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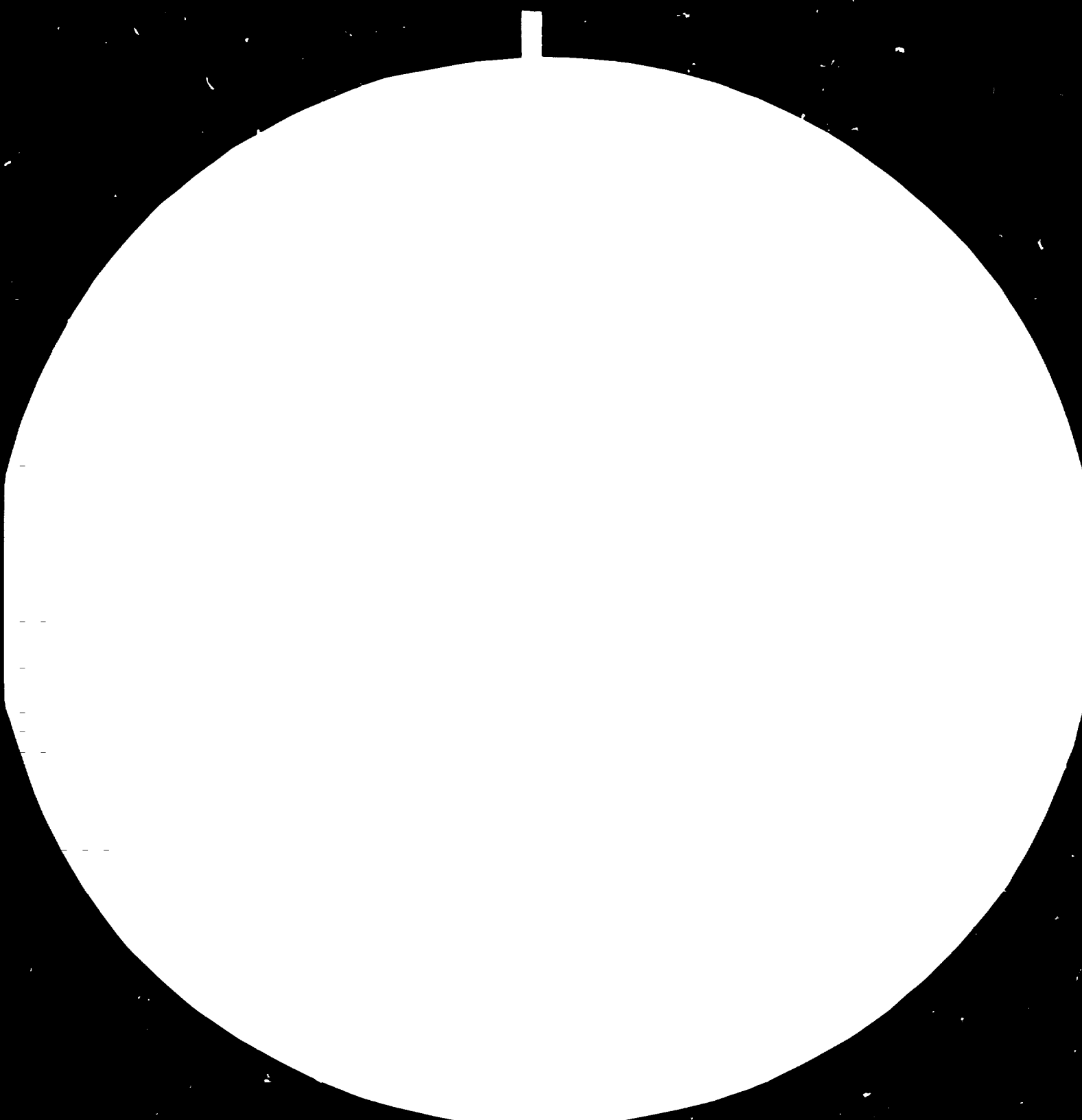

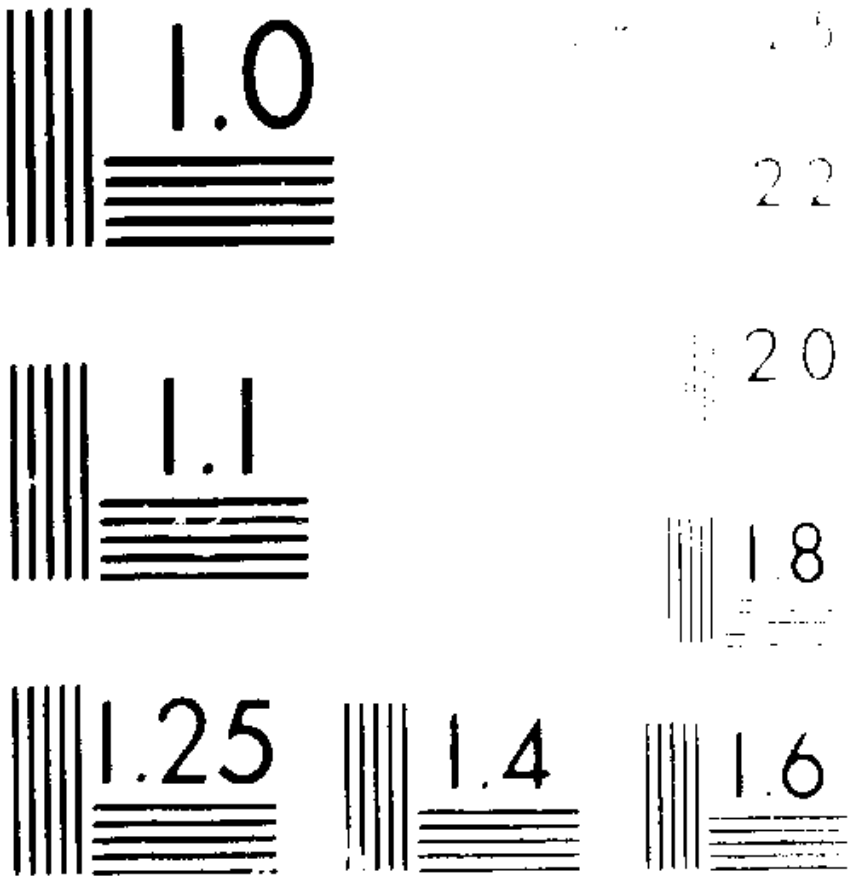
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19 March 1982
English

Yugoslavia.

