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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

19511

Distr.
RESTRICTED

IO/R.229
2 March 1992

ORIGINAL: ENGLISH

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

SPECIALIZED WORKSHOP ON CONCRETE SHIPBUILDING AND OTHER FLOATING STRUCTURES

22-24 OCTOBER 1991
BOURGAS, BULGARIA

US/INT/90/250

Terminal report*

Prepared by KORBSO, Shipbuilding and Shiprepairing Company in cooperation with the United Nations Industrial Development Organization

* This document has not been edited.

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Preface

UNIDO's activities to assist developing countries in shipbuilding and maritime engineering and various other floating structures are conducted now in the light of their increasing importance in connection with the adoption of the new Law of the Sea.

Industrial exploitation of marine sources is vital to the acceleration of the industrial growth of the developing countries and is fostered to develop considerably the increasing requirements all over the world for food and industrial products.

In principal shipbuilding and shiprepair are of major importance to many developing countries since they support the vital shipping, fishery communications and food supply.

A concrete step towards the solution of the existing problem is the realization of the project for assistance in reinforced concrete shipbuilding for the developing countries.

Contents

Introduction

The specialized workshop on concrete shipbuilding and other floating structures was held from 22 to 25 October 1991 in Bourgas, Bulgaria, under the auspices of the United Nations Industrial Development Organization (UNIDO) in co-operation with the Government of Bulgaria and conducted by KORBSO, Shipbuilding and Shiprepairing Company.

The aims of the workshop were to facilitate the development of reinforced concrete shipbuilding industries in developing countries with emphasis on design and construction.

The meeting was attended by eight participants from seven countries.

I. Organization of the Meeting

The workshop was organized by KORBSO, Shipbuilding and Shiprepairing Company.

All the participants arrived on 21 October in Bourgas, Bulgaria. They were accommodated in Hotel Bulgaria, where the hall for the workshop was provided, as well as all necessary supporting appliances and materials.

1. The workshop was opened by Mr. Terziev, Director-General of KORBSO. Mr. Terziev congratulated all the participants. He noted that this meeting was organized under the auspices of UNIDO and due to the efforts of all UNIDO staff, connected with the preparation of the workshop. Mr Terziev emphasized that this specialized workshop on concrete shipbuilding would give an excellent opportunity to contact each other and would foster bilateral agreements on transfer of technology and international co-operation in these activities.

2. UNIDO's representative thanked KORBSO for hosting the seminar and welcomed the participants. He spoke of the intention of UNIDO to strengthen its services to developing countries in shipbuilding and maritime activities and to support international co-operation in this field.

3. All participants said a few words to congratulate the others and to thank UNIDO for its assistance for the organization of the seminar. They supposed that there would be some practical results of it.

Election of Officers

4. The seminar elected as Chairman of the sessions Mr. Vasil Genkov.

Adoption of the Agenda

5. The following agenda was adopted:

5.1 Opening of the meeting

5.2 Election of officer

5.3 Approval of the agenda

5.4 A brief historical review for KORBSO

5.5 Presentation of country papers of the participants

5.6 Constructive and technological peculiarities of the ferro-concrete vessels for public services and for plants

5.7 Ferro-concrete floating crafts for public services and for plants

5.8 Practical design of ferro-concrete floating structures

5.9 Visits to the KORBSO shipyard in Bourgas, to the Shipbuilding Equipment Works, the Shipbuilding Cybernetic Center and Ship Hydrodynamic Center in Varna

5.10 Adoption of the report

Adoption of the report

6. The draft recommendation was adopted in plenary on 24 October 1991.

II. Report of the Discussion

Reports were presented (see Annex III) and discussed during the sessions by experts from participating countries.

1. Summary of reports

1.1 Short history of KORBSO

This report reveals the foundation of KORBSO as a small shiprepair shop in 1903 and its development through all these years until now. Actually today KORBSO is one of the most significant companies in the field of shipbuilding in Bulgaria. The shipyard increases its production capacities due to modern facilities, new technology and trained specialists.

Now KORBSO is building 12,500-dwt product carriers, 5,000-dwt tankers, 650-dwt and 1,240-dwt bunkering tankers, marine dump barges, barges for bulk and general cargoes, river boats and push tug boats, ferries, platforms and floating ferro-concrete workshops.

1.2 Constructive and technological peculiarities in designing of the ferro-concrete vessels

This report reveals main characteristics of ferro-concrete building. It describes the technology and method of preparation of the ferro-concrete. It is based on the monolithic method, which today still remains the basic method for building of vessels. This method does not require expensive and complicated equipment and has simple building organization. Many disadvantages of the monolithic method are eliminated by applying prefabrication and prefabrication-monolithic methods. Another item of the report is the material, used for ferro-concrete shipbuilding. It does not differ considerably from the one required for high-rise building, but there are some specific quality features that should be considered depending on the hull application location. The lecturer emphasizes on advantages and disadvantages of ferro-concrete vessels when we compare them with the steel one.

At the end of the report are enclosed some diagrams and descriptions of built ferro-concrete hulls for vessels, their quantity and main dimensions.

1.3 Ferro-concrete floating crafts for public services and for plants

The main idea of this report is that ferro-concrete vessels are applicable in various environments and conditions. These floating crafts have such characteristics, which make them attractive for solving more specific regional, social, economic, communication, urbanization and other problems.

There are two groups of floating ferro-concrete crafts: for public services and for plants. For the first group, there are designs for a hotel, hospital, hostel, restaurant, public services, garages. The second group is illustrated by a dairy plant, bakery, soft-drink plant, desalination plant, power station and mechanical shop.

Different regions worldwide are characterized by different nature spots and social and economic needs; therefore, they require specific solving of the problems.

To improve technical and economic properties of floating crafts, it is reasonable to build several vessels, but only on, and the hull structure is to be of one and the same type, i.e. dimensions, forms, longitudinal and transverse elements, bulkheads, etc.

Another important question is the strength characteristic of the hull and the superstructure.

Also, the design of the floating ferro-concrete crafts requires application of the normal shipbuilding practice what concerns the local and total strength, loading, hull draft, cargoes distribution, wind loading, etc.

Extremely precise co-ordination is required between the elements, fixed on the ferro-concrete hull and the one built in it.

1.4 Practical design of ferro-concrete structures

In the beginning of the report, basic data are briefly given concerning the main particularities, area of use, type of building materials, power supply of the discussed floating structures.

More detailed information is given for the following features:

Floating ferro-concrete workshop

Its field of application is: repair and maintenance of the ships, floating craftr and different machines, transport, wood processing main engines and otners in areas, where research and production activities precede the provision of repair and maintenance machines.

Field of production facilities: furgery, electrical repair facilities, pipe fitting, radio repair shop, refrigeration equipment repair shop, duel system repair area, mechanical laboratory. The administration and living premises are available as well. Also there are two main diesel generators of 150 kw/380 V 50 Hz each.

Floating hostel

A floating hostel provides the required living conditions in distant places or in areas where power supply, water supply and sewage systems are provided. There are 29 available beds on the main decks and 67 each on the upper two decks.

The following rooms are considered on the decks: a medical isolation room, office, administration office, control office, kitchen, canteen, laundry, ironing room, store, bakery and food-preparation room.

Floating hospital

The floating hospital provides medical services in the distant areas, covers the lack of medical supplies, provides high qualified personnel and specific devices in those area.

The hospital beds are as follows: three beds in the isolation room, five beds in the reanimation room, surgical department for 14 persons, therapeutical department for 21 persons.

There are two main diesel generators of 264 kw each, a fixed diesel generator of 50 kw, a steam boiler and air conditioning system. Modern medical facilities are provided for all of the consulting rooms and service areas.

All the alternatives of ferro-concrete hull cover the requirements for fire protection. It is illustrated that design solution for different types of crafts can be found. The architecture can be enriched by additional plastic shaping, bringing the vivid style and remarkable architectural details.

2. Summary of country papers of the participants (see Annex II)

2.1 Egypt

Mr. W.M.F. Hammad, as a representative of Alexandria Shipyard "Egypt", briefly presented his company.

Alexandria Shipyard "Egypt" is one of the most significant modern shipbuilding and shiprepair yards in the Mediterranean. Organized in 1959, the yard developed and increased its production capacity. They build vessels not only for country use, but also for foreign companies, too. They build dry-cargo vessels, small replenishment tankers, multi-purpose cargo vessels, Ro-Ro vessels, service boats, etc. If they have the know-how and technology of ferro-concrete shipbuilding, they can organize the production of such vessels.

2.2 Zaire

Mr. S. Hebura, as a representative of Omatra's Shipyard, presented briefly his company and the typical conditions in his country. Because of the special geographical and economic conditions in his country, it is obvious that there are great possibilities to use ferro-concrete vessels in Zaire and they will satisfy all economic and social needs of the population. They need assistance from UNIDO and from KORBSO.

2.3 Malaysia

Mr. R. Ramli, as a representative of Malaysia Shipyard and Engineering, presented his company's activities. MSE was founded in 1976 and is almost the biggest and most important figure in shipbuilding in the country, as well as in the whole region. The company is specialized in the building of clean petroleum product tankers, methanol carriers, commercial fishing trawlers, dredgers, ferries and patrol boats. Mr. Ramli made a brief estimation of ferro-concrete vessels--their merits and disadvantages. As a conclusion he noted that now ferro-concrete shipbuilding in Malaysia is too limited, so there are possibilities to develop it.

2.4 Paraguay

Mr. R.G. Yegros, as a representative of Arsenal de Marina, presented his country, industry and shipbuilding activities. According to the specific geographical conditions of the country, i.e. big waterway system, it is obvious that ferro-concrete vessels are the most proper ones for his environment. As all of the shipyards in Paraguay are not large, they cannot produce large vessels and they use old-fashioned methods and simple technology. If they find the adequate assistance, they can develop the shipbuilding industry and mainly ferro-concrete shipbuilding and in this way to influence the whole economy of the country.

2.5 Saudi Arabia

Mr. A.J. Ghabban, as a representative of the Sea Transport Ministry of Communications, presented his country and shipbuilding activities. It is clear that they do have modern facilities for vessels maintenance and perhaps for future shipbuilding. Mr. Ghabban's main idea was that there are many possibilities to organize the production of ferro-concrete vessels in Saudi Arabia; however, they need the assistance of UNIDO and KORBSO, too

2.6 Tanzania

Mr. A.M. Kunghalo, as a representative of Tanzania Harbour Authorities, presented his country and its economic conditions. It is obvious that there are possibilities to develop shipbuilding and mainly ferro-concrete shipbuilding in Tanzania. They need not only financial assistance, but also trained specialists, technology and modern facilities as well.

2.7 Turkey

Mr. U. Akoguz, as a representative of Turkish Shipbuilding Industry, Inc., presented shipbuilding industry of Turkey. Shipbuilding develops from many years in Turkey, but some major developments took place in the last two decades. In Turkey there are 42 shipyards. Four of them are state owned and the others are private. There are enough facilities and capabilities to build different kinds of vessels and ferro-concrete ones can also find their application.

3. Summary of statements and recommendations of the participants

3.1 Mr. Walid M.F. Hammad - Egypt
Mr. Essam Fathy Abdalla - Egypt

As a country that develops tourism, Egypt needs floating structures as hotels, stores and accommodation for offshore activities. All floating structures should be self-propelled, because of some specific navigational conditions of the Nile River.

Mr. Hammad and Mr. Abdalla are very interested in design and construction procedure. They are interested in training of specialists, transfer of technology and know-how. They want a comparison study for steel and ferro-concrete structures to be based for the next seminar. They insist another seminar to be held next year on these problems.

3.2 Mr. Sindi Hebura - Zaire

According to Mr. Hebura, they need assistance to organize training courses for specialists and to transfer technology. Because of their specific geographical position--they do not border any sea--they should organize their own production of ferro-concrete structures. Zaire has many populated regions with no communications, so most suitable for they are floating hospitals, schools, and workshops. They need a preliminary study for different areas of application of ferro-concrete structures. They need UNIDO and KORBSO's assistance.

3.3 Mr. Roslin Ramli - Malaysia

According to Mr. Ramli, ferro-concrete vessels are very prospective because they are cheap and have a long life. The most suitable applications for this region are floating hospitals, schools, hotels and restaurants. Malaysia needs assistance to organize design work and transfer of technology.

3.4 Mr. Ali Jabra Ghabban - Saudi Arabia

Floating restaurants, hotels, hospitals, docks and especially desalination plants are most suitable for these conditions. Mr. Ghabban insists for a new seminar next year with more detailed visual information.

3.5 Mr. A.M. Kunghalo - Tanzania

Because of lacking international waterways, Tanzania needs floating hostels for oil offshore exploration, drilling activities and open pontoons for temporary quays. They are interested in the transfer of know-how and technology and training courses, too.

3.6 Mr. Ustuner Akoguz - Turkey

In Turkey there is a lack of bigger internal waterways, so ferro-concrete floating structures cannot be used there. Mr. Akoguz revealed an interest towards floating garages, which are most suitable for the intensive car traffic in Istanbul. In Istanbul there is a lack of parking paces. Another area of application of floating structures are the floating docks.

3.7 Mr. Ramiro Gutierrez Yegros - Paraguay

His country has internal riverways and developed industry for cement and fitting production, import plates and profile materials. The application of ferro-concrete structures depends on the expenses for their building. They are interested in know-how, technical and technological assistance.

Statements of the representatives of UNIDO:

Mr. Beppu made a brief summary of all suggestions. Technical and technological application of floating structures depends on local conditions in every country. Further exchange of information and suggestions have to continue in order to make investments. The most important are the financial and technological conditions. As a representative of UNIDO, Mr. Beppu insisted all the participants to give their advice and recommendations to maximize the utilization of the seminar.

Mr. Gouriev expects recommendations for everything connected with the meeting. He noted that there must be some results of this seminar and request must follow. Another meeting on stability, project, technology and repair of ferro-concrete vessels must be held in the future.

4. Visits to:

4.1 **Bourgas KORBSO shipyard**: construction of ferro-concrete workshops and launching device; presentation of possibilities and construction capacities of the yard.

