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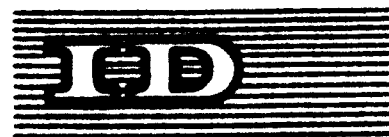
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THE INSTITUTE FOR COASTAL ENGINEERING LTD. ^{1/}

by

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SUMMARY

In the creation of the Institute for Coastal Engineering we have an excellent example of a concept visualized within a university framework and finally attaining the status of a national project of economic importance. We can summarize this development as follows. Members of the Civil Engineering Faculty created a coastal model and wave generator primarily for instructional purposes. The State of Israel needed model studies in many areas for coastal development, necessitating expenditures of hard-to-get foreign exchange. A university professor tied these things together by conceiving of a national research center for coastal engineering. The ability of the University and its Research and Development Foundation to carry out research projects in this area was demonstrated. A company was then formed by the University's Research and Development Foundation and that department of the Government which would be the principal client for its services, namely the Harbours Authority. The creation of the company and the concomitant investment of capital funds has enabled both the construction of new and improved facilities for coastal engineering and the training and concentration of manpower to undertake the necessary national development projects in that field. The Company will operate in every sense as a business.

INTRODUCTION

The Technion Research & Development Foundation is the group responsible for sponsored research at the Technion - Israel Institute of Technology. Since 90% of its contracts involve applied science, the Foundation can be classified as an Industrial Research Institute. In fact we are members of the World Association of Industrial and Technological Research Organizations (WAITRO).

Technion Research & Development Foundation operates on two fronts. Research projects are requested by companies or government agencies. Faculty members with the approval of their Deans and usually by way of the appropriate Research Centres are approached. When full agreement is achieved a contract is written and signed by the foundation with the sponsoring body. The same is true for consulting activities. It then administers the carrying out of the project.

The Foundation also owns and operates its own industrial service laboratories. These are created when a need is felt somewhere in the economic structure of Israel, and when one or more members of a faculty respond to that need. Such units usually do testing and "trouble-shooting" as well as research and consultation (1). This testing is only performed at the Foundation if there is no other group in Israel, private or otherwise, capable of rendering this service. Should laboratories fail to fulfill this function so that their existence becomes unnecessary, they are closed. Despite Parkinson's law, this has been done. We have had as many as 12 units. Four have been closed. This paper describes the creation of a ninth, the Institute for Coastal Engineering. It differs from most of our other service units in that it is truly a national project. A partner both in investment and operation is the Harbours Authority of the Ministry of Transportation. (We are responsible for two other units in which Government bodies are involved in their operation - the Israel Institute of Metals and the Road Safety Centre.) According to an ESCAP report (2), we are one of only three Industrial Research Institutes in the world which have a close working relationship with a University. The following report will show how this actually functions in one particular case.

A striking feature of the geography of Israel is its long coastline - both in the Mediterranean Sea and the Gulf of Eilat. Its proper development is of vital importance to the country. Natural resources are very limited. Therefore Israel is dependent both on its imports and on its exports. Much of the sand that is used for building construction comes from areas bordering the sea. Water is obtained from Artesian wells near the coast, and it is essential that the lowering of the fresh water table does not lead to the incursion of sea water inland. Because of all of these factors Israel is faced with a growing demand for the development and utilization of its coastal resources for various purposes of economic importance. These include activities such as shore protection and reclamation, deep sea ports and harbours, marinas and recreation beaches, cooling water basins and intakes for power plants, sea-water desalination, coastal and deep-sea construction, etc.

Surveys have been undertaken to explore the feasibility of various coastal development projects of the type mentioned above. It appears reasonable to assume that a number of them will start soon and others be completed during the next decade. Almost all of them will need complex surveys, model-testing and analysis.

I. PRE-HISTORY OF THE INSTITUTE FOR COASTAL ENGINEERING

The Technion - Israel Institute of Technology, was founded in 1924. Before the establishment of the State of Israel, in 1948, there was virtually no industry except for agriculture. The most vital problem for its development was shortage of water - or at least control of water. The civil engineering faculty early on gave a high priority to courses and research on water resources and Hydraulics. However, only after it moved to a new campus outside of the City of Haifa was it possible to construct serious facilities. In 1952 a laboratory was established for hydrotechnics. Although a project for a harbour model and wave generator was proposed in 1938, the money and space were not made available until 1958. At that time a small model wave generator was built on the new campus. Both it and most of the other facilities were devoted more to teaching than to research and development.

However, it was felt that this installation could also be upgraded so that it could be used as a research development tool. The first step was to have the necessary know-how and manpower. A young faculty member who received his D.Sc. in 1963 showed interest in this field. He spent a major part of the next few years in studying the state of the art in various European centers.

Now came the problem of how to finance the enlarged research facility. As mentioned above, applied research comes under the aegis of the Technion Research & Development Foundation. It then cooperated with members of the Hydrotechnics section of the Civil Engineering faculty in seeking this support. It had to come from a unit or units of the Israeli government. The problem was that a single authority responsible for coastal development did not exist. It was divided among many government ministries. Before this was resolved, a major research project requiring an improved wave generator materialized.