RECOMMENDATIONS TO IMPROVE STEEL STRUCTURES PRODUCTION AT THE SHIPYARD "VELJKO VLAHOVIC" IN BIJELA, MONTENEGRO

SI/YUG/79/804

YUGOSLAVIA

Technical Report *

Prepared for the Government of Yugoslavia
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of E. A. Heino, shipyard consultant

United Nations Industrial Development Organization

Vienna

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SUMMARY

The one month mission regarding steel structures production, according to the schedule given in job description SI/YUG/79/804/11-03/31.9.D, was carried through from 19 October to 18 November 1981.

The main conclusions and recommendations are the following:

- The location of the shipyard in well sheltered waters is good, but the space for future expansion is limited.
- As a yard with heavy-lift cranes, the transports will not restrict the production programme.
- The yard has a technical knowledge required to undertake most of the works included in the production programme.
- Problems, however, will rise if the organization is not strengthened.
- It is therefore recommended to limit the production programme to some well-known products.
- Proper consideration must be given to develop a long-term plan for the shipyard.
- Special attention must be paid to heavy internal transports and the cranage question as a whole. The choice of heavy gantry is a decisive question and requires careful investigation.
- The operation of all facilities should be prepared in time by working out a Master Schedule.
- The time between design and construction has been too short in Phase 1 of the rebuilding programme. This must be observed in the preparation for Phase 2.
- Co-operation, not only with shipyards in Yugoslavia, but also with foreign yards is hardly recommended.
- Members of Project Group should be given opportunities to visit some foreign yards.
- One specific advantage the yard has compared with many traditional shipbuilding countries is the existing relatively low wage rate. By that means the yard has time to improve its weak points. This time should not be wasted!

Finally the author hopes that recommendations given for the most part can be utilized without waste of time.

I N T R O D U C T I O N

The shipyard "Veljko Vlahović" was founded in 1927 with the main activities in the repair and construction of small wooden and steel vessels. After the Second World War, the shipyard expanded its production facilities and production programme which included two main profiles: ship-repairing of large vessels and the manufacturing of steel constructions, pipelines and other equipment for the chemical and petro-chemical industry.

This expansion was carried out around 1955, when a new plato shop, shops for outfitting and a pier 300 m in length were built. Shiprepairs became the main objects in the production programme for the yard.

In 1968 the yard took in use a floating dock built by the yard itself, but based on design made in Paris. The lifting capacity of this first dock was 10.000 tons. In 1975 the yard received a big floating dock built in West Germany. The lifting capacity of this dock, 33.000 tons, made the yard enable to undertake docking of ships up to 120.000 tdw.

The yard was ... well equipped to undertake also complicated repair works, especially when there were good possibilities to use as sub-contractors the big shipyard in Split and a navy yard in the vicinity for more sophisticated works requiring expensive machines. With only a small design office the new building was limited to simple objects, but by manufacturing also steel constructions labour force of the yard rose to 850.

As a result of the disastrous earthquakes on 15 April and 25 May 1979, the shipyard nearly lost all workshops, including machine tool equipment, tools and parts of vessels which were under repair. Other facilities were also damaged or completely destroyed, including 250 m of the wharf with a travelling crane of 10 tons, 120 m of the wharf without a crane, the main store of raw materials and spare parts, as well as the Head Office with all inventory and documentation. The total damage is estimated at US $120 million. The extent of damaged areas is shown in Appendix I.

The slightly damaged plate shop and a more damaged plumber's shop were the only workshops which could be put in reasonable order immediately. Luckily both floating docks and the 300 m long pier were only slightly damaged. With the resoluteness of all employees difficulties were bridged, and as early as one week after the disaster shiprepairs continued on a smaller degree.

For the time being the shipyard employs 750 people. Shiprepairs go on in both floating docks and on ships moored alongside the undamaged part of the pier. The plate shop and the temporarily repaired plumber's shop are heavily loaded. For saved machines and outfit works provisional sheds have been built. Plate shop is, however, occupied mainly by works for reconstruction. A big job is manufacture of piles needed for rebuilding the facilities of the yard. But a noticeable amount is also produced for reconstruction works outside the yard.

Immediately after the first shock was over, the management of the shipyard started action for the rehabilitation and construction of facilities which were lost. A team of leading experts from local universities and other shipyards have been engaged in preparing designs and programmes for reconstruction.

Two years ago Mr. D. Panyushkin, the substantive officer at the UNIDO headquarters, visited the shipyard. After that three experts have been assisting the yard in questions concerning rehabilitation.

First was Mr. J.E. Ahrensbach from Denmark. He worked in June 1980 at the yard in civil engineering questions. Same fall Mr. J.B. Gorski from Poland was there as an expert in shiprepairs. In August this year Mr. B.K. Mazurkiewicz, also from Poland, was at the yard for the same purpose.

The reconstruction of facilities for shiprepair is now going on all over. The first building, a store, is already roofed, and will be ready in March next year. All outfit shops with an area of 8,500 m^2 altogether will be ready next year. The pile driving for the new part of the quay is mainly done.