4.2 **Varna** - Shipbuilding Equipment Works
Shipbuilding Cybernetic Center
Ship Hydro Dynamic Center

During the visits, the basic information in shipyard and research centers was given by the leading specialists from these organizations. The participants revealed a significant interest to engineering and design matters and ferro-cement technology. They got acquainted with present position and major trends of ferro-concrete shipbuilding.

5. Final conclusion of the report

Ferro-concrete technology is a specific field, which is conducted today by a few companies.

From country papers and discussions, KORBSO better realized actual needs and specific conditions in the participants' countries as well as in other developing countries. Revealed interest from all the participants during the seminar showed that it was necessary and timely conducted.

It is our belief that ferro-cement technology can be successfully and beneficially used in countries located in river and lake regions such as East and Central Africa, Latin America and Asia as well as in gulf countries.

III. Draft Recommendation

1. The meeting adopted the following recommendation:

The participants expressed their great appreciation to the organizers, UNIDO and KORBSO, for their efforts to make the meeting on ferro-concrete shipbuilding informative and useful. The following recommendations were adopted by the participants:

1.1 Application of ferro-concrete shipbuilding technology and design to the construction of self-propelled vessels (fishing vessels, yachts) and non-self-propelled structures (workshop, hospital, garage, hotel, restaurant, etc.) deserve particular attention to meet the needs of the countries.

1.2 It is recommended that a study should be undertaken on the applicability of this technology to the specific needs of developing countries because of numbers of merits of this technology, such as:

a. lower labor cost;

b. simplicity of technology;

c. minor maintenance;

d. lower steel consumption,

e. long life.

1.3 For the regional approach, particular attention should be given to the countries located around lakes and river areas of Africa, Latin America, Asia and to the Gulf countries. UNIDO is requested to place priority to those countries on their request.

1.4 Training opportunity should be provided to the developing countries according to their needs.

1.5 A similar meeting has been recommended to be organized with special emphasis on ferro-cement fishing boats and other applications.

ANNEX I

<u>List of participants</u>

1. Walid M.F. Hammad
Egypt, Alexandria Shipyard "Egypt", Design Department
Telephone: 03/4461897
Fax: 03/445467

2. Essam Fathy Abdalla
Egypt, Alexandria Shipyard "Egypt", Design Department
Telephone: 03/4461897
Fax: 03/445467

3. Sindi Hebura
Zaire, Onatra Shipyard
Telephone: 24761269/ext.1527
Address: Av. TSF No.16, BP 3566, Kinshasa - Gombe

4. Roslin Ramli
Malaysia, MSE, 81707 Pasir Gudang, Johor
Telephone: 07/512111/ext.574
Fax: 07/514249, 511606

5. Ramiro Gutierrez Yegros
Paraguay, Arsenal De Marina
Address: Av. Carlos A. Lopezy 28
Telephone: 661548, Asuncion 595521

6. Ali Jabra Ghabban
Saudi Arabia, Marine Transport, Riyadh
Telephone: 00966-1-4056788
Fax: 4057905
Tlx: 405370

7. Anicet Manita Kunghalo
Tanzania, Harbours Authority, THA
Address: P.O. Box 1130, Dar-es-Salaam
Telephone: 21991
Fax: 32066
Tlx: 41346

8. Ustuner Akoguz
Turkey, TSII
Telephone: 9011518832
Fax: 9011513251
Tlx: 25487

KORBSO participants

9. Dimitar Terziev
General Director, Bourgas 8000
Telephone: +359 56/42634
Fax: +359 56/43157
Tlx: 83511

10. Christon Gogjukov
Vice Director General of Technology
Telephone: 359 56/42566
Fax: 359 56/45304

11. Toshko Marinov, Vice General Director

12. Doyno Demirev, Marketing Manager
Telephone: 359 56/42910
Fax: 359 56/43157
Tlx: 83511

13. M. Milanova, Marketing Department

14. S. Pstadjan, Marketing Department

15. P. Petrov

16. D. Klinkov

17. V. Genkov

18. Toma Kudev, Institute of Shipbuilding

19. M. Dineva, Institute of Shipbuilding

20. R. Klinkova, Institute of Shipbuilding

21. Stafan Petrov, Shipbuilding Institute (Varna)

22. Christon Naidenov, Shipbuilding Institute (Varna)

23. George Lazarov, Ship Hydro Dynamic Center (Varna)

UNIDO representatives

24. Fumio Beppu, Associate Expert, UNIDO
Austria, Vienna International Centre, A-1400 Vienna
Telephone: 21131/4569
Fax: 232156
Tlx: 135612

25. Fedor Gouriev, Consultant, UNIDO

Country papers

1.	Egypt:	Alexandria Shipyard "Egypt"
2.	Zaire:	What I Think About Ferro-Concrete Structures
3.	Malaysia:	Concrete Shipbuilding and Other Floating Structures
4.	Paraguay:	Shipbuilding in Paraguay
5.	Saudi Arabia:	Information Paper
6.	Tanzania:	The Development of Shipbuilding Industry in Tanzania
7.	Turkey:	Shipbuilding Industry in Turkey

Alexandria Shipyard

It is one of the significant modern shipbuilding and shiprepair complexes in the Mediterranean.

Location of the yard

It is geographically situated in the heart of the world's seaborne traffic to and from the Far East. The yard is located in the south of the Mediterranean in the sheltered anchorage of the western harbour of the port of Alexandria. It is in a position to render any required service to all ships entering the port of Alexandria.

The total yard area is about 400,000 m^2, with a total quay length of approximately 1,200 meters.

History

1959 By virtue of governmental order the design of Alexandria Shipyard was started.

1962 A contract for the construction of the Shipyard and the supply of the shops equipment was signed and the yard foundation laid beside the site of Alexandria old repair dock.

1963 Apprentice training center was opened and the preparation of shipbuilding and ship repair personnel was started.

1964 A mechanical slipway with carriage lifting capacity of 600 t was built.

1965 A new repair graving dock with a capacity of 85,000 t went into service and since then Alexandria Shipyard has acquired the best docking facilities in the South Mediterranean.

1968 Two inclined semi-submerged building berths were completed.

1969 After the shipyard had been practically completed, production started on the main berths.

1970 Launching of the dry cargo vessel "SIDI-BESHER" 6,500 dwt.

1971 Launching of the first ALEXANDRIA CLASS cargo vessel "ALEXANDRIA" 12,880 dwt.

1971 Start implementation of payroll, accounting and financial systems on the computer

1972 Launching of the largest general cargo ship ever built in Egypt, the dry cargo vessel "SUEZ" 13,740 dwt built for Sudo Import (USSR).

1973 Launching of the first 500 dwt Navy replenishment tanker built for the Soviet Naval Forces.

1976 Start co-ordination with IHI for the development of the shipyard facilities and management systems.

1977 Installation of two 1/10th scale flame cutting machines in the prefabrication shop, one of them equipped with numerical control head.

Start co-ordination with B&W Shipbuilding Services for the building of three 8,230 dwt "MODIFIED RAMSIS CLASS" cargo vessels under a Danish loan.

1978 Installation of a PC - 100 Kongsberg computer center for numerical control applications.

1979 Signing a contract for the building of three "Modified HAMLET CLASS" multipurpose cargo vessels under license agreement with B&W Shipyard.

Winning a contract for the building of 30 integrated barge units for the service in the river Nile each unit having a deadweight of 770 tons.

1980 Installation of a new automatic plat shot blasting/ priming/drying machine.

1981 Signing an agreement with the Egyptian Iron & Steel company for the transfer and implementation of computerized "Preventive Maintenance System".

Signing an agreement with BWSS for the development of the shipyard operational systems.

Signing a contract for the building of a jack-up "BMC 200 - IC Class" drilling rig for Baker Marine - Ferrostaal joint venture Co.

1982 Signing a subcontracting agreement for the building of some parts of production and accommodation platforms.

Signing a contract for the building of a fourth vessel of the Modified HAMLET CLASS.

1984 Start building of three 90-ton level luffing shipbuilding cranes to Krupp design to own account

1985 Winning a contract for the building of two 3,000-dwt Ro-Ro vessels of the TABA CLASS.

1987 Installation of the biggest and most powerful computer system in the Egyptian shipyards.

1988 Concluding an agreement for building of two more vessels of the Modified HAMLET CLASS.

Winning a contract from Dekhila Port Authority for the building of:

- one fire fighting tug
- two patrol boats
- four port cargo handling cranes

1989 Launching of ship scrapping activity

New building facilities:

The yard has two building berths. On the berths it is possible to build general cargo vessels up to 20,000 dwt and tankers or bulk carriers up to 35,000 dwt with an annual maximum building capacity of 52,000 dwt.

Building berths characteristics:

Berth	Length	Breadth	Cranage
Northern	180.00 m	28.00 m	3 x 30 tons
Southern	180.00 m	28.00 m	3 x 90 tons

Mechanical slipway:

A mechanical slipway comprising of four ways is available. It is served by a carriage having a lifting capacity of 600 tons, affording building facility on two ways for all types of small vessels up to 1,500 dwt.

Way	Max. vessel length	Max. vessel breadth	Cranage
Way (1)	60.00 m	12.00 m	1 x 25 tons
Way (2)	60.00 m	12.00 m	1 x 25 tons

New building programme:

The yard's programme in shipbuilding is geared towards the building of general cargo vessels up to 14,000 dwt and bulk carriers up to 38,000 dwt.

In view of the present market situation, the production has been concentrated on the construction of sophisticated dry cargo vessels, small replenishment tankers, service boats and river-integrated barge units.

Dry cargo vessels:

The standard types of the shipyard have a deadweight of 13,740 and 8,230 tons; of these vessels four and nine had been built.

Multipurpose cargo vessels:

The standard type of the shipyard has a deadweight of 12,600 tons of this design; four had been built and two are on order.

Small tankers:

The smallest standard types of the shipyard are the 300-, 500- and 600-dwt replenishment tankers; of these designs, 1, 16 and 22 vessels had been built.

Bulk/empty container carriers:

The standard type of the shipyard has a deadweight of 38,500 tons; of this type two had been built.

Roll on/roll off vessels:

The standard type of the shipyard has a deadweight of 3,000 tons; of this type two had been built.

12,880 dwt "ALEXANDRIA CLASS" general cargo vessel

Ship's designation is to carry general cargoes, industrial equipment and grain.

The ship is single screw, full scantling, double decker, having five holds, extended forecastle, raked stem and cruiser stern.

Cruising area is unlimited, including tropical latitudes and navigation in broken ice.

Main particulars:

Length between perpendiculars	140.00 m
Breadth moulded	20.00 m
Depth moulded to upper deck	12.00 m
Draft (summer freeboard)	9.37 m
Deadweight (standard version)	12,880.00 t
Deadweight (modified version)	13,740.00 t
Speed on trials	17.70 k
Class	L.R., + 100A1, +LMC, ICE CLASS (3)

Main machinery:

Single slow speed B&W diesel engine, having an output of 9,000 BHP at 110 rpm.

Production programme:

Of this type, four vessels had been built.

Yard no.	Vessels's name	Version	Owner
10002	ALEXANDRIA	Standard	Egyptian Nav.Co.(EGYPT)
10003	SUEZ	Modified	Sudo Import (USSR)
10004	ISMAILIA	Modified	Sudo Import (USSR)
10005	PORT-SAID	Modified	Sudo Import (USSR)

500-dwt "NAVY CLASS" replenishment tanker

The ship's designation is to carry liquid cargoes for replenishment purposes. The ship is single screw, full scantling, having three tanks, raked stem, cruiser stern and nozzle propeller.

Main particulars:

Length between perpendiculars	49.40 m
Breadth moulded	9.40 m
Depth moulded to upper deck	4.20 m
Draft (design)	3.10 m
Deadweight (max)	500.00 t
Speed on trials	10.00 k

Main machinery:

Single RUSSKY Diesel type 6 DR 30/50-5-2 delivering BHP at 300 rpm.

Production programme:

Of this type, 16 vessels had been built.

Yard	Number	Type	Owner
10101#4	four	Mazot tankers	Soviet Naval Forces
10105#9	five	Water tankers	Soviet Naval Forces
10110#11	two	Mazot tankers	Egyptian Naval Forces
10112#16	five	Water tankers	Egyptian Naval Forces

8,230-dwt "RAMSIS CLASS" cargo liner

Ship's designation is to carry general cargo and industrial equipment and occasional carriage of timber in the holds and on deck. The ship is single screw, double decker, five holds, with a bulb cruiser stern and nozzle propeller. The cruising area is unlimited and includes sailing in tropical latitudes and navigation in broken ice.

Main particulars:

Length between perpendiculars	121.00 m
Breadth moulded	17.80 m
Depth moulded to upper deck	9.80 m
Draft (summer freeboard)	7.80 m
Deadweight	8,230.00 t
Speed on trials	17.50 k
Class	L.R., +101A1, +LMC ICE CLASS (3)

Main machinery:

Single slow speed B&W Diesel engine with service output power of 4,900 BHP at 170 rpm.

Production programme:

Of this type, nine vessels had been built.

Yard no.	Name of vessel	Version	Owner
10011	RAMSIS II	Standard	Egyptian Nav. Co.
10012	ISIS	Standard	Egyptian Nav. Co.
10013	NEFERTITI	Standard	Egyptian Nav. Co.
10014	AMON	Standard	Egyptian Nav. Co.
10015	MEMPHIS	Standard	Egyptian Nav. Co.
10016	AHMOS	Standard	Egyptian Nav. Co.
10017	IKHNATON	Modified	Egyptian Nav. Co.
10018	THUTMOS	Modified	Egyptian Nav. Co.
10019	15 MAY	Modified	Egyptian Nav. Co.

12,600-dwt "MODIFIED HAMLET CLASS" cargo vessel

The HAMLET CLASS vessel is a multi-purpose LO-LO/RO-RO dry cargo ship. The ship's designation is to carry general cargo, containers, roll-on/roll-off cargo and cargo in bulk. The ship is single screw, full scantling, double decker having three holds, extended forecastle deck to aft of hold No. 2, raked stem and bulbous how, transom stern and balanced rudder of spade type, ro-ro access to tween-deck by hinged quarter ramp starboard side aft. Cruising area is unlimited including tropical latitudes and navigation in broken ice.

