Intellectual Property Rights for Engineers" was published in 1994. It provides comprehensive chapters on:

copyright,
rights of design,
patents,
confidential information, and
trademarks.

There are subsequent chapters on the ownership of intellectual property and the rights of employees. This latter topic should be worthy of careful consideration by all young engineers.

The chapter on the Effects of the European Community was new to me. In the early days of the EC register rights were regarded with strong disfavour as they restricted cross-border trade.

This attitude has changed in recent years because while it is sometimes decided that an agreement is anti-competitive it is permitted because the effect will be to promote innovation within the EC.

The final two chapters are concerned with Licensing and Litigation and The Management of Intellectual Property.

The need for careful consideration before new work is undertaken is emphasised in terms of, if technically successful will it be so economically and is it already available. It is pointed out that only about 0.1% of patents generate any significant revenue and the UK Patent Office estimates in 1992 that European Companies wasted nearly £55 million each day on repeat work, the results being already available; furthermore 1 in 3 research projects were a repeat.

I strongly recommend that a copy of this book is available to every professional engineer. I would have greatly benefitted from it at every stage of my career.

The book costs £20.00 and is published by:

The Institution of Electrical Engineers,
PO Box 96,
Stevenage,
Herts. SG1 2SD

Review author - D.S. Boyce.

TRAINING

CPD

The Institution of Electronics and Electrical Incorporated Engineers has a brochure on short courses for Continuing Professional Development. They are under the following broad subject areas:

Technical Management
Electromagnetic Compatibility
Control, Communications and Data
Electrical Installation
Health and Safety
Personal Effectiveness

Members can attend any of these courses at members rates by quoting their institution name and membership number. Information from Donald Higham, Savoy Hill House, Savoy Hill, London. WC2R 0BS Tel: 0171-836 3357

BS EN ISO 9000 QUALITY SYSTEMS

More businesses are discovering that effective quality management improves efficiency and reduces costs, leading to increased profits and customer satisfaction.

Implementing quality, demands the commitment of staff at every level, and to be committed they must be trained.

The British Standards Institution (BSI) developed the internationally recognised quality standard BS EN ISO 9000 (formerly BS5750) together with the independent assessment and registration schemes. BSI International Training are able to guide those involved through the standards requirements.

They offer a range of courses to help businesses obtain the quality skills needed, from a general overview to in-depth workshops on 'Investors in People'. These courses combine tuition with practical role playing.

All courses can be tailored to individual requirements. The programme can be adapted to specific businesses or training needs and held at any business premises or chosen venue. The current training programme provides courses in:

Executive Briefing
Quality Systems Certification
Auditing to BS EN ISO 9000

Quality Systems Documentation
Internal Auditing
Assessor/Lead assessor Training
Preparing for Assessment
Small Firms

For information contact - BSI International Training, Talon House, Presley Way, Crownhill, Milton Keynes. MK8 0EE Tel: 01908 220908

SEE DIPLOMA IN ENGINEERING MANAGEMENT (DAM)

The Institution of Incorporated Executive Engineers is administering a number of courses for a Diploma in Engineering Management. The courses are offered at Colleges around the country, full-time at Greenwich University and part-time elsewhere and the course is also available by Distance Learning. Entry is via an HNC in engineering although there is also a Mature Candidate entry.

For further information contact D.J. Dacum, The Institution of Incorporated Executive Engineers, Wix Hill House, West Horsley, Surrey. KT24 6DZ Tel: 01483 222383

BRANCH DIARY

East Midlands Branch

8.00 pm, 23rd January, 1995

Landrover Products Design and Development, Powertrain Div, Rover Group, Willoughby Hotel, Nether Broughton, Leics.

7.30 pm, 21st February, 1995

Developments in Crop Storage Technologies, Farm Electric/Rekord Farm Machinery, Kings Hotel, Grantham.

Provisional

8.00 pm, 17th March, 1995

AGM, The Red House, Kelham, Notts.

South East Midlands Branch

7.30 pm, Monday 9th January, 1995

Research in Agricultural Engineering - Short PhD research presentation from Silsoe College and Silsoe Research Institute at Silsoe College.

7.30 pm, Monday 6th February, 1995

CFD - Tool for Research; Mr B. Harrall, Silsoe Research Institute at Silsoe College.

7.00 pm, Monday 6th March, 1995

AGM followed by Satellite Imagery
Dr J. Taylor, Silsoe College at Silsoe College.

7.30 pm, Monday 24th April, 1995

Turbochargers for Diesel Engines, B. Walsham, Holset Engineering Co. at Silsoe College.

7.30 pm, Friday 16th June, 1995

Social evening to be arranged.

June/July 1995 details to be arranged

Technical visit to a Shanks & McEwan site.

For further information contact D.B. Tinker, Silsoe Research Institute. Tel: 01525 860000

Southern Branch

2.00 pm, 15th February, 1995

Performance requirements of lubricants in agriculture, Pyromanias Exxon Chemical Technology Centre, Milton, Abingdon, Oxon. Visit restricted to 20. Pre-book through Hon. Secretary.

7.00 pm, 8th March, 1995

AGM followed at 7.30 pm by an after dinner address. Details to be advised.

7.30 pm, 5th April, 1995

The operation of the UK's largest combine hire fleet and direct selling operations, Philip Steam, Agricultural Plant Hire, Peterborough at Rycotewood College

7.00 pm, 17th May, 1995

Setting up an American Style golf club
Martin Jones, Head Greenkeeper, Oxfordshire Golf Club at The Clubhouse, Oxfordshire Golf Club, Thame, Oxon.