II. FIRST MAJOR PROJECT - ATARIM

The largest city on the Mediterranean coast of Israel is Tel-Aviv. In fact it is the largest city in Israel. They were planning - and have since

completed - a coastal development within the city limits involving hotels, bathing beaches, marinas, and special recreation facilities. In addition, the town's airport and power station which was located on the coast had to be modified. For this purpose they set up a special company which would be the authority for the coast of the city of Tel-Aviv. This was called "Atarim", and it was owned 50% by the City and 50% by the Government of Israel.

It was clear to the consulting engineers of Atarim, as well as to its Manager, that extensive model studies would have to be made. Before 1971, this would have involved contracts with foreign installations with the concomitant expenditure of foreign exchange. The Technion Research & Development Foundation was approached and asked whether it could handle this important project. The answer of the Technion group was positive, and its capability was investigated by the foreign consultant to the Atarim company. A contract was signed, and a second wave generator was installed to handle the complex operation. This involved a "shore development plan" for the Tel-Aviv coast - approximately 5 km - which consisted of a marina, two off-shore breakwaters (for beach stabilization) a Marina City on a reclaimed area with a business and entertainment center, a residential area, services, docking facilities for small craft, etc. A sea landing strip was also planned for small and medium aircraft.

A project of such magnitude involved many complex structures. It entirely "disfigured" the normal form of the coast, and thus required thorough investigation as far as coastal morphology was concerned. The relative influences of each of the above mentioned structures on the beach formation was investigated. This included studies of the morphology in the immediate vicinity of each facility and at a distance from it. An investigation was also made into how the development project in its totality effected the coast both north and south of Tel-Aviv. The research group had to recommend the right configurations and sequences of the erection of the different separate structures constituting the entire program.

The Atarim project took about 2 years for completion. However, after several months work with the model, enough confidence was generated to encourage

us to proceed with the planning of the enlarged facility. An engineer with business administration experience was employed to direct both the organisational aspects of the Atarim project and the realisation of the enlarged and more sophisticated model. UNIDO assistance was requested for bringing a consultant to Haifa in order to evaluate our plan. As part of the same UNIDO project we also sent the head of the research centre to tour installations in Europe and the United States. Both of these activities contributed to the drawing up of an acceptable plan for a commercially viable research facility.

III. NEGOTIATIONS WITH THE ISRAEL HARBOURS AUTHORITY

The Harbours Authority of the Ministry of Transportation expressed interest in participating in the Coastal Engineering Centre. It has the responsibility for the development and operation of the three main ports of Israel: Haifa, Ashdod, and Eilat.

It was clear that in the future it would be the main client for the services of our coastal engineering centre. They were interested in developing such a model here in Israel both for saving foreign exchange and having the necessary technical manpower at hand for problems which might arise. In the words of their Chief Engineer "the Authority wants to be "in" at all phases of research and development of coastal engineering. It is a small, highly specialised field today and the number of engineers who understand it are few. We hope that the centre will create a new potential for Technion's engineering students. We see it as a source for the future manpower needs of the authority".

In keeping with the other service laboratories of the Technion Research & Development Foundation it was thought that the Research Centre for Coastal Engineering should be self-supporting - the contracts obtained should pay the expenses of the centre's operation. A number of projects were completed during the period of negotiation between the Technion Research & Development Foundation and the Harbours Authority. Even though the special company was not yet established, they were all undertaken on a commercial basis.

IV. PROJECTS UNDERTAKEN DURING THE PERIOD OF NEGOTIATIONS

One of these projects was a research program concerning the development of solar ponds. Israel has always been in the forefront of the commercial utilization of solar energy. Obtaining water at a temperature close to boiling has been a goal for several years. With the present high price of petroleum it now makes more economic sense. The task of our centre was to find appropriate means to prevent the wind-wave energy to dissipate into the water in the pond so as not to disturb the delicate equilibrium of its density gradient.

Need was also felt for mathematical models to either check or replace the work in the actual experimental facility. We have succeeded in producing a computer program for wave refraction in coastal structures.

Smaller projects were ordered by the Harbours Authority in connection with problems arising with the Ports of Haifa and Eilat.

V. MANPOWER DEVELOPMENT

One goal which both the Technion and the Harbours Authority have in common was the development of the necessary technical manpower. The Atarim project described above was a "one man show". It served however as a vehicle for the training of manpower. One of these engineers is receiving further training in our Danish counterpart. Another is continuing to work at the Research Centre, and a third has joined us after having received his Ph.D. in California. Thus we now feel confident to handle quite complex operations.

VI. FOUNDING OF COMPANY

The negotiations with the Harbours Authority were long and drawn out. It was not simple for two bodies created for entirely different purposes to agree on all of the conditions for a successful joint venture. After two years of discussions the Institute for Coastal Engineering has finally taken form. The Technion Research and Development Foundation and The Technion - Israel Institute

of Technology, acting jointly, and the Israel Harbours Authority have established a Company. Each of the two participants have equal rights. Each will contribute its share in money or kind to the construction of an enlarged installation of model wave generators. The actual operation will be in the hands of the Technion Research and Development Foundation. We shall start by improving and roofing the present wave generators. Computer facilities are being added. This is in accordance with the advice of the UNIDO consultant mentioned previously. The investment, including equipment purchased for the Atarim project will be about \$ 430,000. Ground has been acquired and at a later stage a larger facility will be erected.