Main particulars:

Length between perpendiculars	122.30 m
Breadth moulded	20.50 m
Depth moulded to upper deck	12.20 m
Scantling draft	9.40 m
Deadweight (max)	12,600.00 t
Container capacity (20 feet units)	374. TEU
Trailer-lane length	486.00 m
Speed on trials	14.80 k
Class	L.R., +100A1, +LMC ICE CLASS (3)

Main machinery:

Single slow speed B&W Diesel engine 5L55GF delivering 6,700 bhp at 150 rpm.

Production programme:

Of this type, four vessels had been built and the other two are on order for the Egyptian Navigation Company.

Yard no.	Name of vessel	Version	Owner
10024	ABU RDEES	Modified	Misr Shipping Co.
10025	ABU ZNIMA	Modified	Misr Shipping Co.
10026	ABU EGILA	Modified	Egyptian Nav. Co.
10031	EBN AL WALEED	Modified	Egyptian Nav. Co.

38,500-dwt "ALEXMAX CLASS" bulk carriers

The ship's designation is to carry all kinds of grains, heavy ores and twenty empty containers. The vessel is single screw, diesel driven, full scantling, having five self-trimming holds, top-side tanks for water ballast only, flush upper deck with sheer forward, engine room and accommodation aft, raked stem with bulbous bow, transom stern and balanced rudder of spade type. Holds number 1,3 and 5 strengthened for the carriage of heavy ores. Cruising area is unlimited, including tropical latitudes and navigation in broken ice.

Main particulars:

Length between perpendiculars	190.00 m
Breadth moulded	26.50 m
Depth moulded	15.80 m
Scantling draft	11.38 m
Deadweight at scantling draft	38,500.00 t
Design draft	10.36 m
Deadweight at design draft	35,000.00 t
ISO container capacity (20 feet units)	640. TEU
Total grain capacity including hatches	51,000.00 m^3
Speed on trials	15.00k
Class	L.R., +100A1, H.C., ICE (3), +LMC

Main machinery:

Single slow speed B&W diesel engine 5L67GFCA delivering 10,900 bhp at 123 rpm.

Yard no.	Name of vessel	Version	Owner
10029	DOMIAT	Standard	Egyptian Nav. Co.
10030	KENA	Standard	Egyptian Nav. Co.

3,000-dwt "TABA CLASS" RO-RO vessel:

The ship's designation is to carry cars, trailers, including special heavy-lift trailers, pallatized cargo and 20' containers. The ship is twin screw, full scantling, freedecker with two continuous decks, having one hold accessible via a lift, one continuous garage deck "tween deck", partially sheltered weather dk "main deck", racked stem, bulbous bow fitted with bow thrusters, transom stern and stern ramp. Cruising area is unlimited and includes tropical latitudes.

Main particulars:

Length between perpendiculars	101.10 m
Breadth moulded	17.50 m
Breadth over wings	19.00 m
Depth to main deck	5.25 m
Design draft	5.06 m
Scantling draft	5.22 m
DWT at scantling draft	3,000.00 t
DWT at design draft	2,750.00 t
Trial speed	19.50 k
Service speed	17.00 k
Total lane length	1,015.00 m
Trailer and car capacity:	
+ 40' trailers	63
+ 20' trailers	131
+ Passenger cars	359
+ Containers, TEU	236

Lifts:

+ 46-t hydraulic trailer lift (T.dk. - M. dk)
+ 15-t hydraulic lift (Hold - T.dk.)

Class GL, +100A4E, +MC E Aut

Main machinery:

Two 4-stroke medium-speed MAK 9M453 diesel engines having MCR output of 3,670 hp at 600 rpm.

Production programme:

Of this type two vessels had been built:

Yard no.	Name of vessel	Version	Owner
10032	ALQUSAYR	Standard	Egyptian Nav. Co.
10033	NUWAYBA	Standard	Egyptian Nav. Co.

OFFSHORE INDUSTRY

New building programme:

The yard programme in offshore industry is geared towards the building of jack-up drilling rigs and partial building of oil production and accommodation platforms.

Jack-up drilling rigs:

The standard type of the shipyard is the "BMC-200-IC CLASS" jack-up drilling rig designed for service in the Gulf of Suez and the Red Sea.

Production and accommodation platforms:

The yard had built modules of some production and accommodation platforms.

"BMC-200-IC CLASS" jack-up drilling rig:

The oil rig is designed for operation in the Gulf of Suez and the Red Sea. It was designed by Baker Marine Engineers (USA) and owned by the joint-venture company "Baker Marine (USA) Ferrostaal (West Germany)".

Main particulars:

Length overall	174.25 ft
Breadth overall	162.50 ft
Hull depth	18.00 ft
Draft	12.00 ft
No. of legs	3
Maximum working depth	200.00 ft
Crew	70

The rig is equipped with helideck.

Production programme:

One rig and two platform modules had been delivered at the end of 1982.

GENERAL ACTIVITIES

Building of dry-cargo barges:

The standard types of the shipyard have deadweights of 100, 200, 250, 300, 500 and 770 tons.

Type	Deadweight tons	Number	Area of service
Nonpropelled	100	32	Harbour
Nonpropelled	200	26	Harbour
Nonpropelled	250	23	Harbour
Nonpropelled	300	10	Harbour
Nonpropelled	500	8	Harbour
Integrated pushed & pushing units	770	30	River Nile

Building of heavy steel structures:

The shipyard has acquired good experience in the building of heavy steel structures like:

- Trusses;
- Steel warehouses;
- Petroleum towers and storage tanks;
- Steel bridges;
- Caissons.

Engineering works:

The available production shops facilities enable the yard to meet the customer's ever changing demands for any metal processing job within the limitations of its shops facilities and the well-proven machining.

Shop facilities:

1. Steel fabrication and assembly shops

a. Automatic blast cleaning/painting/drying of plates and pickling basing for pipes and profiles

b. 1/10th scale lofting

c. Automatic 1/10th scale N/C gas cutting machines for plate thicknesses up to 35 mm

d. Semi-automatic gas cutting machines

e. Guillotine shears for the cutting of plates up to 16 mm in thickness

f. 200-, 400- and 800-ton shipbuilding presses for plate thickness up to 32 mm

g. Bending rolls for plate widths up to 8 m

h. Automatic and semi-automatic arc welding machines

i. Electroslag and inert gas welding

2. Machine shop

a. Lathes for machining of shafts up to 16 m in length

b. Horizontal boring and gear cutting machines

c. Slotting, planning and drilling machines

d. Dynamic and static balancing

3. Foundary work and pattern-making shop

The foundary shop is equipped with electric high-frequency furnaces for melting ferrous and non-ferrous metals up to one ton.

4. Machine tool shop

5. Blacksmithing and forging shop

The forging shop is equipped with pneumatic hammers and presses up to 160 tons of pressing force.

6. Pipe work, coppersmithing and alloy piping shop

The pipe workshop is equipped for the fabrication of all types of pipes, cold and hot bending.

a. Galvanization and electroplating shop

b. Heat treatment shop

c. Electric workshop

d. Painting and insulation workshop

7. Carpenter's shop

The carpentry and joinery workshop is equipped with wood-drying and impregnation units.

8. Laboratories

In addition, the shipyard is equipped with its own laboratories for metallurgical and physical testing, spectrographic and radio graphic examination of welds, and magnaflux and ultrasonic crack detection.

T R A I N I N G

1. Training center

Alexandria shipyard has a training center adequately equipped to meet the yard's need for skilled workers to carry out specialized work in fourteen different activities covering all the demands of the modern shipbuilding and shiprepairing techniques.

The shipbuilding and shiprepair personnel at Alexandria Shipyard are well trained and receive refresher training at regular intervals to be capable of producing high-quality work.

2. Missions

Missions have been arranged and are arranged regularly to train the technical staff in the leading shipbuilding countries such as Denmark, England, Italy, Norway, USSR and Yugoslavia.

What I Think About Ferro-Concrete Floating Structures

The techniques of concrete shipbuilding are known as existing techniques, but we have no experience with them.

However, they may have many wonderful applications in our country, mainly for the floating structures that do not have to move for long distances.

For instance, we have a 1,700-km river along which we have many people who live in the forest and must use it for many of their economical and social needs. It is obvious that vessels like floating hospitals and schools would be primarily important for those people. Furthermore, docks with ferro-concrete hulls are certainly more economical for shipyards than for classical ones.

Peculiarly, high resistance to seawater makes ferro-concrete floating structures more involved than other structures in such conditions.

Maybe because of the small average depth of the river, it would be difficult to design vessels with very small draft (1.5-1.8 m) to more easily on the whole part considered as available for sailing.

On the Atlantic coast by the far west of Zaire, there is no draft problem and because of its touristic seaside, vessels like floating hotels would be certainly economically interesting for the development of the surrounding regions.

Personally, with my experience in inland shiprepairing, I would be particularly interested in problems which are currently encountered in shiprepairing. The most important are:

- waterproofness;
- resistance against chemicals, especially salt water;
- propellers and shafts dispositions.

Sindi Hebura

ZAIRE

Workshop on Concrete Shipbuilding and Other Floating Structures

Bourgas, Bulgaria

22 to 24 October 1991

organized by:

United Nations Industrial Development Organization and the Government of Bulgaria

prepared by:

Roslin Ramli, MSE on 8 October 1991

General information

Malaysia Shipyard and Engineering (MSE) Sdn. Bhd. was founded in 1976. At an early age, MSE only concentrated on shiprepair services. At present, MSE is divided into: Shipbuilding and Allied Services Division; Engineering Division; and Shiprepair Division and their subsidiaries of which includes Tug and Towing, Tank Cleaning and MSE's Corporate Services.

With a work force exceeding 2,000 employees, MSE today is at its highest commitment to become the biggest contributor in shipping and engineering industry in the country as well as in the region.

The Shipbuilding and Allied Services Division consists of two major sections which are the Shipbuilding Division (where I am located) and the Allied Services, which deals fully with the repair and maintenance of government vessels and small boats. The area covered about 95,000 square meters of land facing the Johor Straits which tracks its way to the South China Sea (easterly) and the Indian Ocean (westerly). Its strategic geographical location is seated not very far from one of the busiest ports in the world, the Port of Singapore.

The facilities available are a slipway of 8,000-dwt capacity and a wide spread of concrete slabs built to obtain a construction of another three vessels with the same capacity at the same time. Each section is provided with an overhead crane and necessary transport facilities.

The company is specialized in a building of the clean petroleum product tanker, palm-oil tanker, methanol carrier (shallow and international waters), commercial fishing trawler, purse seiner training vessel, split hooper dredger, ferry and fast patrol boat.

Problems we are now facing

In this report I would only point out a few major problems of which the shipyard is facing to my own careful observation during the working period.

a. Poor work ethics among employees

The employees of MSE originate from all parts of the country and have different backgrounds and multi-racial communities. The main issues are communication, working attitudes and a good relationship between employees during and after working hours. At the managerial level, also are very weak in planning and executing a certain plan in order to enhance co-ordination between all employee levels thus carrying out everyone's best working quality and simultaneously increasing the company's productivity.

b. High cost of materials

Our normal practices are to buy a material ranging from steel plates to the main engine and other equipment, such as for electrical, piping and hull fitting through a local or a foreign agent who is based in Singapore. Many of those so-called "middle men" are out to cut our throat with their outrageous supply prices.

c. Lack of technical expertise

The lack of qualified personnel to handle a widespread operation, especially in machineries, their applications and conceptual system of equipment of which are chosen to be installed on board the vessel. In other words, to break into the international market, the shipyard must have respected professionals who will give confidence to a foreign customer.

Concrete shipbuilding

The use of concrete for the construction of floating structures in the maritime industry is a material innovation of the latter type. In terms of historical consideration, a major impetus from two emergency wartime construction programmes, concrete has not achieved widespread acceptance as a construction material for floating structures.

The principal objection raised against this application of concrete and a major disadvantage in comparison with steel is the increased structural weight of the concrete hull.

Merits of concrete ships over those of steel are:

a. Less steel consumption;

b. No rivet holes nor joints, therefore no deduction of hull strength and no fear of leaks;

c. Cheaper construction cost and less expenditure for maintenance;

d. Shorter construction period;

e. No special technique required and accordingly easy to arrange necessary number of workers;

f. Cement can be easily obtained worldwide;

g. No corrosion; long durability;

h. Smooth and fair surface easily made contributions to higher speed;

i. Decreased danger against fire.

Demerits of concrete ships are:

a. Heavy hull weight, decreasing deadweight capacity, increasing engine output and fuel consumption, increased draft and generally increased operating costs;

b. Less local strength in hull strength;

c. High launching cost;

d. Difficult bottom repair.

Application of reinforced concrete shipbuilding in Malaysia

Reinforced concrete--concrete which has been strengthened against the action of tensile stresses by embedding steel reinforcing in the concrete.

At present, in Malaysia the reinforced concrete application is too limited. It includes only small boats such as ferro-cement boats and canoes. Only a few boatbuilders are keen to know about the concrete shipbuilding process. For them the construction of ferro-cement boats and facilities required is very simple. The cost of a ferro-cement boat is very cheap. Also, the maintenance of the boats is very economical compared to wooden or steel boats.

However, this concrete technology in maritime industry is not yet utilized in Malaysia, especially in offshore industry, for example,floating pontoons or mooring pontoons. As we know, the increased weight of a concrete hull results in more favourable behaviour, a factor which is particularly important for supportive floating plant pontoons.

With specialized workshop on concrete shipbuilding and other floating structures, interest in this workshop has the following range:

a. Observation of the actual design, manufacturing, maintenance and application of reinforced concrete shipbuilding and floating structures;

b. Study of the feasibility of building the reinforced concrete structures;

c. Study of the prospect of building ferro-cement boat in Malaysia with new and improved construction techniques.

Conclusion

In view of the simplicity and low investment of concrete shipbuilding and floating structures, it is worthwhile for Malaysia to experiment constructing more reinforced concrete in the future plan.