Information from: Hon. Secretary, O. Statham, Potato Marketing Board Tel: 01865 714455.

West Midlands Branch

8.00 pm, Monday 9th January

N.J. Froment PTO Dynamometers

Mr. K. Sewter,

Sales Director,

M.F. Training School, Stareton, Stoneleigh.

8.00 pm, Monday 13th February

Agricultural Engineering in the 3rd World

Mr. Derek Sutton,

Silsoe Research Institute, Top Barn Farm, Holt Heath, Worcs.

7.15 pm, Monday 13th March

AGM followed at 8.15 pm

The History of Bomford & Evershed Products

Mr. John V. Fox,

Bomford Turner, Salford Priors, Evesham

7.00 pm, Monday 10th April

Visit to Horticultural Research International
Dr. Chris Woods, Wellesbourne, Warwick.

11.00 am, Sunday 11th June

Tour & Bar-B-Q at Warwickshire College
Moreton Hall, Moreton Morrell, Warwick

Information from: Neil Sparey, Oak Barn, Clifton-on-Teme, Worcs. WR6 6EN.
Tel: 01886 812378

DIARY OF EVENTS

2nd-7th January, 1995

Holland Agro Exhibition 95, Amsterdam RAI.
Organised by Agricultural Equipment Federation

6th-8th January, 1995

9th National Conference on Organic Food Production Food, Health and the Environment at Royal Agricultural College, Cirencester, Glos.
Organised by British Organic Farmers/Organic Growers association
Details from The Conference Organiser, 86 Colston Street, Bristol BS1 5BB Tel: 01272 299666

23rd-26th January 1995

Garden Trade Fair, VTB, RAI Gebouw BV, Europaplein, 1078 GZ Amsterdam. Tel: (020) 5491212

31st January, 1995

Sylvanus P. Thompson Lecture.
Computer Fraud and Misuse - Chris Cook, National Computer Centre.
6.30 - 7.30 pm at Red Lecture Theatre, Octagon Building, Staffordshire University, Beaconsfield, Stafford.
Organised by The Institution of Mechanical Engineers and The Institution of Electrical Engineers. Contact: Craig Pointon Tel: 01782 399955 or 01785 275364

8th-9th February, 1995

Grain '95, National Agricultural Centre, Stoneleigh Park
For further information contact Jayne Spence, RASE, National Agricultural Centre, Stoneleigh Park, Warwickshire. CV8 2LZ Tel: 01203 696969

26th February - 2nd March, 1995

SIMA '95 - The International Agribusiness Show, Paris-Nord Exhibition Centre, Paris
For further information contact: Promosalons (UK) Ltd, The Colonnades, 82 Bishops Bridge Road, London. W2 6BB Tel: 0171-221 3660

28th March - 1st April, 1995

16th International Agricultural and Agricultural Machinery Exhibition Agro+Mashepo: Budapest, Hungary.
Details from Clare Taylor, London Chamber of Commerce and Industry, Europe House, World Trade Centre, London. E1 9AA Tel: 0171-488 3399

5th-6th April, 1995

Muck '95 - Theme "Make the Most of It" National Agricultural Centre, Stoneleigh Park. Organised by Royal Agricultural Society of England and ADAS in association with What's New in Farming and supported by NRA.
For further information contact: RASE, National Agricultural Centre, Stoneleigh Park, Warwickshire. CV8 2LZ Tel: 01203 696969

4th-8th April, 1995

R.D.B.A. Spring Tour 1995 Brittany, France
For further information contact: Sir Pat Astley-Cooper, National Secretary, Rural Design and Building Association, Stoneleigh, Kenilworth, Warwickshire. CV8 2LG Tel: 01203 696525

16th May, 1995

Production and Processing of Crops for Industry.
Institution of Agricultural Engineers Conference, AGM and Annual Dinner, at Silsoe College. Contact Yvonne Miles, 01525 861096.

14th-15th June, 1995

Cereal '95 - Theme "Efficiency through effective management"
Shuttleworth, Old Warden Park.
Organised by Royal Agricultural Society of England, ADAS, Home Grown Cereals Authority and East of England Agricultural Society, in association with Farmers Weekly and sponsored by Lloyds Bank.
For further information contact: RASE, National Agricultural Centre, Stoneleigh Park, Warwickshire. CV8 2LZ Tel: 01203 696969

4th-11th June, 1995

International Workshop on Soil Conservation Extension: Concepts, Strategies, Implementation and Adoption
Chiangmai, Thailand
Organised by Soil and Water Conservation Society of Thailand, Department of Land Development and The International Board for Soil Research and Management. Details from Mr. Sompong Theerawong, Department of Land Development, Paholyothin Road, Bangkok 10900, Thailand. Tel: 66-2-5611954

20th - 23rd September, 1995

Agricultural & Biological Engineering: New Horizons - New Challenges.
International conference at Newcastle University. Details from: Marion Turner Tel: 0191 222 6891.

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Details from:

Marion Turner, Conference Secretariat,
Faculty of Agriculture & Biological Sciences,
Agriculture Building, University of Newcastle,
Newcastle upon Tyne. NE1 7RU, UK
Tel: 0191 222 6891 Fax: 0191 222 6720

agricultural engineer

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