All these works are based on a technical base project for the shipyard - hereafter called Main Project. The first approved part - Phase 1 - now in progress, and paid by the state, will restore the facilities to their level before the earthquake.

The later part - Phase 2 - in Main Project is a wider modernization plan aiming to a maximum use of the outfitting capacity of the shipyard. The decision of the realization of this Phase 2 will be made later on conditions that the yard itself can finance it.

The modernization of steel structures production - for which the author has worked as an expert - as a part of the Main Project and the main points of this are included in Phase 2.

I. THE MISSION

The work of the author was performed under a one month UNIDO contract (Mission: SI/YUG/79/804/11-03). It was performed mainly at the shipyard "Veljko Vlahović" in Bijela, Montenegro. It also included briefing at UNIDO in Vienna on 19 and 20 October 1981 by Messrs. A. Rassadin and B. Banic and administrative personnel. Before starting the field work in Bijela, and when this was finished, discussions also took place in Belgrade with representatives for SANU, Srpska Akademija Nauka i Umetnosti (Serbian Academy for Science and Art) acting as consultants for the reconstruction and modernization project of the shipyard.

About a debriefing at UNIDO in Vienna on 13 November 1981 has been agreed.

During his stay in Bijela from 22 October to 12 November 1981 the author worked in close co-operation with the small but effective Project Group of the shipyard. Here, in meetings with the chief designer of the rebuilding and modernization plan for the yard, Dr. S. Milošević, the author also had opportunities to be well acquainted with the philosophy behind all solutions presented in this plan.

Representatives for all organizations mentioned above have made a valuable work and the co-operation with them is herewith gratefully acknowledged.

List of participants is presented in Appendix II.

According to "Job Description" of 24 July 1981 (SI/YUG/79/804/11-03/31.9.D.) the purpose of the project was as follows:

To provide consultancy in steel structures production to improve its quality:

The expert will specifically be expected to:

1. Evaluate the state of equipment and steel structures production technology;
2. Give advice on up-to-date equipment and technological schemes;
3. Suggest ways and means for improving steel structures production at the shipyard;

4. Assist in the evaluation of the new design of the shipyard and the production programme.

The expert will also be expected to prepare a final report, setting out the findings of the mission and recommendations to the Government on further action which might be taken.

All these duties have been carried through with a particular stress laid on the evaluation of the new design of the shipyard.

II. TERMINOLOGY

In the report special scientific terminology and symbols as well as unusual abbreviations have been avoided. Abbreviations are usually explained when they first appear.

A term however requires explanation as below:

tdw = tons deadweight, ship carrying capacity for cargo and stores expressed in mass tons.

In economical evaluations the exchange rate:

US dollar 1.00 = 37,50 new dinars (ND) has been used.

III. STEEL STRUCTURES PRODUCTION

The rebuilding of facilities for steel structures production is now carried out according to a base technical project (Idejni Tehnološki Project) for steel structures production and offshore construction at shipyard "Veljko Vlahović" dated 9 September 1980. This project is a part of the Main Project, and will also be realized in two phases.

Phase 1 when completed will secure the yard facilities corresponding them before earthquake, but modernized where possible.

Phase 2 is an expansion plan taking into account the maximum use of the outfitting capacity of the shipyard. This design is made on conditions that the old plate shop will be restored. In this chapter the proposed steel structures production is described beginning with base figures.

The design is made for universal production and the production programme includes a wide variety of objects - from complicated sections for ships to simple piles - and also offshore construction.

The calculated yearly steel throughput is 18.000 tons divided in 15.000 tons for steel construction and 3.000 tons for shiprepair. 1.700 tons will be plates, 4.800 tons profiles and 1.440 tons pipes.

Maximum plate dimensions are:

Length	12.000	mm
Breadth	3.000	mm
Thickness	50	mm and
Maximum weight	8,9	tons.

Medium dimensions for plates are 9,000 x 2,000 x 15 mm, and medium weight 2,16 tons.

For profiles and pipes the maximum length is also 12,000 mm, and for pipes the maximum diameter 430 mm. For these items medium length is 8,000 mm, and medium weight 500 kg.

A simple one-direction steel flow has been aimed at. With slight modifications this flow is U-shaped, beginning at stockyards, separate but beside its other, for plates and profiles. The steel is supplied primarily by means of road transport, and delivered mainly from inland

steel-mill. The plate storage area, calculated for 12 weeks' supply, is provided with gantry crane with magnetic lifting equipment.

This crane lifts plates on a roller conveyor and another crane, of a type not yet determined, profiles. Both plate and profile material pass through the same abrasive cleaning, priming and drying equipment. The output of plates and profiles leads directly into the plate shop of about 6,500 m^2. There exists also a possibility to let the plates on the conveyor pass the plate shop. By this means the yard can undertake works also from outside the yard without disturbing own jobs in plate shop.

In the plate shop the plates and profiles progress through common steel preparation equipment and can be routed either through the old plate shop or the new bay. In the latter an area for pipe preparing is planned. In order to avoid expensive foundation work old heavy machines in old plate shop will be left on their present unfavourable places.

It is calculated that 40% of steel material, 7,200 tons, will be pre-assembled. For this purpose an area of 1330 m^2 is reserved in the new bay in plate shop, and an other of 1800 m^2, served by one 25 tons double boom crane and self-propelled mobile cranes, outside.

Assembly work will be done outside on an area of 4320 m^2 served by same cranes as outside pre-assembly and in addition to this by the proposed big gantry crane with two 75 tons hooks.