In terms of research and development (R&D), our country needs possible technical assistance from UNIDO and co-operation with the Mechanical Faculty (Marine Technology Group), University of Technology Malaysia to run the project such as reinforced floating structures like barges or pontoons.

Shipbuilding in Paraguay

The Republic of Paraguay is situated in South America, with 406.756 km^2 and a population of 4.200.000 (1990).

As an island country with no seashores, the direct link with the world are the Paraguay-Paraná rivers which form the second greatest waterway system of the continent.

Draining southeastern Bolivia and southern Brazil, northern Argentina and crossing Paraguay, the system flows into the Rio de la Plata (River of Silver) which empties into the Atlantic. The system is navigable by large ocean-going vessels to Santa Fe (Argentina) and up to Asunción by smaller ships (up to a draught of 12 feet).

The city of Asunción (population 700,000) is the capital of Paraguay and also the main port located on the left side of the Paraguay river 1,100 miles from the open ocean.

Paraguay is a country in development, with no oil, ore or other minerals but with an impressive variety of agricultural and pastoral products like cattle, corn, barley, fruits, cotton, soybean and timber. Traditionally, these agricultural exports finance the importation of oil-manufactured goods--especially capital equipment designed to accelerate agri-industrial development. Foreign trade is vital to the health of the country's economy. Seventy-five percent of the imports and sixty percent of the exports are made via the rivers.

Ocean-going vessels link directly Asunción to the principal ports of Europe and the United States. It is also common to see along the river a train of 16 to 20 barges pushed by a 4,000-bhp towboat carrying grain and other commodities.

Shipbuilding is an old, traditional but scarcely developed industry in Paraguay.

There are no state-owned shipyards except for a navy's arsenal and shipyard. There are about eight private shipyards in Paraguay; six of which are in Asunción. These are not large, modern shipyards. All of them employ a small number of workers and use old-fashioned methods and simple technology building, transforming and repairing small river-going, self-propelled cargo vessels, tugboats and barges.

Chaco's shipyard has delivered to owners eight river barges of 2,000 tpm (dwt) each and repairs vessels and barges in its slipway.

San Insidro's shipyard assembled and launched about 30 barges prefabricated in blocks and shipped from Japan to Asunción.

In the Navy's shipyard, all kinds of repairs and overhauls of Paraguayan Navy vessels are carried out. It has a slipway, a floating drydock with 1,000-ton lifting capacity and a drydock with a yearly repair capacity of about 100 ships, of which many are from government owned merchant fleet and from private owners, national and foreign.

In Paraguay we have no experience in the reinforced concrete shipbuilding.

We can list the principal problems of the shipbuilding industry:

- The national market is not enough to require and support modern and large shipyards.

- The export market is rather closed because our neighbours (Argentina and Brazil) have their own strong shipbuilding capacity.

- There are neither a government-aid programme for the development of the industry nor the merchant marine nor a line of credits for shipbuilding.

- We do not have auxiliary or supporting industry for the main one.

- There are not enough naval engineers and well-trained technicians, but we have excellent workers.

The "Paraguay-Paraná Waterway" is a multinational project of Argentina, Bolivia, Brazil, Paraguay and Uruguay by which the governments of those countries have agreed in the development of the natural waterway formed by the Paraguay, Paraná and Rio de la Plata rivers in total 3,500 km which form a vital part of the transportation system.

Much work and agreement must be done to develop and improve the capacity of transportation of the system.

With the engineering skills available today, the physical improvement of the waterway presents few problems. However, the political trade agreement to be hammered out is immense. In the endeavour to ensure a smooth interchange of traffic, the representatives of the countries are meeting. Working parties must unify technical requirements ships paper and many other items relative to law, signals, etc.

We believe in the "Paraguay-Paraná Waterway" project. In the future the port of Asunción, as the geographical center of the system, will increase its capacities and importance in shipbuilding and principally in shiprepairing.

Asunción, October 1991
RRGY

Information paper

I would like to state that the Kingdom of Saudi Arabia has a commercial fleet with a total capacity of 2.7 million GR tons representing 312 vessels and other marine units of different types and sizes. These are provided with the most advanced technological equipment.

The Saudi marine companies enhance their fleets through purchasing used vessels contracting their building abroad or renting. Shipbuilding in Saudi Arabia is considered to be in its initial stage.

There are four floating docks at Jeddah and Damman ports to receive vessels of different types. One of the two docks in Damman has a lifting capacity of 80,000 tons to accommodate large vessels. The capacity for the other dock is 30,000 tons and carries out rectification work and medium-maintenance operations.

The other two docks in the Jeddah port on the side of the Red Sea have lifting capacities of 45,000 and 16,000 tons.

Shipbuilding in the Kingdom has not been practiced yet and we are attending this debate to benefit from the participation in this workshop regarding the vital industry, particularly in shipbuilding from reinforced concrete, where the Bulgarian shipbuilding industry has significant experience in reinforced concrete shipbuilding.

I feel that the concrete shipbuilding will be the material that will be used in the future as long as cheap, raw material is available.

The Kingdom has five major ports on the Red Sea and Arabian Gulf with a total of 165 fully operating berths equipped with modern facilities for handling all types of vessels.

For container traffic, for example, the Jeddah Islamic Port ranks among the top ten in the world in volume. In addition, the Kingdom has paid great attention to the development of oil ports.

The port of Rastanura on the Arabian Gulf, which is considered to be the most modern oil port in the world, includes 18 berths for crude oil tankers in addition to six berths for ultra large crude carriers considering the importance of the vessels' maintenance.

Finally, I consider this workshop as a good opportunity to build a kind of co-operation with UNIDO in its activities, specially in the shipping-industry field such as an old fishing wooden-vessel industry in my country called (daw).

Also, never hesitate to get assistance from KORBSO, the leading company in the field of concrete shipbuilding.

Thanks and regards.

Eng. Ali Jabra Ghabban
Saudi Arabia

The Development of Shipbuilding Industry in Tanzania

Introduction

Tanzania is on the East African coast between longitudes 29° and 40° east and between latitudes 1° and 12° south. The country has an area of 942,000 square kilometers and a population of 23,174,300 people. In the north the country shares common borders with Kenya and Uganda. In the west the country borders Rwanda, Burundi and Lake Tanganyika. In the south Tanzania borders Zambia, Malawi, Lake Nyasa and Mozambique. In the east the country borders the Indian Ocean. Of the countries total area, 53,000 square kilometers are inland waters in form of lakes and rivers. Unfortunately none of the major rivers is navigable. There are three large lakes and shipping activities are restricted to these lakes and the Indian Ocean.

Shipping activities

Tanzania has three main ports on the Indian Ocean. These are Dar-es-Salaam, Tanga and Mtwara in the order of their sizes. The ports of Tanga and Mtwara only save the Tanzania hinterland. However, plans are in hand to develop the port of Tanga and the railway to Musoma in the northwest so that the port can save landlocked Uganda. By far the most important port on the Indian Ocean is Dar-es-Salaam. Besides serving the central part of the country, the port also serves the landlocked countries of Rwanda, Burundi, Zaire, Malawi and Zambia. In the hinterland the main ports are Mwanza in Lake Victoria and Kigoma in Lake Tanganyika. Both these ports are connected by rail to the port of Dar-es-Salaam.

Shipbuilding and building

Shiprepairing in the country has followed a natural development of the port both at the coast and in the lakes. However, shipbuilding is a slow developing activity which is often hampered by inadequacy of the availability of facilities. Prior to 1954, the port of Dar-es-Salaam like the port of Tanga was an anchorage port and cargo handling was through lighters (barges and pontoons) towed to and from the ships by small tugs. To enable the servicing of these lighters and other utility boats, small slipways were established at both Tanga and Dar-es-Salaam ports. The slipways were designed to handle lighters of maximum deadweight of 200 tons (approximately 60 tons light displacement weight). These facilities were adequate until 1954 when construction of the first deepwater berth was completed and tugs were now required to assist ships to the berth. Maybe it would be unfair to talk of shiprepair and shipbuilding in Tanzania without reference to colonial government strategies and subsequent legacy by the independent East African states. The colonial strategy was to make the colony of Kenya the industrial centre and the three protectorates the market for these industries (East African Common Services Organization). This policy applied to shipping and related industries. The main port was Mombasa in Kenya and any shiprepair or shipbuilding facilities were installed at Mombasa on the coast and at Kisumu Kenya on Lake Victoria (share by Kenya, Uganda and Tanganyika). After the independence of the four states, everything remained as designed by the colonies with a change of names from East African Common Services Organization to East African Community. The break up of the community was the turning point for Tanzania in planning shiprepair/building activities. There was a time when the available capacity in Kenya for repairs and building was accessible to Tanzania.

Present position

Since the breakdown of the East African Community, the Lake Victoria services has done better than the service on the Indian Ocean coast. Tanzania Railways Corporation has acquired a floating dock and it is installed at Mwanza. The dock is used for assembling of passengers and cargo vessel for the lake service. The dock is also used for the periodic drydocking of the fleets in the lake. Also at Mwanza is a slipway used for assembling of fishing boat and building of lighters and pontoons.

On the coast the situation has not changed since the small slipways at Dar-es-Salaam and Tanga were installed. The first deliberate attempt to provide better facilities for the repair of floating craft on the coast was made in 1974 by the defunct East African Harbours Corporation. It had commissioned M/S Bertling and Partners Consulting Engineers (UK) to look into the possibility of siting a shiprepair yard in Dar-es-Salaam.

At the time of the consultant was already at the port of Dar-es-Salaam carrying out a development study for the port commissioned by UNDP. The terms of reference for this study was to facilitate the docking of port flotilla based in the Tanzania region of the EAHC. At the time the largest craft in the fleet was a tug of 560-ton LDW. The consultant produced an interim report in September 1976. However, before any further action could be taken, the EAHC disbanded. Nevertheless, the report had recommended for 800-ton slipway. This slipway would not have taken care of the docking of the coastal passenger/cargo fleet.

The next serious attempt was made in 1976. The Norwegian Government through Norad had offered to finance the project of providing a shipyard in the Tanzania Government. The government accepted the offer. Norad appointed M/S Ship Research Services (Norwegian) to carry out studies from pre-study to tendering. The terms of reference of this study included the drydocking of the coast fleet. Final report, including tender documents, was presented in the early 1980s. Here again the project did not take off because of unavailability of funds for it. M/S SRS has also recommended for a provision of a 1,000-ton slipway with transfer facilities to enable several vessels to be worked on simultaneously, and also provide new building bays. The facility proposed was also inadequate for the large coastal vessels.

No more studies were made by Mantra (Norwegian) and Code Blizard (UK) for Norad and Overseas Development Agency (UK) respectively. Both reports were not implemented due to the lack of funds by the respective sponsoring organizjation, i.e. Norad & O.D.A. (UK).

In December 1985, I attended an experts' meeting on small-scale boatbuilding and repair for the East African countries held in Mauritius. At the meeting we presented a project of rehabilitation of a shiprepair facility at the port of Dar-es-Salaam and Tanga for possible assistance by UNIDO. This was done between November 1989 and January 1990. Unfortunately, the final report has not yet been presented.

The importance of the shipyard

This report will be incomplete without mentioning the importance attached to the provision of a shipyard on the Indian coast of Tanzania. It will be recalled that in the last few years, the industrial development decade and transort and communications decade called for special action to assist in hastening the project implementation in these sectors. That the Tanzanian Government has given priority to these sectors is reflected in its Economic Recovery Programme (ERP) launched in 1986. Rehabilitation of existing industries and improvement in transportation infrastructure are emphasized in the programme. To that end the port of Dar-es-Salaam is currently undergoing major improvement so that it can render better service to the country and the land-locked neighbours to the West (Malawi, Zambia, East Zaire, Burundi, Rwanda and Uganda). However, the improvement of the port facilities may not be fully utilized if ships cannot enter the port because of tug breakdowns, pilot boats, etc. A shipyard at the port of Dar-es-Salaam will not only improve the port performance but also keep the coastal fleet of coasters and fishing boats moving.

It would be rather unfair not to mention anything about concrete floating structures. There is very little activity on this basically because of the lack of proper infrastructure. However, a small fishing port within the port of Dar-es-Salaam has anchored floating pontoons joined to form a jet. The unit pontoons were moulded ashore on the main port lighter quay and then lifted into the water by 120-ton floating crane. The floating jet is connected to the shore by a vehicle bridge. The port of Tanga in the north of the country uses lighter and pontoons for loading and unloading vessels. At present steel lighters are in use, but I believe this port could do with large capacity ferro-cement units. The operation cost can be reduced because of the local availability of both cement and steel at the port.

Until such time as funds are secured for hte development of a ship building/shiprepairing facility, there is very little activity on the Indian coast in the way of construction or repairing a ship in Tanzania.

A.M. Kunghalo
Assistant Port Manager (TS)

Shipbuilding Industry in Turkey

Although there has been shipbuilding activity in Turkey for many years, some major developments in the industry have taken place in the last two decades since the foundations of the Pendik Shipyard were in 1969.

Put into operation on 1 July 1982, Pendik, Turkey's largest shipyard, was initially furnished with a number of domestic orders as the country's shipowners were encouraged to invest in new tonnage. At the same time, the state provided an area around Tuzla/Aydinlik for private-sector shipyards to start ship production and the shipbuilding industry in Turkey really came of age.

A number of developments took place during the fifth Five Year Plan, which ended in 1989, including the establishment of the General Management of the Turkish Shipbuilding Industry (TSI) which separated shipyard activities from the operations of the Turkish Maritime Association in accordance with Law 233. During this period, the Pendik Shipyard won an order to construct three 26,300-dwt bulkcarriers for export to Poland and two 75,000-dwt breakbulk ships for DB Turkish Cargo Lines. Pendik Shipyard also houses an engine factory which has been manufacturing engines under licence for ships in Turkey since 1981, having signed an agreement with Sulzer. So far, most of the 84 Pendik/Sulzer Type A diesel engines manufactured at this plant have been used as main engines on passenger ships and car ferries and as generator diesels on cargo sup up to 5,000 dwt. In addition diesel engines of Sulzer RTA Type with slow cycle are being manufactured and three engines of 4 RTA 58 Type, 5,425 KW have been made and mounted into the Polish bulkcarriers.

