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Conclusions

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When I hear such a range of papers I am always surprised at what my engineering colleagues get up to in their working lives.

Now probably the best definition of civil engineering ever given was Thomas Tredgold's "the art of directing the great sources of power in nature for the use and convenience of man".

Now civil engineering undoubtedly started as construction engineering - the rational analysing and solving of practical problems. It is still true that the ability to construct what is conceived, to be a good contractor, is the core of an engineer's art. Being able to predict physical performance by the use of science came later but it is these two areas of knowledge which enable us to think out what we wish to build before we start to do it - which of course is design.

Now to be responsible for the execution of a project is an immense responsibility since all problems are multifaceted. You have to inter-manipulate between the restraints of climate, site conditions, labour, materials and so on. Often nowadays some of these restraints are extreme because the mineral resources now available are in extreme conditions like the artic, deep offshore - or because the underdeveloped country is underdeveloped because physical or political problems are so acute.

But it is also true that it is from extreme conditions that answers are produced which are relevant to all situations and I presume this is why this subject was chosen.

The papers you have heard can only touch a small area of this vast field yet all fit clearly in this thread.

The paper on the building of the station on the Matterhorn, with its problems of materials' transportation and climatic change effecting the construction programme and the design; the techniques used to construct Sidehill bridge and the Azergnes bridge are reactions to specific local problems as is the technique developed for installing prestressing tubes during slip forming operations during construction of Cormorant A oil production platform. The paper on how the climatic conditions affect concrete, not only "as placed" but also the monitoring samples, in Jeddah continues the work done by Portland Cement Association as well as others. The paper on bridges in the South Pacific area is broader and relates to

the problems of an underdeveloped area. The one on airport construction in Zaire covers the logistics of planning a very large scale project. The final one on the physiological problems of workers in the deep gold mines in South Africa I found fascinating as it directly relates to the human problems we have to deal with - and which we perhaps do not discuss enough in IABSE.

Yet there is need for much more sharing of information - many more papers - and I hope you will all re-read the excellent papers of Prof Mahmood and David Osborne-Moss and see if you can enlarge our knowledge.

Man's needs are constantly changing. Since the use of energy is probably an indication of the living standards people aspire to they are worth considering.

Using the World Bank classification, the non-communist industrialised countries include only 16 per cent of the world population but consume 57 per cent of the total energy whilst producing only 37 per cent.

The centrally planned economies (including China) comprise 31 per cent of the world population and they use and produce almost the same percentage of total energy.

The developing group of countries, who form more than half the world population, consume less than $^{1}/_{6}$th of the total commercial energy which not only gives an indication of the development of new sources of power we require but also reflects the enormous rise in all of the services of modern society which countries aspire to. If we fail to try to satisfy then we will have increasing conflict and civil engineering, like other disciplines, must combat this. The world is knee deep in civil engineering problems and all we need are people willing to pick them up.

My disappointment with this session is not with the papers we have received but with the ones we have not had. Prof Mahmood's paper asks for those studies, which some engineers must be doing, which relate to the organisation of construction in developing countries. If IABSE does not contain these engineers it will decline because it is in the third world that the innovative engineering should come.

Finally we have all enjoyed being in Vienna. You will doubtless have visited the Loretto Chapel in the Augustinerkirche next to the Hofburg and seen the fifty or so silver urns containing the hearts of the Hapsburgs. I think part of our hearts too will remain in this beautiful city.