For unit assembly and erection the yard disposes an area of 1,5 hectares covered by the big gantry crane and an other of 3 hectares between the plate shop and the waterfront. For erection work on the latter is proposed:

1 self-propelled mobile crane with lifting capacity of 400 tons,
2 self-propelled mobile cranes with lifting capacities of 35 tons and ten tons.

For moving heavy sections with weights up to 6,000 tons from erection area into the floating dock taken in the basin included in the design, hydraulic rams are proposed.

The need of workers is calculated by 60 h/ton steel. This gives 600 workers in relevant trades. For more complicated works, requiring 100 h/ton, the need of workers rises to 1,000. The difference will be covered by co-operation with other Yugoslavian shipyards.

A really ambitious project for a yard nowadays employing 120 workers in steel structures production.

IV. E Q U I P M E N T

The equipment chosen in the Proposal of Technical Project for Steel Construction and Offshore Production is modern and well adapted to the production programme kept as base. For a shipyard with a technical knowledge like this the shipyard "Veljka Vlahovic" processes there is no use to make an evaluation item by item. Some general remarks will mostly do. Only points of decisive importance for the success of the Project are handled more in detail.

A. Machine Equipment

Specification of the correct machine equipment for a yard with a very diversified production programme is not an easy problem. In this case, however, it has been solved well. Machines are of safe, not too complicated type, suitable for universal and flexible production.

Some remarks about old machines. The hydraulic C-press has a capacity of only 170 tons. This will not be enough for effective work with place thicknesses included in the production programme. Same goes with roll press of 600 tons.

However, it has been noted that the yard has ability to develop effective equipment from simple machines. A good example is the semi-automatic welding equipment for longitudinal butt welds in piles.

B. Cranes

This is a field where a fat can be done. Accustomed mainly in ship repairs and simple steel structures production, the yard doesn't have sufficient knowledge in effective cranage required for a more complicated production. This is also a field where investments are costly. It is therefore worth a careful investigation.

Shop cranes

Overhead gantry cranes, in use of the old plate shop and proposed for the new one, have a sufficient lifting capacity and height. The number is also adequate. One thing which must be examined is the need of local small cranes.

Main cranage

The three 25 tons double boom travelling cranes as well as the one of 10 tons are well suited to the production programme. The proposed new 25 tons crane of same type is well needed.

The number and the lifting capacity of cranes for assembly areas require, however, special attention. The flexibility for construction of alternative objects makes the investigation not easy, but by doing some rough estimations one the safe side it can be done. The aim must be to use cranes in an effective way: Heavy cranes for heavy lifts, light for light lifts.

The author's impression is, that the yard by aiming to use same cranes universally at large areas will cause disturbance to the average work and lose working time, especially when loaded hocks are not allowed to pass over working areas.

Gantry for heavy lifts

The choice of big gantry will be the key-point in Phase 2. A right choice will guarantee the success, a wrong may spoil possibilities for future development. It is therefore a problem for special attention.

As an ideal solution is presented an arrangement shown as plate 1 in appendix III. The sole conditions are not observed in this proposal. Anyway, it offers so many advantages, that it is worth an investigation. Main advantages are:

1. Investments in heavy lifts could be made in two stages.
2. The gantry - if any - required first will be less expensive.
3. The 25 tons cranes could be used for lifts in basin.

4. The repair yard should receive a spare area well required scaffoldings and intermediate storage.
5. The future building berth - or slipway - could be built under the second gantry, without spoiling the now designed system for transporting heavy units from quay to floating dock.
6. If the yard includes in its programme also demolition of ships it can be taken into account when defining the lifting capacity of the gantry crane. The second gantry could be given a capacity to enable lifts of double bottom sections ashore and thus eliminate the risk for deteriation of see water.
7. The choice of a bigger gantry in Phase 2 should also justify a choice of one with 3 hooks arrangement (two in one trolley, one in the other), and herewith guarantee simple 3-points lifts with great accuracy.

Last but not least, all future development of unit assembly and erection techniquewill depend on this choice. All facts available must therefore be in hands when the decision is taken! In order to facilitate the investigation required in this urgent question the author will have a study made in Finland.

V. PRODUCTION PROGRAMME

The proposed production programme for steel structures production includes the following objects:

- floating objects without propulsion machinery (ship sections, barges, pontoons etc.);
- bridge constructions;
- steel construction for ship hulls;
- pipelines;
- cisterns and tanks;
- crane constructions;
- hull sections (bow and stern sections, deckhouses, and steel masts);
- piles, and
- offshore constructions.

The total yearly steel throughput for these objects is - as mentioned before - 15,000 tons. This is about three times the amount the shipyard produced before earthquake (exclusive ship repairs).

The production programme thus covers a wide field of different kinds of objects. There will therefore also be a wide variation as well in quality requirements as in need of skilled workers. Some are easy jobs the yard already is used with, other with really high requirements.

To give a general answer about the possibilities of the yard to success in all of them is impossible without a time-consuming thoroughly investigation. The capability of the drawing office and the skill of workers in different trades need special attention. It must also be observed that planning for steel structures production cannot be based on experience from repairs. The reality that there are big differences between more improvisated repair works and strict controlled new buildings must be taken into account.

Generally speaking, the author thinks that the shipyard has a capability to do well with a lot of jobs included in the list above. The more complicated objects with high quality requirements, big ship sections and offshore constructions, cannot be managed in an economical way with only a skeleton drawing office.

It will therefore be wise to increase the present production selection slowly and at the same time build up a drawing office with a well trained staff.

VI. NEW DESIGN OF THE SHIPYARD

The new design of the shipyard is worked out on conditions that the only slightly damaged plate shop will be restored. This has been a restrictive factor for the concept of layout. An ideal solution with ample free areas against waterfront and workshops grouped behind in right-angled arrangement has not been possible. In an evaluation this must be kept in mind.