At present shipbuilding capacity in Turkey comprises 42 shipyards, four belonging to the state-owned Turkish Shipbuilding Industry and 38 private yards, excluding the naval forces shipyards. Total capacity is around 300,000 dwt a year, 100,000 dwt belonging to the TSI which currently employs 4,500 workers, including 2,000 at Pendik. At the beginning of January 1991, TSI's orderbook comprised 14 ships of 241,300 dwt. Currently Pendik can construct vessels up to 75,000 dwt with its semi-dock type stock and has a dry dock (300 m by 70 m) enable constructing of vessels up to 170,000 dwt. Drydocking and shiprepairing facilities also are available, Cranage a 450,000 tons gantry crane and three 80-ton jib cranes will be positioned and fully operational by the end of 1991. The existing facilities provide a 16,000-ton-a-year steel processing capacity, but Phase II of the development involving operation of the drydock will increase the annual processing capacity to 48,000 tons. The first of three 26,300-dwt bulk carriers for Polish SS, named Ziemia Lodzka was launched on 26 October 1989 and delivered in December 1990. The second sistership is being fitted out and should be ready for delivery at the end of the year. The third Polish vessel is being outfitted. Another construction project is starting to take shape on the building bed in the form of 75,0000-dwt bulkers for DB. Turkish Cargo Lines.

Looking elsewhere, the Camialti Shipyard which can construct vessels up to 18,000 dwt and has orders for two bulkers of this size for DB. Cargo Lines. The other two yards under the auspices of the TSI focus mainly on shiprepair activity. The oldest shipyard in Turkey, Halic offers three drydocks up to 153 m in length with a total steel processing capacity of 3,169 tons per annum. Aside from repairing, Halic also undertakes construction of small ferries, tugs and pilot boats.

Outside the Istanbul area, TSI operates Alaybey Shipyard, located near Izmir, which was established in 1925 to provide facilities for the Turkish fleet operating in the Aegean and Mediterranean Sea. The shipyard which undertakes repair and ship construction, recently finished a small car ferry for the Turkish Maritime Organization which was the last in a series of eight vessels.

Private Sector Expands

Looking around at the private sector, Sedef Shipyard is currently constructing 24 timber carriers for the Soviet Union, Marmara Transport is building two 4,200-dwt multipurpose ships for West German owners and at Madenci four drycargo ships of 5,700 dwt for England are under construction. Meanwhile Turkish shipowner Ugur Mengenecioglu has initiated the construction of a newbuilding slipway for vessels up to VLCC size at a site in Gölcük, Izmit Bay. On the repair side, a number of contracts to dock and repair vessels have also been gained by the Erkal Shipyard, many from foreign clients. From this business, it is apparent that the Turkish shipbuilding industry is expanding, however, these orders are not enough. Turkey stood eighteenth with a share of 0.9 per cent of the world orderbook at the end of 1989. According to a survey by the West European Shipbuilders Association AWES, the demand for shipbuilding which was approximately 15.2 mn dwt a year between 1987-1990 will increase to 20.6 mn dwt during the next five years and to 38.4 mn dwt from 1995-2000. Therefore, the shipbuilding industry in Turkey must be encouraged and supported with sufficient credits in order to modernize our fleet with domestically built ships and to increase our share of the shipbuilding market worldwide.

ANNEX III

Reports

1. Short History of KORBSO (S. Pstadjan, D. Klinkov)

2. Constructive and Technological Peculiarities in Designing and Building of the Ferro-Concrete Vessels, Vessels for Public Services and Vessels for Plants (H. Naidenov)

3. Ferro-Concrete Floating Crafts for Public Services and for Plants (S. Petrov)

4. Practical Design of Ferro-Concrete Structures (M. Dineva)

Short History of KORBSO

(past, present and future)

The favourable location of Bourgas on the Black Sea coast creates adequate conditions for shipbuilding, ship maintenance and navigation.

John Stainbeck said, "Nearly for every human being the ship is much more valuable than any tool made by him. It is the incarnation of his dream which obsessed the men so much that there is nothing else in this world created with such cleanliness of the thoughts. The ribs rigidity, keel stability, correct selection and board strengthening depends on the heart he puts in his own work." Shipbuilding is one of the oldest occupations in Bourgas well known for many years. At the end of the last century, the requirements of the coastal navigation and fishing were satisfied by small shipbuilding companies. They produced mainly small boats because of the manual production activities. The first shiprepair shop was established in 1903. The equipment was very primitive and limited shiprepair and shipbuilding activities were carried out. Many private shops for building of wooden boats were established in the following 35 years.

In 1938, a co-operative society for shipbuilding and navigation "Bulgarian Lloyd" was established. This was a great step forward for the shipbuilding industry.

In 1948, a maintenance shop was established and it can be considered as the foundation of the future shipbuilding company in Bourgas. Building of 80 tons fishing ships, boats for the educations purposes, raw sailing boats, yachts and shiprepair according to the rules of the Bulgarian register was started there. In this period of time the plant is equipped with many new machines and facilities. All the special departments required for proper shipbuilding and ship maintenance were created. Process and design departments were established at a later stage and their duty is to cover completely the production activities, materials and parts provision, new building methods implementation, documentation issue for more complicated and bid repair works. This is considered as a beginning of the design work. A remarkable event in the history of the state shipbuilding company is building of the first ship with a metal structure in 1960. This was a river tugboat 200 H.P. and then the first fishing vessel was also built.

The production list of the company covers mainly tugboats 135, 300 and 360 hp, not-self moving dredger barges of 200, 300, 500 and 1,500 tons, hydrobuses with 150 seats, self-moving dredger barges, dredges, floating pump stations, barges and others.

Implementation of the modern section shipbuilding method can be implementation of the modern section shipbuilding method can be considered as the biggest success. This method allows the creation of correct shipbuilding plans based on the available design documentation. In this way all departments can plan and co-ordinate the outstanding work.

In order to enlarge the production abilities for building of fishing and technical vessels in 1969-1970, the company is moved to the present location of 800,000 m^2, which is great change compared to the old 15,000 m^2 area available in the port region.

The years following 1970 marked a new stage of development of the shipbuilding industry. New, modern vessels are built: 300-ton fishing vessels; 500-m, self-moving dredger barges; 1,500-t, coal-carriers and pushers with a high degree of mobility and floating ferro-concrete workshops which are the largest number of ships built in the yard.

Two new designs were implemented in 1977: 2,000-t section and modified ferro-concrete workshops. In the meantime self-moving dredger barges, ferry-boats, floating cranes, and grapples were produced.

The first 5,000-ton, tanker-type "KASPIA" was built in 1980. This was the start of new production brand: medium-tonnage vessels.

The first stage of plant erection and modernization was nearly completed during 1981-1987. The letter of credit for the second stage is already opened.

The biggest achievement is the commissioning of the unique hoistir. launching synchro-lift unit with a capacity of 7,300-ton launching weight of 25,000-ton dwt. Those new units and equipment allows building of the medium-tonnage vessels such as tankers, cargo multipurpose vessels, ships type "RO-RO", container carriers and special ships. A possibility for vessel maintenance and repair is also given. This includes repair of the hull, ship devices, furniture, mechanical units, piping systems, and electrical systems.

Specificity and development of the production processes in KORBSO during the last twenty years were determined by the following circumstances:

1. Building of new production facilities and continuous work of the existing one was done simultaneously;

2. Great variety of the vessels, floating crafts and other equipment in this time;

3. Development of the shipbuilding technology worldwide.

The great variety of the process decisions is especially evident in the building of the hull.

In the beginning treatment of the material for the building of the hull was done by chemical cleaning without preliminary straightening. Then blast shot cleaning of the sheet and profile steel was implemented together with a painting chamber for shop priming with the purpose of temporary protection. straightening for sheet material.

These units form a modern department for preliminary treatment of the hull material.

In the beginning the sheet material was cut mechanically by gate shears and manually by oxygen cutting of the curved areas. Cutting data were based on hull drawing in actual size on a mould loft by means of wooden templets. The oxygen cutting machine "ODESA" with an optic control from the cutting chart in a scale of 1:10 was commissioned later.

This was followed by implementation of oxygen cutting machine "KRISTAL". This machine allowed use of "FORAN" system for design drawing of the hull on a computer. Available machines in the center for navigation cybernetics in Varna are used for the above-mentioned purposes.

Bending department has a 315-ton flanging press, 500-ton hydra lic press, three-roller machine and "HU SMITH" profile bending machine. This equipment together with the accepted method of additional on-site bending through heating allows bending of nearly all details of the hull. Actually only some specific details are bent by other equipment.

Comparatively intensive programme with high quality of the work is reached in field welding sectors even though they are not completed yet because of the lack of the more exact erection lines. Automatic flux welding and shielded arc welding are the welding methods applicable in these sectors.

We are commissioning now a stand for single run welding of the panels.

The slipway is one of the sectors with advanced development during the past years.

In the beginning the slipway capacity allowed building of vessel hulls having a launching weight up to 400 tons. Section method was applied when the hulls were drawn on the tackle way up to the launching unit and then launched in the water by side uncontrollable launching. The implementation of the new launching unit and the slipway N1 changed completely the process of slipway erection of the vessel. The launching unit allowed launching and taking out for maintenance of the vessels and equipment having a launching weight of 7,200 tons. These are the limitations for vessels building and maintenance of KORBSO. The slipway equipment includes support bars lifted by hydraulic trolleys. This equipment allows block method application in building of the hull. The above method together with the on-line labour organization was tested and adopted in the building of the 5,000-ton tanker-type "KASPIA".

The experience gained in the period of maintenance of this slipway proves that it is most reasonable to apply block method in the cylindric part of the vessel and section method in the remaining parts.

A question of interest is the shot blasting method applicable before painting of the hull structures and considered as part of the completion works. This process improves the protection degree and the company is successfully adopting it now.

Dynamometer method of alignment is applied during the installation of the main engines and shaft lines.

Vessel systems manufacturing and installation is done in accordance with the requirements of the industrial treatment method for the ship pipings.

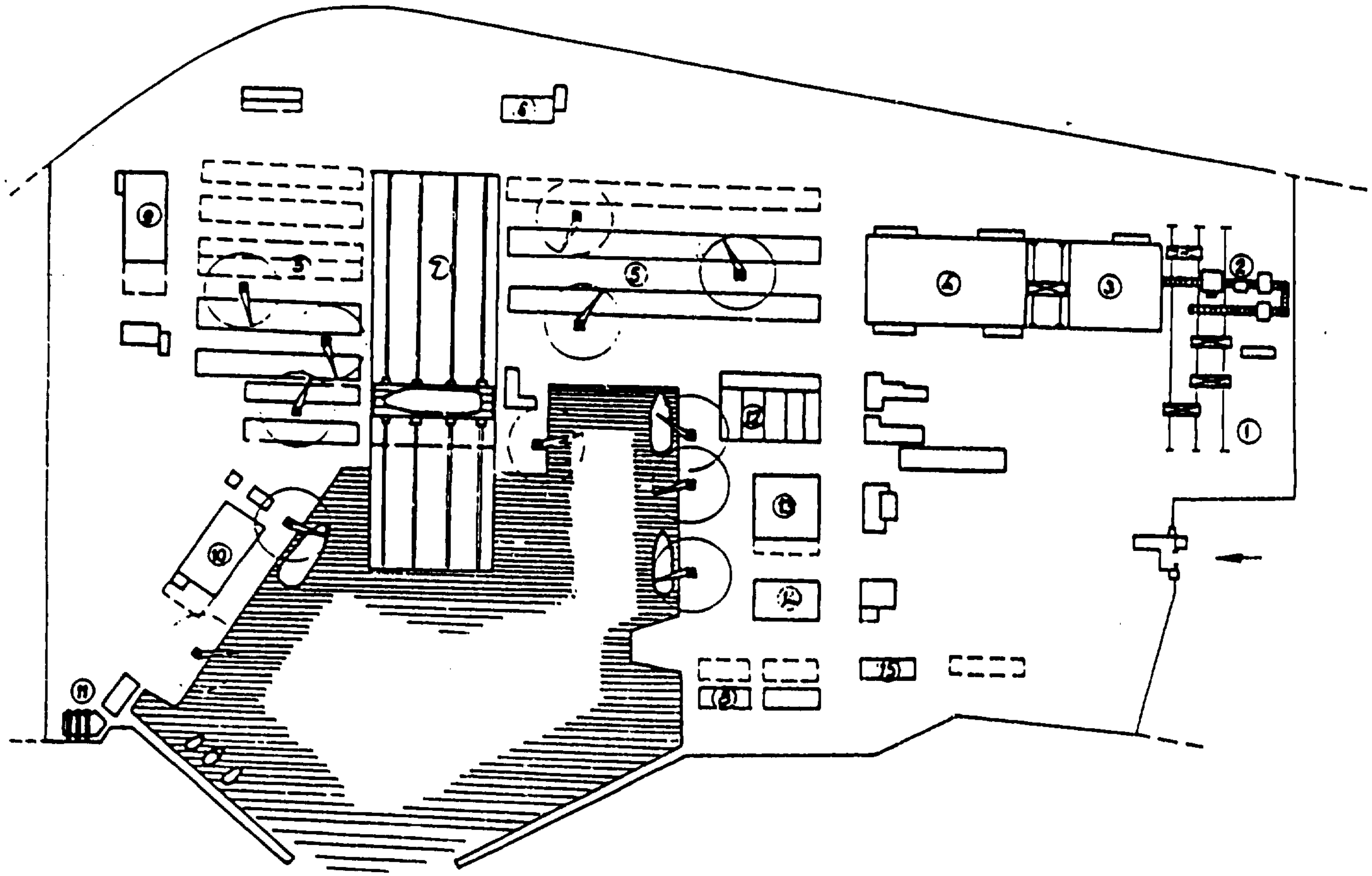
Experience is already gained in building of the floating workshops on the ferro-concrete hulls.

It is proven that those units built on the concrete hulls can be easily transported actually to any point of the world.

In the past years, we have adopted successfully the manufacture of the metal structures and grapples for lifting devices.