The Company has been registered as one with limited liability. There are six members of the Board of Directors, three from each of the two parties. The Dean of the Faculty of Civil Engineering is an ex-officio member of the Board, representing the Technion. This is to ensure participation of the faculty in the activities and engineering level of the services will be of a high order. The contract creating the company also assures the Harbours Authority that their needs for Port development would be met.

VII. FUTURE

The Institute is expecting a busy future. We should embark in our first year of operation with the Harbours Authority on projects involving about \$ 300,000 in income. The plan is to increase this gradually until at the new installation a turn-over of at least one million dollars will be achieved. Work on the immediate horizon comprises harbour extensions, especially those of Haifa and Ashdod. Loading facilities for our fertilizer raw materials and unloading facilities for coal must be planned. Problems in the development of the Dead Sea involve interesting model studies. Naval and fuel installations must be increased. Finally, the combining of our knowledge and facilities with those of the newly created Oceanographic and Limnological Research Institute should enable the carrying out of complex operations on all of our coastal areas.

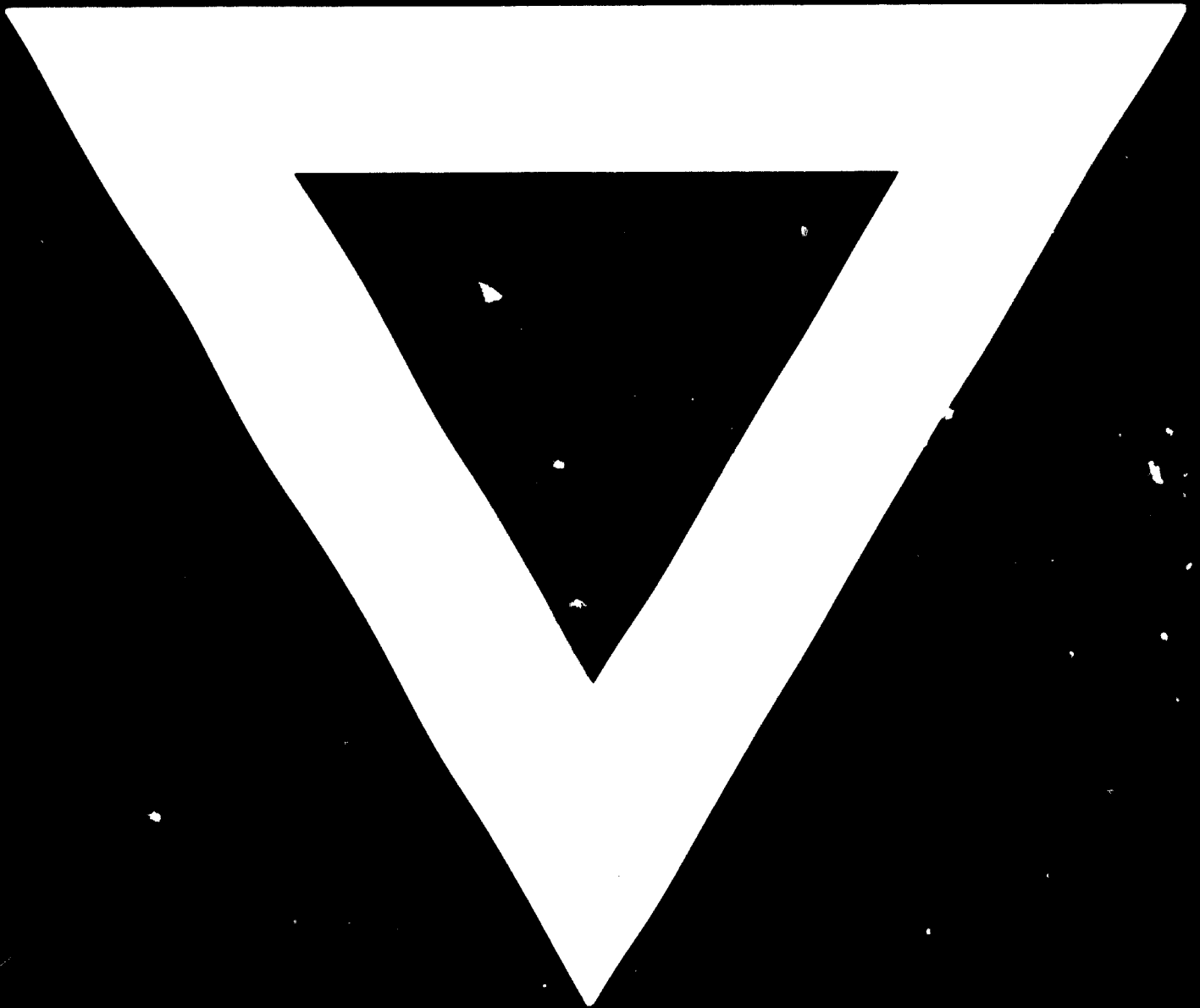
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