The importance of effective facilities for shiprepairs and the flexibility for construction of alternative type of steel work have been well noticed.

Workshops for outfit, mainly for repairs, are well situated and ample, but due to the restrictive factor mentioned above, too close to the waterfront. Storage areas required, especially when working with big hull repairs, must therefore be found from farer away. The platform in front of the floating docks will be very useful and partly compensate the shortage mentioned.

The plate shop with a new bay beside the old one lengthened with 28 m will do well for the calculated steel throughput. The proposed steel stock-yard has been laid out in a proper way and has adequate area.

Assembly areas outside are only roughly indicated and need more attention when the production programme is investigated in detail. Heavy self-propelled mobile cranes recommended for unit assembly are an expensive solution and most be considered only as provisionals.

The proposal to move heavy sections by hydraulic rams from erection area into the floating dock taken in the basin included in the design, represent an advanced technique and will if rightly managed be effective.

The service supply is well arranged. All electrical and piped services are grouped in ducts, with outlets where necessary.

In general it can be said, that the design of facilities under construction is well adapted to the purpose. There will also be time enough to improve the design of the rest, proposed but not yet commenced.

The site of 14 hectares (about 35 acres), and limited possibilities to increase it, will in the future restrict the expansion. Before big investments it must therefore be decided to what extent is future expansion of the facilities to be allowed for.

VII. C O N C L U S I O N S

General impression very positive. The shipyard is situated in well sheltered waters and have a competent labour force. The rehabilitation works are also progressing well. By this means the yard has all possibilities to manage technically the proposed production programme. The quality of the steel work now in progress was good.

The proposed prodrction programme of the shipyard is so many-sided that there may be difficulties to manage this with present organization. The yard, however, has a lot of experience, and is situated in a land with well-known shipbuilding industry. Experts from other yards can therefore be easily obtained when required.

The equipment chosed is - on the whole - well adapted to its purpose. In the beginning not too complicated equipment will be used, but possibilities to turn over to more sophisticated working methods - when more experience is gained - have been beared in mind. However, the capacity of the hydraulic G-press seem to be too small; should be 400-600 tons.

A weak point, when doing big hull repairs or conversion works, is the lack of sufficient storage and marshalling areas for assemblies close to the floating docks. A point which required more attention is the cranage question in whole.

The space used for repairs workshops is very crowded. Anyhow, it is worth thinking abour reserving a place for a simple shed for easy steel work. By this means the interruption of more regular works in progress in the plate shop could be avoided. This shed with sliding roofs requires only same simple gas cutting equipment and a small hydraulic press. The press could be taken from the main plate shop, when this receive a well required bigger press.

Service supply is well planed. All services are available where they are required.

One disadvantage, well known to Mr. Milošević too, is that reconstruction works must go on directly according to the base project. There has not been any time to scrutinize this base project and then work out a final project. The design is therefore made without comparing many alternatives on a wide scope. Only the most important parameters are carefully investigated. Problems arisen have been, however, well bridget.

The author has a slight feeling, that the yard by striving to be well prepared for an universal, very diversified and at the same time flexible production, now try to cover with same equipment - especially cranes - too wide fields of production. There may therefore be a loss in rehability and efficiency.

As well can be understood in a situation like this, when production must go on at same time as reconstruction needs a lot of attention, and tend to disturb normal works, the staff is heavily loaded.

The Project Group is well qualified for its task, but must in the first place tackle actual problems. The time required for further design is difficult to find. This is one of the main problems, which must be solved in good time before starting the final design for Phase 2 in modernization project.

There will be, no doubt, a growing need for steel structure products included in the building programme of the yard. The difficulties the yard must overcome are:

how to obtain entry to the markets, and

how to reach a competitive efficiency.

The quickest way to obtain this is by accuracy in delivery times and by high quality.

In offshore construction with its rigorous quality requirements the accuracy and quality of the product can best be guaranteed by effective,

and therefore heavy, unit assembly technique. The choice of type and size of the gantry for heavy lifts is by that time a decisive question!

And last but not least. The yard has one specific advantage compared with many traditional shipbuilding countries: the existing relatively low wage rate. Average wage rate per hour for skilled workers is only 50 ND (new dinar). The yard has hereby time to carry through the modernization plan, to strenghten its organization, and to have managerial staffs conversant with the latest techniques.

VIII. RECOMMENDATIONS

To begin with one generally accepted rule kept in mind when these recommendations are worked out:

Almost without any exception it pays best to use methods and acquire equipment well adapted to a known production, use it effectively, pay it of quickly, and be well prepared for more sophisticated designs in the future, but postpone the realization until adequate knowledge is obtained.

If the shipyard now - when the production programme is only outlined and still in need of a more thorough investigation - strives to the best possible universal solution, it may have to use for years an expensive and for its ordinary production assortment a more ineffective equipment than a cheaper one.

Proper consideration should therefore be given to the development of a long-term plan for the shipyard, based, as far as possible, on well verified facts. If this is made by sufficient care, it will yield a good return for the capital investment.

The more specified recommendations can be divided in two categories:

A. Recommendations for immediate action, and

B. Recommendations to be dealt with before the decision to realize Phase 2 is made.

A. Recommendations for immediate action

1. Strengthening of the Project Group.
   The Project Group of the yard possesses good knowledge in questions it has to deal with, but it seems to be overloaded with daily routine duties.

   A reorganization, either by increasing the staff or by reducing its routine duties, is recommended in order to get one person, well acquainted with the whole project, free to concentrate upon follow-up of the project as well as upon future development.

2. The operation of reconstructed and new facilities should be prepared in time by working out a Master Schedule for the production programme

of the shipyard for some probable combinations of products. When doing this, it will be observed that also a very diversified production includes many work phases similar to each other.