We are in the process adopting, together with the Norwegian company "Hydraulic Bratvaag", the production of hydraulically-driven windlass and mooring winches.

KORBSO, Shipbuilding & Shiprepair Co



LEGEND:

① Open/outdoor/Storage Complex
② Zero line
③ Steel Shop
④ Assembly-welding Shop
⑤ Open Slipways
⑥ Transport Shop
⑦ Hoisting-Launching Complex
⑧ Electro-assembly Shop
⑨ Block of Shiprepairing Shops
⑩ Erecting Shiprepairing Shops
⑪ Jaught Club
⑫ Erecting Shops and Stores
⑬ Erecting Block
⑭ Electroplating Shop
⑮ Ship's Outfitting Shop

Constructive and Technological Peculiarities in Designing and Building of the Ferro-Concrete Vessels. Vessels for Public Services and Vessels for Plants

It is well known that building of the floating crafts and some types of the transport vessels of ferro-concrete is economic and reasonable. More than 60 per cent of the steel is saved when ferro-concrete is used as construction material in building the vessels hulls and floating devices. Ferro-concrete vessels life time exceeds the one of the wooden and steel vessels 2 to 3 times and the maintenance expenses of the ferro-concrete vessels are 6 to 8 times smaller than the one made for the steel vessels.

Bulgaria is on one of the first places in the world list of the manufacturers of ferro-concrete floating crafts.

Even though there is some success in the field of technology, machines provision and organization of the production, the production technical level of the manufacturers of the ferro-concrete vessels, their culture and economic features are seriously behind the industrial and civil ferro-concrete building. In technological aspect the ferro-concrete shipbuilding has numerous serious open problems. The basis for shipbuilding development is improvement of the technology and production organization, implementation of the complex machines, use of new efficient materials, design of the qualitative technological structures. Building of the ferro-concrete vessels and floating crafts has many common features with building of the industrial ferro-concrete units that is why in the beginning the monolithic method was applied in shipbuilding and on a later stage when prefabrication and prefabrication-monolithic complex method were applied in the industrial and civil building they were accepted in shipbuilding as well.

The monolithic method was applied for building of different vessels worldwide such as tankers, submarines, pontoon cranes, landing stages, barges, fish plants. Floating hotels, floating docks with lifting abilities in the range of 6,000 to 8,000 tons, etc. When this method is applied all the work steps connected with building of the ferro-concrete hulls starting with building berth supports, floor covering, shuttering, reinforcement installation and concrete application is done at the building berth. Thanks to the simplicity of the monolithic method building of the ferro-concrete vessels is easily adopted by workers with low degree of qualification.

Even today monolithic method remains the basic method for building a new vessels. The monolithic method does not require expensive and complicated process equipment. It has comparatively simple building organization. It is an efficient method and has a wide application although its big disadvantages are well known: long-term building berth stage of the vessel, dependance upon the seasons, great labour consumption of the building berth works, difficulties in machines application at various building stages.

At the end of the 1950s, a tendency towards elimination of the disadvantages of the monolithic method by means of the process industrialization was evident. This problem was solved applying prefabrication and prefabrication-monolithic method. At first frameworks, bars (keelsons, carling and local reinforcement) and bulkheads were applied. These, of course, were trials to improve the monolithic method. Prefabrication of the hull internal elements and of the external elements was implemented at a later stage. In the 1960s pure prefabrication methods were applied for some types of hulls allowing this - ribless sections for smaller vessels which brought to 90 to 95 per cent industrialization especially in batch production.

Preparation and provision of the required process equipment and units should precede the application of the prefabrication and monolithic-prefabrication method. That means availability of inert materials treatment unit, concrete production unit, prefabrication shop, moulding shop, steaming boats and adequate cranes provision at building berth stages and hull launching devices.

The materials used for ferro-concrete shipbuilding do not differ considerably from those required for high-rise building but some special quality features should be considered deper[illegible]n the hull's application location.

Water tightness and frost resistance should be considered for water concrete used for ship hulls working in low temperature areas. Seawater resistance is reached by using sulphate-resistant portland cement.

Special requirements do not exist for the reinforcement except using killed or semi-killed steel depending on the area of application.

Smooth and well-tightened shuttering is strictly required for each of the cases in order to avoid cement outflow and to ensure smooth concrete surface.

The inert materials such as gravel and sand should be washed well and should cover the required grain size. Gravel grain size should not exceed one-fifth up to one-fourth of the thickness of the hull construction materials.

The concrete should be designed for dosing of the relevant compound materials by weight and of the water in liters and this should be strictly followed in order to provide the required consistency of the concrete. The consistency of the concrete used for the horizontal construction elements should be in the limits of SL = 9-12 cm and of the one used for the vertical elements - SL = 16-19 cm.

Potable water should be used for concrete preparation. Ferro-concrete shipbuilding development describes the advantages of the ferro-concrete vessels over the steel one as follows:

1. Metal saving using concrete following the relevant positioning of the steel in the vessel construction elements: ferro-concrete hull building requires 1.5 to 3 times less steel than the one required for the similar steel vessel. Repair work also requires less steel. As a result of this the total steel consumption is 2 to 4 times less than the one required for the steel vessels. Ferro-concrete shipbuilding requires cheaper steel compared to the not readily available sheet steel and shaped iron used for the steel vessels.

2. The concrete used in the shipbuilding during the ship life is not destroyed from the corrosion as it is done with the steel, the strength and the other properties are not influenced also. Thanks to this the ferro-concrete vessels do not require maintenance at regular intervals, long stay on docks, lifting or synchronized lift for painting which is required for the steel vessels.

3. The long life of the vessels (hulls) which is 1.5 to 2 times longer and the above-mentioned properties at normal operating conditions is a guarantee that the vessels age much more morally than physically. It is accepted that the life of those vessels is 70 to 80 years, i.e. 1.5 or 2.5 times longer than the one of the steel vessels.

4. Simplicity of the repair works. Repair can be easily done by the crew itself which is not always possible with the steel vessels.

5. Building organization of the ferro-concrete vessels is comparatively simple and cheap especially in case of production in series.

6. High heat resistance which in most cases is better than the one of the steel vessels. It is important to know that there is much better resistance at the influence of some of the harmful chemicals also.

At the same time the disadvantages of the ferro-concrete vessels over the steel one are as follows:

1. The 1.5 to 2.5 times heavier weight of the ferro-concrete vessel than the one of the steel vessel results in bigger draft or in case of equal draft it results in larger overall dimensions.

2. Reduced resistance of the thin walls of the ferro-concrete structures to the dynamic and especially concentrated cargoes. This is highly important for plating of the vessel board and transom, for the bottom and load area decking which are under knocks and shocks in case of sheet-anchoring, ice load, sludge stranding, drift shocks, etc. Those loads may cause forming of the cracks, local destructions and breaches, water tightness breakdown and sometimes it will result in hull strength loss. In this case the required vessel reliability will be reached by increasing the required additional protection devices.

3. The lack of adaptation abilities for future modernization of the hull or reinforcement and changing of its parts. This is because simple and reliable methods of attachment of new structures to the ferro-concrete do not exist.

4. Rather high criteria for floodability provision since the strength of the outer sheathing is lower than the one of the steel hull. Provision of the required floodability often results in increasing of the watertight, bulkheads and therefore the rooms use is deteriorated.

5. Weather conditions influence on the progress of building work. In case of temperature below 0°C the work gets very complicated and sometimes it is just impossible to work.

And sometimes it is just impossible to work.

The above-mentioned peculiarities of the ferro-concrete vessels do have great influence on taking a decision for reasonable implementation of the ferro-concrete and shipbuilding material. Shipbuilding industry normally uses normal ferro-concrete consisting of normal concrete (with natural fillers) and reinforcing steel bars of low and average strength and as a result of this the hulls are heavy and steel consuming. The application of light concrete made of artificial fillers (such as expanded clay aggregate, etc.) reduces the hull weight of 15 to 20 per cent and use of high resistance steel together with prestressed reinforced concrete reduces the steel consumption of 30 to 50 per cent and concrete consumption of 10 to 20 per cent compared to the normal concrete and steel application. Another advantage of the prestressed reinforced concrete is the increased strength of the sheathing.

Use of the light concrete and especially prestressed reinforced concrete increases the hull cost. Application of the ferro-cement and fibre-cement (with glass fibre) is especially advantageous in small vessels such as fishing boats and yachts because the steel consumption is reduced but the cost of the hull is increased. Except for the hull building, ferro-concrete can be used for the superstructures where the requirements for fire resistance is much stricter.

Ferro-concrete application helps create a perfect architecture and long life and the hull draft increases with 5 to 10 cm in case of superstructure of one or two floors. Building of small number of ferro-concrete hulls in the countries where special launching devices are missing can be done in basins dug for that purpose surrounded by dykes. The basin is filled with water when the hull is ready and then it is taken out of it. Another alternative is using the dry period and the low river level for building and when the high water comes the hull is taken out.

The variety of the ferro-concrete vessels depending on their application is as follows:

1. Vessels for plants

1.1 Soft-drink production plant

1.2 Bread-making plant

1.3 Processing dairy

1.4 Meat-processing plant

1.5 Metal-articles production plant

1.6 Wood-processing plant

1.7 Floating power station

1.8 Floating pump station

1.9 Floating docks

1.10 Floating cranes

1.11 Floating prefabrication shop for ferro-concrete elements and others

2. Vessels for public services

2.1 Floating parking places

2.2 Floating school

2.3 Floating hospital

2.4 Floating hotel

2.5 Floating restaurant

2.6 Floating hostel

2.7 Floating shop

2.8 Floating entertainment islands

2.9 Floating storage for inert materials, cement, corn, etc.

2.10 Compressor station and others

3. Floating equipment

3.1 Floating piers

3.2 Floating bridges

3.3 Floating transport bridges

3.4 Floating ports

3.5 Floating moles and others

List of the Ferro-Concrete Hulls for the Vessels and Equipment Built from 1942 to 1991

No	Description	Quantity (pcs)	Dimensions (meters)		
1	3,200-t tankers	3	L = 96	B = 14	H = 8
2	Barges	20	L = 42	B = 9	H = 2.8
3	Fish processing plant	15	L = 42	B = 9	H = 2.8
4	Floating hotels (100 beds)	20	L = 67	B = 13	H = 4.3
5	Panels for piers walls	12	L = 20	B = 10	H = 11.8
6	Floating repair shops	215	L = 62	B = 13	H = 3.7
7	Bathy-wall	2	L = 44	B = 10	H = 11.5
			L = 32	B = 9	H = 9.5
8.	Floating pedestrians Bridge made of 3 blocks		L = 63	B = 5.5	H = 2.1
			L = 58	B = 5.5	H = 2.1
			L = 30	B = 5.5	H = 2.1
9.	Floating pump station	1	L = 44	B = 13	H = 3.7

Total length of 16.92 kilometers of 291 hulls built in the town of Varna will be reached if they are put one after the other. Technical properties and economic indexes are especially valuable as design basis for choosing the main dimensions (L, B and H) of the ferro-concrete hulls:

		Consumption
1.	Weight module for 1 m^3 LBH of the vessel	0.20 - 0.47 tons
2.	Weight module for 1 m^3 LBH of the hull	0.19 - 0.28 tons
3.	Consumption of concrete for 1 m^3 LBH of steel of the hull	0.07 - 0.10 m
4.	Consumption of reinforcement steel for 1 m^3 LBH of the hull	0.02 - 0.03 tons
5.	Consumption of cement for 1 m^3 LBH of the hull	0.04 - 0.05 tons

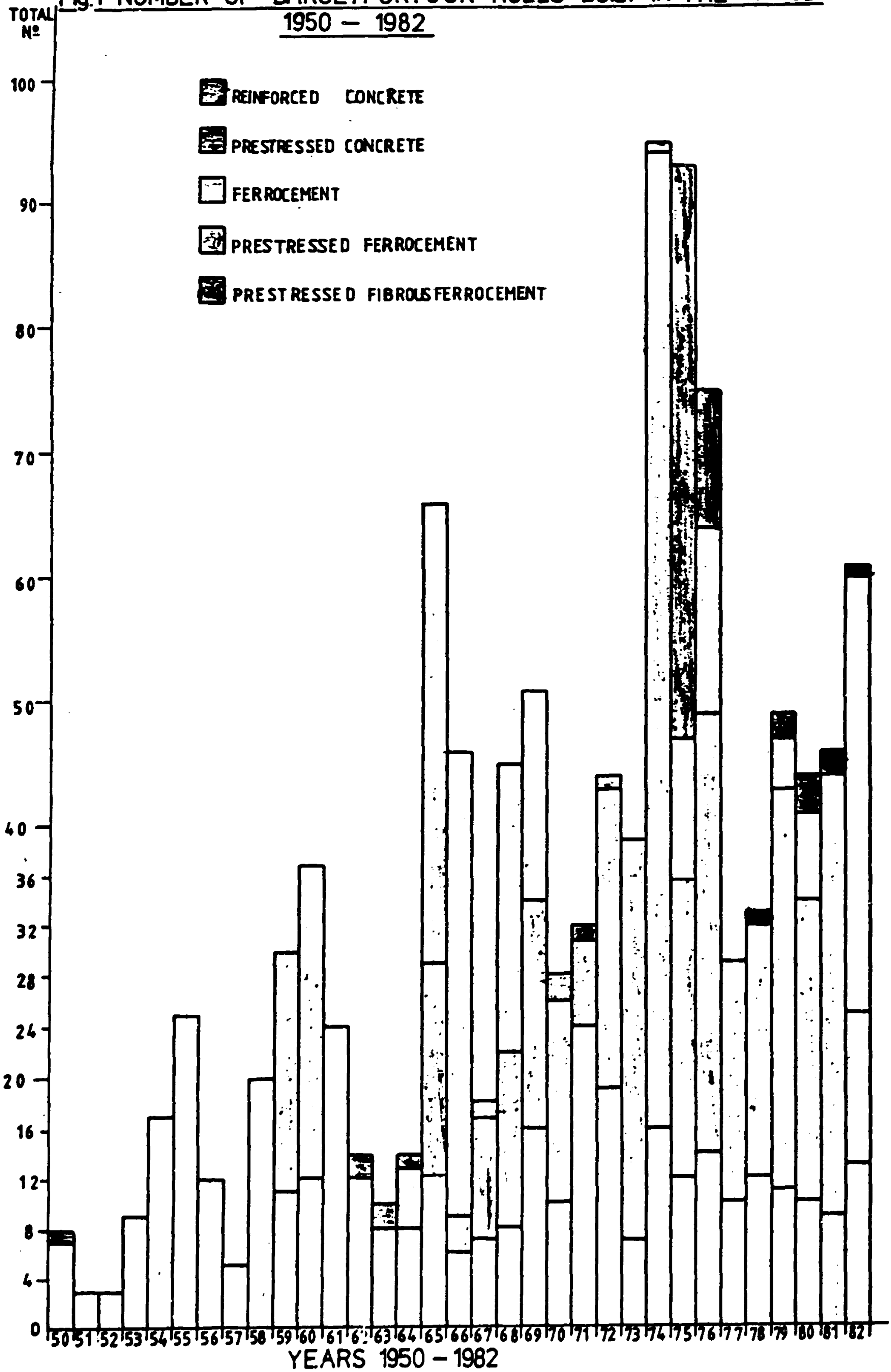
Attachments:

