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## To Build in Developing Countries

Construire dans les pays en développement

Konstruieren in Entwicklungsländern

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The majority of the construction work which has to be done in a country can best be done by local firms. Building is a rather intensive labor activity; the greater part of the materials, at least in weight, has to be found locally too. Only when there is an insufficiency in required capacity, consulting and/or construction companies from elsewhere have to be called in and someone has to pay the extra cost for that.

The insufficiency can be in technical know how, quality wise or quantity wise, but also in organizational or managerial know how. The insufficiency must also be a temporary one. It may last only until the education schemes in the country have been completed and the various schools have produced a sufficient number of skilled and professional people.

What always will happen in a country where development has started is that for some decades a demand has to be satisfied, which is greater than the corresponding one at the time when the economy will have reached the new equilibrium. It does not seem wise for a government to create a national production capacity large enough to satisfy both the normal and the temporary extra demand. It will be more appropriate to buy most of the needed extra capacity, both in design and in construction, from countries which are ahead in development and where the economy has stabilized. Most of these countries will have spare capacity available.

It is too general to speak about the needs of developing countries and the ways these needs can be met, without making a more detailed distinction. The picture is changing with the sequential phases of development. In heavily populated countries other solutions have to be chosen than those in nations where the popula-

tion is thin and scattered. Some countries have strong economic resources of their own - like the oil countries at the moment - and can pay their own development. Others have to rely on foreign aid, which will lead to a different approach.

Every human being, and structural engineers are no exception, is far stronger linked to his own limited experiences than he realizes. When we start a design or construction, we think that we are listing all the assumptions in the first phase. However, most of these assumptions are made subconsciously without noticing them. That is the reason why extrapolations so often lead to the wrong results, such as extrapolations into another size (enlargements); into another type of loading (e.g. dynamic); climate; aggregate; but also into another culture where people have a different way and appreciation of life.

The wrong results can be disastrous. Some examples of note: Firth of Forth; unliveable housing; unnecessary damage due to earthquakes; concrete deteriorating due to the chemical composition of the ground water or the aggregates used; plastic sewer pipes collapsing due to the permanent high temperature of the disposal. And how often has an exported design or method of execution proven to be very uneconomical in the circumstances, which differ from those it was originally meant for.

What I am advocating is that building elsewhere, which means outside the borders of your education, your experience, the society you come from, is only possible for people with a talent for imaginative analysis. You have to be a lot more fundamental than you are used to being in the familiar circumstances back home. If a task abroad is given to you, try not to remain a visitor, but go to stay and live there. Feel the hot sun, dig in the earth, swim in the water, look and listen. Try to understand why things are as they are, why people live in the way they do, why, why, why. Not until you combine understanding and, I repeat, imagination, with the know how and expertise you carried from home, will you be able to arrive at sensible solutions in your work.

An example may be illustrative. In a poor country with a dense population a low-cost housing scheme has to be executed. The answer must show very simple types of buildings, fully made with local materials and nearly all the work to be done by hand. The layout may differ from the traditional ones, but not too much, and the differences have to be clear and necessary improvements. Water, sewer systems and electricity are of course a must.

Now such a housing scheme has to be realized in a rich oil country. There are no local materials available except water, aggregates, some cement and some steel. There is no skilled local labor or staff to speak of. So an important part of the materials and all the staff and labor must be imported. Now, these people have to live, which means you must provide for them temporary housing, transportation, recreation, schools for the children, medical care and leave arrangements. Also materials have to be transported, which means waiting ships in congested harbors, traffic jams, overloaded roads. There is also the problem of insufficient communication such as telex and telephone. And so on. Problems and costs.

The consequence of these considerations must be a design which asks a minimum of manpower, both staff and labor, on the spot, and a short construction time. The fewer manhours, the fewer the problems. The production methods, if reliable may be very much advanced and sophisticated. The equipment may be heavy and expensive. The materials to be imported may be of first quality and not necessarily cheap, but both volume and weight must be minimized.

The author happens to live and work in such a developing oil country. He is confronted daily with the unforeseen problems. He can demonstrate with many examples how good intentions from elsewhere work out wrongly in the circumstances on the spot.

When some years ago the governments in the Middle East called in architects and consulting engineers and formulated their wishes, they often had been misunderstood. What the client asked was often something which could at least be compared with the best in the world. With some exaggeration: It had to be the biggest, most luxurious, most spectacular, most advanced etc. of its kind in the world. Maybe it was said or only implied. At least the architect understood it in that way, and his fantasy started to work. Indeed, very spectacular buildings appeared on paper and in maquette. Wonderful designs, which made everybody enthusiastic. Why are these proposals made and sometimes even realized in a developing country and not in the industrialized Western world with their abundance of professional know how and high GNP per capita? The industrialized countries could more easily afford to do so than countries in progress, but usually they don't, and why not? Not because there is a lack of imagination or courage, but because clients and their experts know that infrastructural and building works in the first place have to be functional, which means fit for their economic purpose. This does not mean that fantasy and good taste do not play a role, but the whole has to be an harmonious answer to the different, often conflicting requirements, of which costs is not the least important.

When something will not be built in the industrialized part of the world because it is too expensive, it makes no sense to realise it in an oil country, for in the difficult circumstances of a booming economy in a country with an incompletely infrastructure, the costs will be magnified several times. The extraordinary design always will mean more manhours, more difficult details, more quality control, more supervision, more engineering, longer erection time. All these extras have to be done by expensive, imported specialists, laborers, supervisionary and staff personnel.

The only good solution is a structure of good quality in all aspects, which can be built by a relatively small labor force in a relatively short period of time.

What has been said about the architecture and the type of building also holds for the choice of materials. Good quality yes, but no exaggeration. Don't specify rare materials with a long delivery time. Often something goes wrong on the long and vulnerable routes. Then replacement must not be too difficult.

In most countries-under-way, good maintenance is nearly unknown. There is always a lack of skilled mechanics and laborers for that kind of work. But also the population must learn to make good use - which means maintenance - of the newly acquired things. This takes time. It must grow into the habits and even into the culture. The lesson from this fact is that such structures, installations and materials must be chosen which require an absolute minimum of maintenance work.

For construction companies, the accent on their different activities moves when they start to work in a developing country. When we leave out the commercial part, then in the homeland the accent is fully on the organization and the technique of the execution itself. But when you have the construction sites far from



home and difficult to reach, the major attention must be concentrated on the logistics of the operation. That is the art and science of having the different kinds of people, equipment and materials at the correct times, in the correct numbers and quantities at the correct places, which is easier said than done. In addition to that, what do you think about personnel policy and handling, financing, insurance, and guarantees?

In this short article, a few of the many problems have been indicated, which will be met when specialists of building, architects, structural engineers or construction firms from industrialized countries have to come to work in a developing country.

To conclude, I want to give the following reflection:

In our diversified human society, the tasks are distributed over all kinds of specialists: housewives, farmers, carpenters, draftsmen, physicians, clergymen, etc., etc. Everybody fulfills minor detail tasks, sometimes in part directly for himself but for the major part, in exchange for services he needs which are rendered to him by hundreds of other specialists: i.e. housing, clothing, food, education, transportation, information, etc. When a structural engineer starts to work for, or even to live in, a developing country, the relation between the individual and the society remains the same in principle. But the circumstances are different. Think of religion, culture, habits, feelings and language. We are invited to come because of your profession and skill and you will be a contracted party. However, you are also a guest and have to behave as such. If you do, you will be working for a nation in progress, which can be most inspiring and rewarding.