- Based on this it should be arranged to have steel preparation as well as sub-assembly done at definite working stations.
- Sufficient storage areas for work in progress, to balance the widely varying operation times for various processes, should be prepared and clearly marked.
- Efforts should then be made to specialize a reasonable amount of workers to fit for the job they mainly are assigned to do.

3. The use of assembly areas should be outlined by making a division in areas for: pre-assembly, unit assembly and erection.

4. Special attention must be paid to heavy internal transports. The modern concept that cranes should mainly be used for lifts and transports should be kept on ground must be followed.

5. The cranage question as a whole should be thoroughly investigated. Attention should be paid to the need of local cranes, with direct control of all motions from ground level.

6. The decision about the span, lifting capacity and type of the proposed big gantry crane should not be made before gaining more exact information about future production programme of the yard.

7. It is essential that machines should be sited in their correct sequence in the production line. This should be observed and realized in the plate shop when the production reaches a level to bear it.

8. For quality control: tolerance bands for all stages in unit assembly work should be specified.

9. A site reservation should be made for a shed for easy steel works in ship repairs.

10. Before starting with offshore constructions semi-automatic innershield welding should be testing in local conditions.

11. The site within natural boundaries should be reserved for future expansion. The Government should prohibit all constraining building on this area.

12. In order to widen views members of Project Group should visit shipyards in some countries with diversified shipbuilding and steel structures production comparable with the on yard is aiming at.

B. Recommendations concering Phase 2

Preparation for a final plan for Phase 2 must start as soon as possible. Ample time must be given to scrutinize the design before decision or realization is taken.

Special attention should be given to:

1. Flow patterns and working station, spaces fo intermediate storage and needs for marshalling areas. Material must be routed by process, not by job or unit.

2. Transport system and equipment.

3. The integration of steel and outfit works.

4. Testing new working methods in small degree in good time.

C. General recommendations

To an end some general recommendations.

It should be in the interest of the shipyard to create regular communications with foreign yards with advanced technology.

This could be done either by:

signing a know-how agreement with a shipyard familiar with the most up-to-date production methods and with a good capacity for research and development, or if this turns out to be too expensive, by:

co-operating with some experts in countries with ample knowledge in diversified shipbuilding and steel structures production. In other words: to have some co-ordinators for questions the yard likes to check.

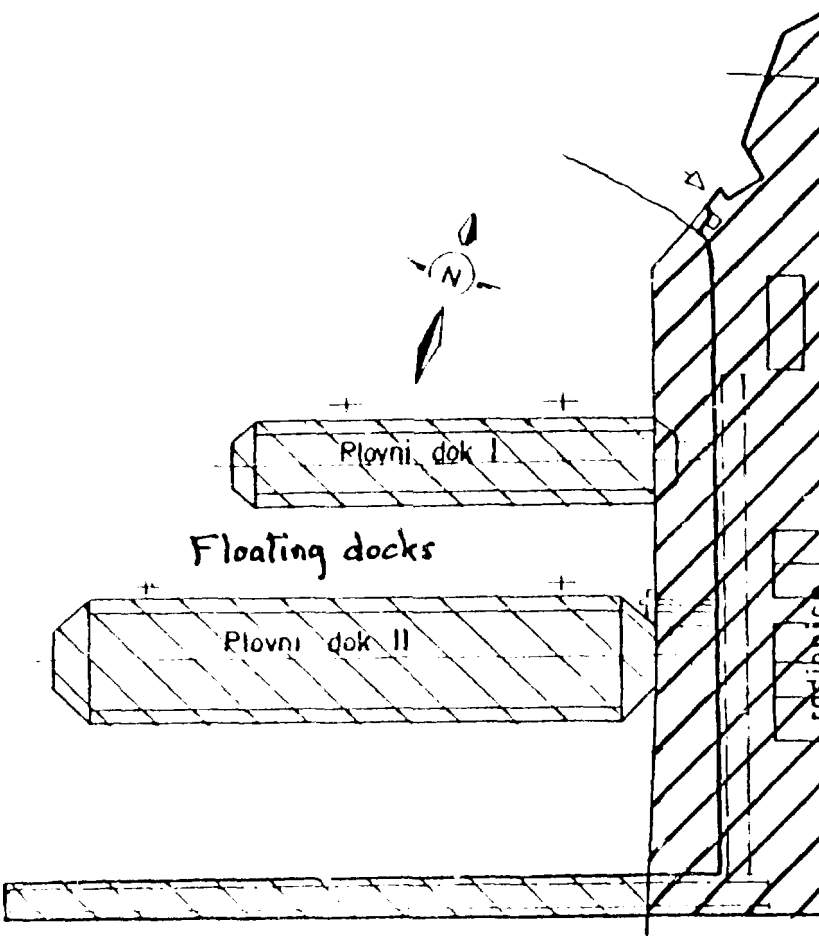
By these means the realization of the project could be continuously backed up by specialists.

Most of those recommendations made above are based on evaluations in general, and not on accurate investigations. They are therefore also given without exact specification. The author, however, hopes that recommendations for the most part can be utilized without waste of time, and that they in rest of cases give a solid base start preparations required before realization.