Figure 1: Number of barge/pontoon hulls built in the period 1950-1982

Figure 2: Number of barge/pontoon hulls of a particular length

Figure 3: Total number of barge/pontoon hulls of various materials in each country 1950-1982

Fig.1 NUMBER OF BARGE/PONTOON HULLS BUILT IN THE PERIOD 1950 – 1982



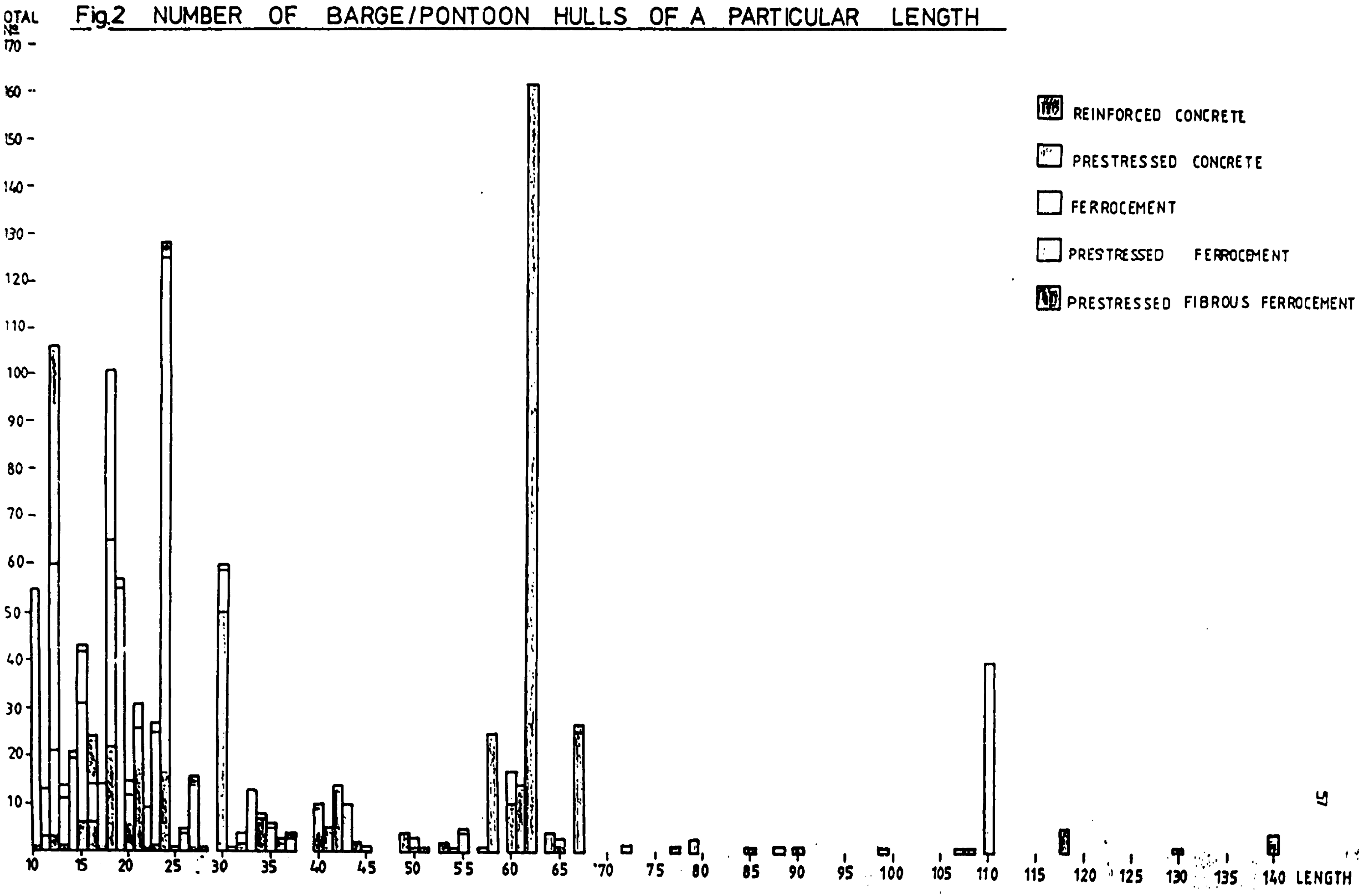


Fig.2 NUMBER OF BARGE/PONTOON HULLS OF A PARTICULAR LENGTH
OTAL №
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
REINFORCED CONCRETE
PRESTRESSED CONCRETE
FERROCEMENT
PRESTRESSED FERROCEMENT
PRESTRESSED FIBROUS FERROCEMENT
10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130 135 140 LENGTH

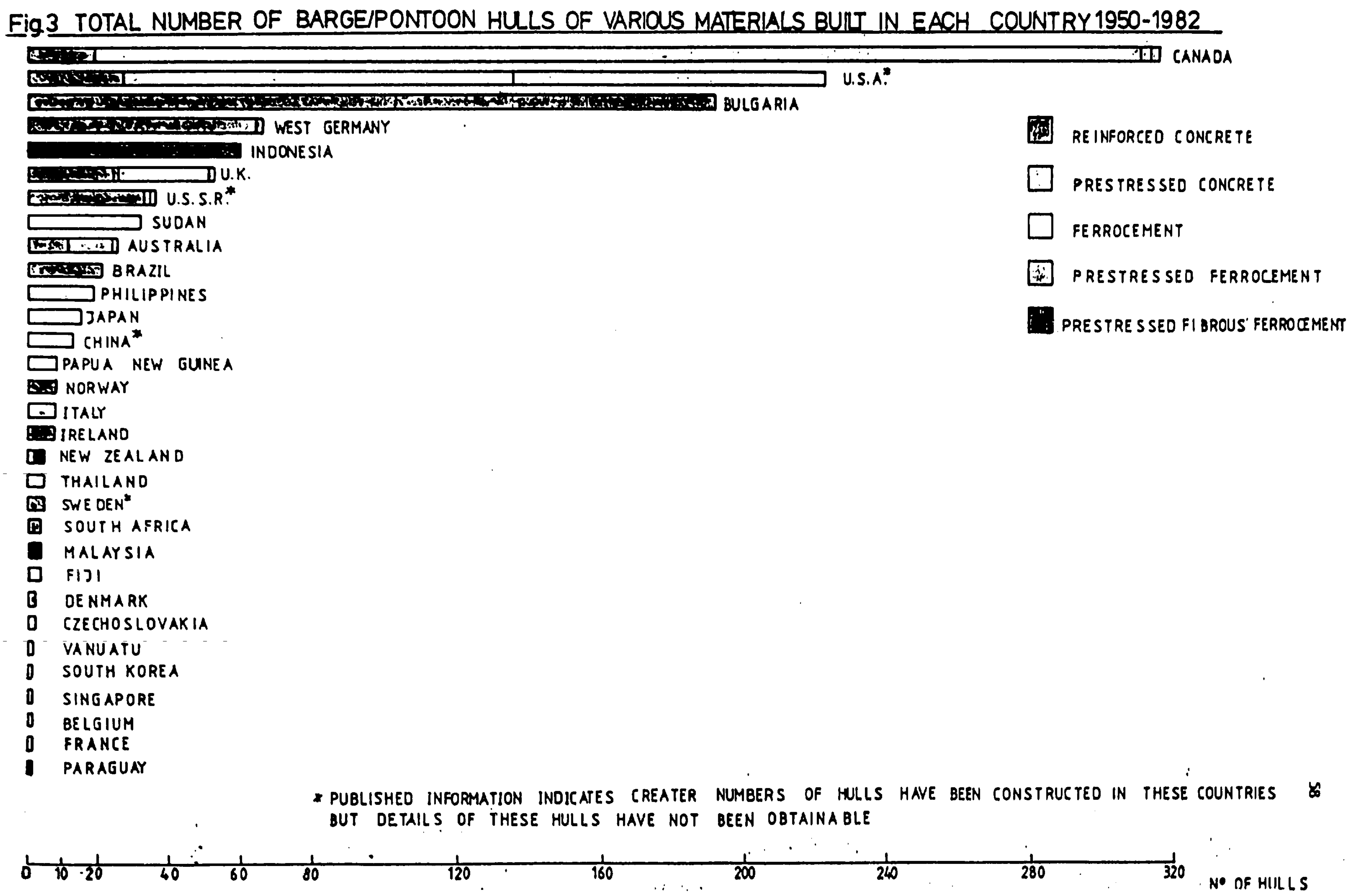


Fig.3 TOTAL NUMBER OF BARGE/PONTOON HULLS OF VARIOUS MATERIALS BUILT IN EACH COUNTRY 1950-1982
CANADA
U.S.A.*
BULGARIA
WEST GERMANY
INDONESIA
U.K.
U.S.S.R.*
SUDAN
AUSTRALIA
BRAZIL
PHILIPPINES
JAPAN
CHINA*
PAPUA NEW GUINEA
NORWAY
ITALY
IRELAND
NEW ZEALAND
THAILAND
SWEDEN*
SOUTH AFRICA
MALAYSIA
FIJI
DENMARK
CZECHOSLOVAKIA
VANUATU
SOUTH KOREA
SINGAPORE
BELGIUM
FRANCE
PARAGUAY
REINFORCED CONCRETE
PRESTRESSED CONCRETE
FERROCEMENT
PRESTRESSED FERROCEMENT
PRESTRESSED FIBROUS FERROCEMENT
* PUBLISHED INFORMATION INDICATES GREATER NUMBERS OF HULLS HAVE BEEN CONSTRUCTED IN THESE COUNTRIES
BUT DETAILS OF THESE HULLS HAVE NOT BEEN OBTAINABLE
0
10
20
40
60
80
120
160
200
240
280
320
Nº OF HULLS

Ferro-Concrete Floating Crafts for Public Services and for Plants

The ferro-concrete vessels are considered specific because their hulls are not made of conventional steel and wood materials. The subject of the present study concerns the more specific ferro-concrete vessels which during the maintenance period are fixed, not self-moving.

This is a good reason to call them floating crafts to distinguish them from the wide concept of "vessels" and bring the discussion to more specific limits. The floating crafts may have a variety of properties depending on functional abilities, service conditions, equipment provision, building methods, design solutions, etc. The present study of the ferro-concrete crafts will cover in detail some more specific questions.

Without calling it classification, we will allow ourselves to form two groups of floating crafts which we have studied and we can illustrate them. The groups are (1) floating ferro-concrete crafts for public services and (2) floating ferro-concrete crafts for plants.

Referring to the first group, we can present designs for a hotel, restaurant, hospital, hostel, public services, and garages. The second group is illustrated by dairy plants, bread-making plants, soft-drink manufacturing plants, water desalination plants, power stations, and mechanical shops.

The floating crafts of both groups have characteristics that make them attractive for solving more specific regional, social, economic, communication, organizational, environmental and other problems. Different regions worldwide are characterized by different nature spots where the social and economic needs are impeded because of inaccessibility.

Our interest is directed to the regions where rivers, lakes, and channels exist and where expensive dock equipment is unavailable. Without going into detail, we would like to mention that the specific conditions raise specific problems. Common problems refer to the availability of small or large human societies, economic and social state policies, etc., when a region is inaccessible by land or a great investment is required if water communication is available to solve the communication problem, even if it is a temporary solution. A good example of the above-mentioned is Brazil, where great regions inside the country are accessible mainly by water.

When ferro-concrete floating crafts are used, certain regions become not only accessible and well serviced, but also they can become centers for the surroundings.

There are unlimited possibilities for installing equipment differing in size, volume and type on the floating crafts since this can be done in industrial conditions where a high industrial level and human resources are available. The important advantage of the floating ferro-concrete crafts is that when their services are no longer required, they can be moved to other regions without changing the basic investment, as is required with on-land devices. This alternative for quick move to the other region can be for long periods of time or in case of disaster, epidemics, creation of proper living conditions, etc. The aggressive environment created by the water is the reason for making periodic maintenance and repair work on this part of the floating craft study from the technical point of view depends on their specific peculiarities, field of application, provision of equipment, area, and maintenance conditions.

Technical and economic factors are much more complex because they depend on detailed problem evaluation. This problem is not a subject of the present study. What are the more important general technical peculiarities connected with the design and structure of the floating ferro-concrete crafts?

The questions concerning the characteristic of the structure and materials of the ferro-concrete hulls may be studied separately because of their specific nature. Their coupling to the remaining sections of the craft, however, brings numerous questions requiring general solution of the problems.

The experience gained with the above-mentioned preliminary designs allows us to make the following general solutions:

To improve the technical and economic properties when several floating crafts are being built, it is reasonable that the hull structure should be of one and the same type, i.e. in general there should be a similarity in dimension, form, longitudinal and transverse elements, bulkhead, etc. It is acceptable to have different deck openings, foundations for equipment and machines and other built-in erection materials, etc.