Completely destroyed
Potpuno uništeno (100%)

Partly destroyed, reconstruction possible
Delimično oštećeno, rekonstrukcija moguća

Undestroyed
Neoštećeno



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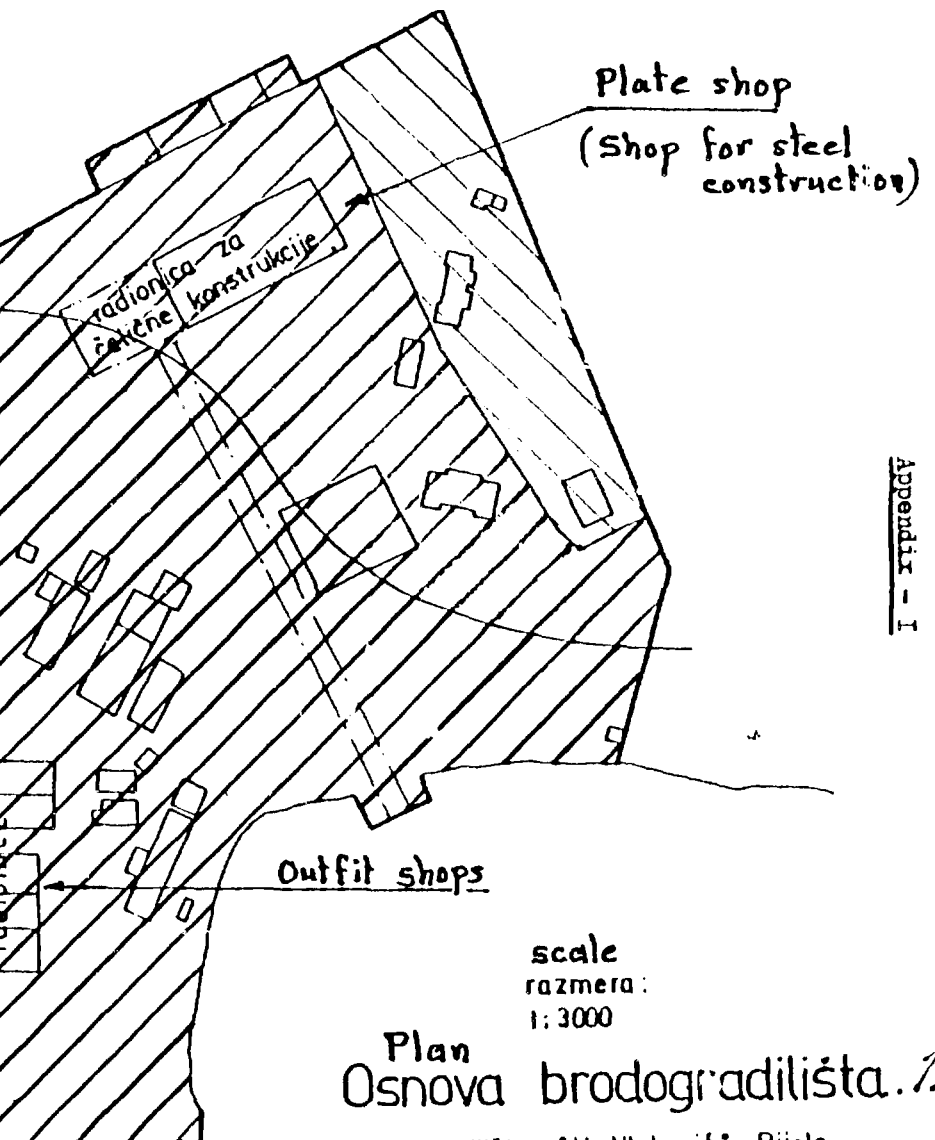
Appendix - I

Zemljotres 15.04. i 24.05.79.g.
Earthquakes



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Plan
Osnova brodogradilišta. 1.

Brodogradilište "V. Vlahović" Bijela

Appendix - II

LIST OF DESIGNERS

Institutes and persons directly connected to the New Design of the shipyard "Veljko Vlahović"

Institutes:

Institute of Technical Science of SANU (Serbian Academy of Science and Art), Belgrade, Abbreviation: ITNSANU

Technical Faculty Rijeka in University of Rijeka, Rijeka

Persons:

Chief Designer: Professor Dr. S. Milošević, Technical Faculty Rijeka

Chief Designer for Steel Structures Production:
Dipl. Eng. J. Skarpa; Director of Development at shipyard "3 Maj"

Supervisors: Prof. Dr. N. Zrnić; Director of ITNSANU until end 1980

Dr. B. Bilen; scientific adviser in ITNSANU, Director from beginning of 1981

Shipyard "Veljko Vlahović"

Managing Director: Voja Adjanski, Commercial graduate

Project Group: Dipl. Eng. B. Durović; Chief of Project Group

Dipl. Eng. V. Tušup, Depty Chief and Technical Secretary, Equipment

Dipl. Eng. T. Milinović; Civil Engineering

Dipl. Eng. M. Zečević; El. generating and supply

3 assistants and 1 secretary

Steel Production: Chief: S. Zloković, Naval Architect

Appendix - III

A G E N D A

for meeting at the shipyard "Veljko Vlahović"
3 November 1981

1. Steel Structures Production

   Equipment

   Production technology

   Questions of importance:

   - Material flow, working stations and intermediate storage areas
   - Internal transports: trailers and fork-lift trucks

2. Labour Policy

   Recruitment and training with on-the-job experience

   Cooperation with other yards:

   - Communications
   - Accomodation

3. Plate Shop

   Span and height of bay 2 (Phase 2)

   - Possibilities to divide in high and low

     Crane arrangement

     Hydraulic press too small for effective work

     Quality control

4. Assembly Areas

   Cranes

   Storage and marshalling areas

   Sheds and shelters

5. Erection Area

   Cranage

   Heavy self-propelled mobile cranes only provisionals

   Floating border line between assembly and erection areas

6. Big Gantry (Goliath crane)

   This will be the key-point in Phase 2!

   Bigger lifting capacity and wider span, no outrigs over rails.

   Proposal is shown as Plate 1.

7. Evaluations

The new design of the yard in general

Demarcation line between steel work and repair?

Outfit facilities are without space for expansion.

8. Shiprepair

Own plate shop or shelter for easy work?

Service functions

Space for sub-contractors?

9. Phase 2

Time for realization?

In the meantime:

- Collect data to define size and weight of products, and their division in units, and relevant data of units too
- Targets for activities should be worked out (efficiency, material surplus, supply level etc.)
- Investigate the integration of steel work and outfitting

10. Demolition of Ships

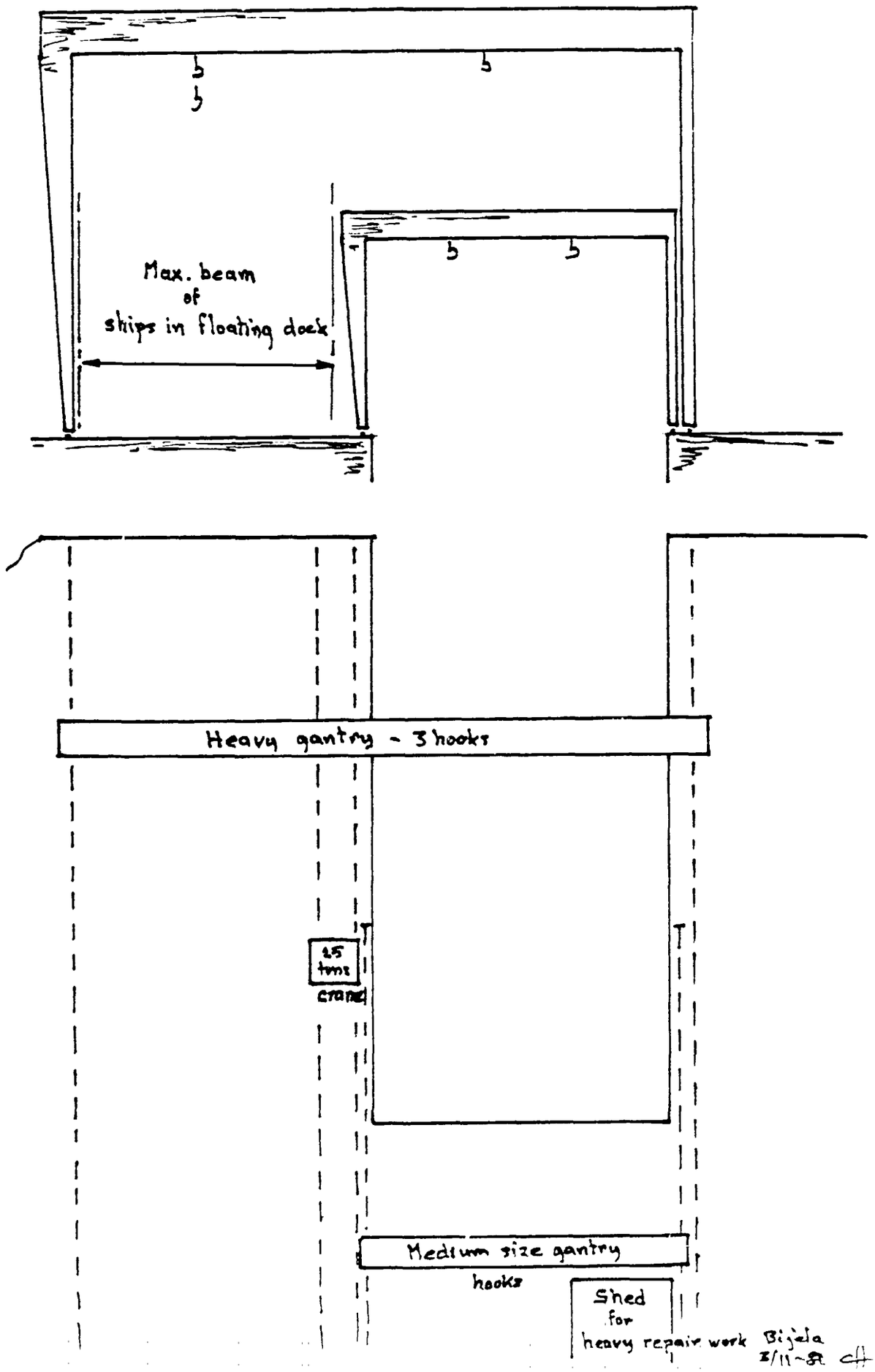
Use of big gantry

Scrap storing and transport

Bijela, 3 November 1981

Erik A. Heino

Plate 1
For 1981-11-05
meeting



Bijela
2/11-81

Appendix - IV

A G E N D A

for meeting at ITNSANU in Belgrade

13 November 1981

1. Summary of works done in Bijela

2. Evaluations
   - Production programme
   - New design of the shipyard
   - Production technology
   - Ways of improving production

3. Conclusions

4. Recommendations

5. Points requiring special attention
   - Organization
   - Management
   - Planning and production control
   - Preparation for Phase 2
   - Cranage, especially big gantry
   - Transports

Belgrade, 13 November 1981

Erik A. Heino

Appendix - V

A G E N D A

for final meeting at ITNSANU in Belgrade

17 November 1981

1. Points raised during first meeting

2. Quality requirements

   High quality in complicated constructions cannot be obtained without staff used to work preparation and production control

3. Production Programme

   Need of drawing office should be investigated in time (long build-up time)

   Widely diversified production cannot be economic without drawing office with experienced staff

   To take into consideration: Specialization in objects of same kind

4. New Design of the Shipyard

   Importance of scientific approach

   When realization commences the design must be ready

   Training of employees must start at same time

   Short building time favourable

5. Activities to develop

   Management services

   Methods engineering

Belgrade, 17 November 1981

Erik A. Heino