Another important question is the scrupulous study of the strength of the hull and the superstructure. In the case of simultaneous work on the hull and superstructure, it is very important to reach a monolithic connection between them, considering that this is definitely influencing the total construction strength. The superstructure in this case is of conventional type made of steel. Here we shall allow ourselves to discuss another design solution where the steel hull is designed as a separate construction element which carries the superstructure. As an additional factor, we must consider the method of transport from the manufacturer to the place of work and whether this is from the manufacturer to the place of work or whether this is done by towboat and what are the sea-transport limitations. In any case the alternative studied wherein will increase the building cost of the hull. Therefore, it is natural to ask why it is necessary to study such an alternative.

As it is well known, the technical and economic conditions sometimes require the application of the complex installation methods in the completion of construction work. Therefore, a possibility for the application of construction and volumetric modules in the completion of erection is available.

The solution whether monolithic method/hull with superstructure or complex installation method is chosen depends on many factors. This is a subject of separate study where the common features of the industrial building and shipbuilding can be used. We can only mention an essential peculiarity which distinguishes the ferro-concrete crafts from the conventional ship structures.

Conventional superstructures cover the requirements of the classification organizations while the superstructure of the floating ferro-concrete crafts should be in accordance with the applicable civil standards. The experience gained in shipbuilding and in the industry in general can help to a great extent to superstructure construction and building. The possibility for application of different building systems and technologies results in quality improvement and cost reduction. The meaning of "building systems" should not be limited to its simplest understanding but has to include the significant achievements of the industrial and public building. To avoid any misunderstanding we have to remind the specific and common features for all floating crafts. A requirement for small weight of the structures and materials used for completion work can be considered as a general ship rule. The above-mentioned can apply to the same extent to the floating ferro-concrete crafts.

Design of the floating ferro-concrete crafts requires application of the normal shipbuilding practice what concerns the local and total strength, loading, hull draft, cargo distribution, wind loading, etc.

Extremely precise co-ordination is required between the elements fixed on the ferro-concrete hull and the one built in it. The design co-ordination on very high level is the best guarantee for high quality and faultless building of the floating craft.

This is especially valid when different elements, systems, and furnishings are built in the hull. The best result is attained by experienced engineers and their co-ordinated work, the unification of the design solutions, the application of the standard articles, availability of many machines and equipment, and the high degree of building industrialization. We can also add the use of modules prefabricated in the relevant shops.

Practical Design of Ferro-Concrete Structures

KORBSO has much experience in the field of design and building of the floating crafts on ferro-concrete module with the dimensions of 62-m length, 13.40-m width, 3.70-m board height and draft in the range of 1.90 to 2.25 m. This report gives a brief explanation of some of the basic architectural characteristics of the craft already built or to be built on the ferro-concrete module.

The plants and services listed here above (mechanical shop, hospital, hostel, hotel, restaurant, shops, bread-making plant, fish plant, soft-drink manufacturing plant, etc.) are intended for inland waterways or location in closed lakes or sea areas. After adequate preparation they can be moved by towboats in case of unlimited sailing area or to be carried by suitable ships to the relevant point of the world.

The structure of the hull listed above is monolithic, ferro-concrete and the type of the concrete is M300 and the reinforcement bars type is BCT 3CP4, 25G 2C, 35G C. This material allows very long (nearly unlimited) life without dock maintenance and easy deck service. Bottom and deck system set longitudinal and transverse on boards. It is divided in eight watertight compartments which provide single-compartment floodability. The pick compartments are with strengthened set and intensified out sheathing. The hull flexibility allows quick change of the location and easy solving of the communication problems between the hull itself and the superstructure in any of the alternatives. The superstructures are made of steel and as architectural type they are typical ship structures with mixed system of the set or pillar deck structures with walls of corrugated sheet metal. They are completely welded. Depending on the client's requirements for the classification, some part of the designs is according to the river register of the USSR Class "P" for inland waterways or to Lloyd's register - rules and regulations for the classification of inland waterways ships - zone 2.

They can work in moderate climate areas as well as at the north and south geographical latitudes. The field of application defines the degree of independence of the floating craft. For example, a hotel of 140 beds and a restaurant with 60 available seats has spare fuel, sewage and portable water for three days and food stock for two days.

Inland power supply is considered for all alternatives and can be used if that is feasible.

We bring to your attention some of the properties of the floating crafts.

Floating ferro-concrete workshop

Field of application of this shop is repair and maintenance of the ships, floating crafts and different machines (transport, wood processing, mine machines and others) in areas where research and production activities precede the provision of repair and maintenance machines. Shop high efficiency is defined by its complete independence, high production capacity and easy move. It is equipped with two diesel generators of 150 kw/380V, 50 Hz/ each and with a fixed generator of 25 kw/380V, 50 Hz, a steam boiler with a capacity of 1,000 kg/h, two water boilers (used for heating) with a capacity of 200,000 kkal/h, compressors.

The following production facilities are located in the two-story superstructure and:

- in the hold - a forgery, electrical repair facilities, battery and painting facilities;
- on the main deck - mechanical facilities and pipe fitting facilities;
- on the upper deck - woodprocessing area, radio repair shop, refrigeration equipment repair shop, fuel system repair area and a mechanical laboratory.

The administration and living premises include: offices, stores, one single and two double cabins, a dining room, bathrooms, doctor's cabin, etc. All the required ship systems and devices are available and some more specific are provided as well.

A floating hostel

The floating hostel on a ferro-concrete hull provides the required living conditions in distant places or in areas where power supply, water supply and sewage systems are provided. Its independence is ensured by fuel and food stock for seven days and potable, wash and sewage waters for one day or unlimited water supply if water treatment unit is provided. There are three decks with adequate living premises. The available seats on the main deck are 29 and one the upper two decks - 67 each. The living premises are as follows: an apartment for four persons consisting of a bedroom, a nursery, a hall and a bathroom and an apartment for three persons consisting of a hall, three-bed cabin and a bathroom. The following rooms are considered on the decks: a medical isolation room, office, administration office, control office, kitchen, canteen for 80 persons, laundry, ironing room, store, bread-making shop and food preparation room.

There are two diesel generators with a capacity of 249 kw each and a fixed generator with a capacity of 48 kw. The required ship devices and systems are provided.

Floating hospital

The floating hospital on a ferro-concrete hull provides medical services in the distant areas, covers the lack of medical supplies, provides highly qualified personnel and specific devices in those areas and helps developing the infrastructure in other districts.

The hospital has a crew of ten persons. No beds are provided for the crew. The hospital beds are as follows: three beds in the isolation ward, reanimation room beds for five persons, surgical department for 14 persons, therapeutical department for 21 persons. The spare supplies of fuel can last for seven days, portable water for three days, wash and sewage water for five days.

There are two main diesel generators of 264 kw each, a fixed diesel generator with a capacity of 50 kw and a steam boiler with a production capacity of 630 kg/h. The air conditioning system covers 30 per cent of the premises including the sterility wards. It operates at 40°C ambient temperature and a relative humidity of 70 per cent. The height of the rooms is 2.8 m and the metal superstructure is located on the following areas: main deck 45 by 10.55 m, first deck 57 by 11.55 m, second deck 39 by 10.55 m. Lifts are provided for the crew and for the patients.

Some of the basic characteristics of the departments are listed here below:

Isolation ward

Patients requiring special living and hygienic conditions are accommodated here. Conditions for avoiding the mixed infections, special food and treatment, preparation and storage of the disinfection medicines are also provided.

Blood transfusion sector

It is used for blood transfusion to the patients in laboratory or hospital conditions.

Hospital

Consists of surgical and therapeutical departments where the required living conditions and proper treatment is provided. All the conditions for general cases treatment and for planned or urgent surgical intervention are ensured. There is a reception hall as well.

Polyclinic

The following consulting rooms are provided: reception hall, administration, dentistry, obstetrician's room, dermatology, ophthalmic room, therapeutic room, surgical room for urgent intervention and surgical room, mortuary, pathology, X-ray diagnostics, laboratory for clinic, biochemical and parasitclogical tests, pharmacy and the relevant stores, blood and blood products store.

Medical service includes kitchen, laundry, sterilization sector, repair shops and stores. Modern medical facilities are provided for all of the consulting rooms and service areas.

All the alternatives of ferro-concrete hull listed above cover the requirements for fire protection. There are horizontal fire protection areas, fireproof structures are selected and all internal bulkheads are fire retardant type. The floating craft location will define the type of the heat insulation, the fire protection will define the type of the heat insulation, the fire protection, antivibration and other insulation on some spots of the craft client's requirements, problems detail study and maintenance conditions define the specific features of each of the alternatives listed above.

It is illustrated that design solution for different types of the ferro-concrete crafts can be found. It is evident that one and the same hull is used. Space distribution by the hull transverse beams is one and the same for all the designs. This proves the possibility for high degree of unification of the hulls of the floating crafts. Hull's area is mainly used for service devices, tanks, stores and other similar facilities.

The accessibility to the compartments through the ferro-concrete deck is a subject of the detail design considering that communication passages in the main hull bulkheads are not allowed. The passages through the ferro-concrete deck has to be studied separately. Solution for the deck structure has to be made by calculation methods when it is required.

Smaller or bigger number of facilities, workshops and tanks on the deck depends on floating craft degree of independence. The aim of the design engineer is to reveal the nature of the relevant craft, its properties and field of application through the architecture.

The architecture can be enriched by additional plastic shaping bringing the vivid style and remarkable architectural details. The floating crafts together with the water areas, land facilities and communication are giving a good chance for unique solutions matching to the natural and urban character of the district.

ANNEX IV

KORBSO's Closing Statement

We are happy with the organization of this meeting and that the representatives of the countries from Asia, Africa and South America show their interest to our experience in ferro-concrete technology.

Our contribution to this meeting is that we were the hosting country and together with you we try to assist developing countries in this field. This meeting is our first, but not the last one and we can maintain our activity in this field. This is just the first step of these bilateral activities.

We understood that not all of the participants' countries are interested in this technology, but from offered speeches we just better understand local conditions in these countries. Although there are specific conditions in every country, we believe that this technology could be beneficial and practically introduced in a country, concerned with the benefit of its population. In this respect, we would be happy and fully prepared to provide further assistance in co-operation with UNIDO or on some bilateral basis. We feel that the activity of the participants is going to do the best so to understand needs of their countries. Our goodwill is to help the countries and to contribute our high technological achievements to them.

Also we are fully prepared to send our experts and:

1. to study the local market, the demands and applicability of ferro-concrete structures;

2. to advise on the location of proposed facilities;

3. to advise a type of floating unit most suitable for the local conditions and to prepare design of such floating units;

4. to assist introduction of our technology.

5. to recommend the equipment and instrumentation for this technology and we are ready to deliver this equipment;

6. to provide training of local personnel in your companies;

7. to accept your specialists in KORBSO for training.

So why did we organize this meeting and what is its purpose?

It is not only to meet each other, which is also a pleasure for us, but also to give practical assistance. This meeting must have some practical results--co-operation between our countries and companies, exchange of technology, know-how, training of specialists, etc.

Perhaps we should organize another meeting too, it is also the opinion of the participants, we think that this co-operation between use under the auspices of UNIDO, the international supporting organization, will be salutary for us both.

If you desire you can send written recommendations for future co-operation to UNIDO office as a joint venture, transfer of technology, know-how or specialists.

We want to thank you for your coming and nice assistance. Thank you very much for your outstanding work job during these three days.

Hope to see you again in Bulgaria.

ANNEX V

Programme of the Meeting

of specialized workshop on concrete and other floating structures, organized by the United Nations Industrial Development Organization (UNIDO) in co-operation with the Government of Bulgaria and KORBSO, Shipbuilding and Shiprepairing Co., 22 to 25 October 1991 in Bourgas, Bulgaria.

21 October 1991

Arrival of the participants

22 October 1991

10:00 Opening of the workshop, speech of Mr. Terziev, General Director of KORBSO

Reports:

1. What should we know about KORBSO (a brief historical review)
2. Presentation of country papers of the participants
3. Constructive and technological peculiarities in designing and building of the ferro-concrete vessels, vessels for public services and vessels for plants.

Discussions

15:30 Visit to KORBSO shipyard

23 October 1991

10:00

Reports:

1. Ferro-concrete floating crafts for public services and for plants

2. Practical design of ferro-concrete floating structures

Discussions

14:30 Discussions

24 October 1991

08:00	Visit to Varna
10:00	Visit to Shipbuilding Equipment Works
14:30	Visit to Shipbuilding Cybernetic Center
15:30	Visit to Bulgarian Ship Hydrodynamic Center
18:00	Departure to Bourgas Closing of the seminar: conclusion and adoption of the recommendations of the meeting

25 October 1991

Departure of the participants

Letter of advice to the Participants

It was a pleasure for us to meet and get acquainted with Mr. __________, a representative of __________ at the specialized workshop on ferro-concrete shipbuilding, organized by UNIDO and KORBSO, Shipbuilding and Shiprepair Co. in Bourgas, Bulgaria.

We would like to reveal our satisfaction and we want to thank Mr. ______ for his attendance and nice assistance at this specialized workshop.

We highly appreciate his participation with his country papers and revealed interest towards ferro-concrete shipbuilding.

We believe that this meeting should have practical results. We know that there are specific conditions and environment in every country, but we hope that our technology could be beneficial and of further assistance to some of them.

We would be happy if we can propose our capabilities for assistance in co-operation with UNIDO.

We are fully prepared to provide different forms of technical assistance as follows:

1. Training courses - their direction and content will be additionally agreed;
2. Teaching of specialists;
3. A co-operated investigation of needs, possibilities and expediency of development of ferro-concrete shipbuilding in the country;
4. Design and technological projects of ferro-concrete floating structures;
5. Design and building of ferro-concrete shipbuilding works;
6. Organization of the production of floating ferro-concrete structures.

The above-mentioned forms of technical assistance will be provided from our best trained specialists.

We expect Mr. __________ to inform the appropriate country companies and government authorities for the subject and activity of this meeting, as well as their recommendations before them for future contacts and practical use of the workshop's results and for the organization of another meeting in the future (it might be organized periodically) with special emphasis on ferro-cement fishing boats and many other applications as well.

We would like to believe that we can be at your best service.