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FINAL REPORT ON STUDIES OF  
ATTTESTATION OF PREFABRICATED ELEMENTS  
IN BUILDING

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IN SWEDEN JANUARY 31 ST - APRIL 12 TH 1974.  
IN DENMARK APRIL 16 TH. MAY 9 TH 1974.

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TECHNICAL ASSISTANCE OFFICE  
Economic Commission for Europe  
UNITED NATIONS

Date of award:

31 January to 9 Mai 1974

Name and home country:

Mrs. W. JONAK (Poland)

Field of study:

Attestation of prefabricated elements  
in building.

Country (ies) of study:

Denmark, Sweden



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P O L A N D

THE TAO FELLOWSHIP HOLDER  
IN SWEDEN AND DENMARK.

THE FINAL REPORT ON STUDIES OF  
ATTESTATION OF PREFABRICATED ELEMENTS  
IN BUILDING

IN SWEDEN January 31st - April 12th 1974

IN DENMARK April 16th - May 9th 1974



I. The brief statement of my responsibility, training and the nature of the work I have been doing in Poland

I have graduated in the Warsaw Polytechnical University in 1961 as civ. eng. in the field of prefabrication and technology of building materials. In 1961 I have started my work in the Precast Concrete Factory in Warsaw as the Chief of the laboratory and the quality control. My duty was to supervise the routing<sup>e</sup> tests of building materials and concrete products, the control of technological processes and the quality control of final products. In 1966 I had started a new job in the Center for Building Design and Technics Development of the Warsaw Building Trust as the Chief of Laboratory. My responsibility consisted in directing and supervising research and experimental work carried out by the laboratory service in the field of

- the new technologies of the precast concrete production for housing in Warsaw,
- the finishing processes of prefabricated elements and units in the factories and in the building site,
- the routing tests of building elements and materials; and also in supervision and checking the work of all the laboratory services ~~in~~ attached to Warsaw Housing Enterprises.



II. The brief statement of the problem of the attestation and quality control of prefabricated elements in Poland

The increasing "housing hunger" in Poland is the main reason of the permanent increase of the housing production. The problem that is the most important in the Polish housing policy is to give people as many dwellings as possible - what considering the shortage of building workers leads very often to neglect the question of quality and quality control in building.

On the other side, the still increasing number of new finishing materials /wall papers, plastic wall coats, carpet's and soft PVC flooring/ that are essentially connected, with the prefabricated building constructions, require the high quality of precast elements, particularly in the surfaces smoothness and plainity.

The requirements of the tightness of joints determine the accuracy of forming the borders of elements. The "forced erection" is connected with a great accuracy of dimensions of elements.

Moreover, the quality of prefabricated elements depends on the quality of concrete and reinforcement as well as on <sup>on</sup> ~~are~~ casting, compacting etc.

Almost all the requirements in the Polish obligatory regulations and standards dealing with concrete and concerning the concrete constructions casted in situ. At the moment there is almost no obligatory criterion to qualify the quality of prefabricated concrete elements, particularly concret<sup>ern</sup>~~ing~~ the outer features of products.

In the field of quality criterion for finishing of



prefabricated constructions /walls and floors covering, painting, cladding/ there are much more regulations, but most of them are temporary not obligatory, because of the lack of experience - the modern finishing materials have been introduced in Poland during the last few years only. The western countries have much more experience in that field of finishing techniques.



III. A statement covering the programme of observation and studies.

1. Studies in Sweden, February 1-st - April 12th, 1974:

Visit to the Swedish Cement and Concrete Research Institute of the Royal Technical University in Stockholm.

Meet Mr. Nils Petersson - head of division, who presented the aims of the Institut's activity and the principal achievements in the field of concrete research and tests. The Institute conducts and supports basic technical research concerning cement, concrete and related materials. There are sections for chemistry, physics, strength and additional sections for consulting, training and control.

Meet Mr. Torsen Lundin - the principal Swedish regulations for quality control of precast concrete has been discussed in general - such as the Swedish Regulation for Concrete Structures, Materials and Workmanship B5 - 1965 and the Regulation of the Concrete Product Inspection Council /Kontrollrådet for Betongrörer/ for the production control for the class I and special.

The system and criterias for the classification /class I, II, III/ of concrete products plants have been presented as well as the system of inspections and of evaluations of its results.

- Meet Mr. Oscar Beijer. The question of complex requirements for concrete facade units has been discussed, considering in particular the variations of air temperature and moisture, air pollution and the general demand



for more attractive outlook of prefabricated concrete building elements.

Different types of facades outdoor finishing in Sweden have been discussed as well as some methods and results of investigations on finished outdoor surfaces.

- Meet Mr. Paul Holbye - The Courses in Concrete Technology has been discussed. Institute is running courses in concrete technology, intended for supervisors and inspectors of Class I concrete works

According to B-5 the supervisor responsible for concrete work shall possess special training and experience regarding the execution of high-grade concrete work. To fulfill this requirement, a supervisor should, in addition to practical experience, have undergone training at a college of technology or possess an approved certificate from a course in concrete technology in the Cement and Concrete Research Institute.

The course in Concrete Technology is divided into two parts: basic and supplementary. The basic course is common while the supplementary course are specialised in concrete technology, in the manufacture of concrete products and in the manufacture of ready mixed concrete.

The participants are required to have the course type B undergone as well as at least two years' practical experience in a supervisory position in the concrete industry.

- Meet Mrs. Rune Hard - the question of quality-control of ready-mixed concrete factories has been discussed.



The B-5 State Regulations stipulate that concrete structures of some importance shall be constructed only of high quality concrete which is designated as class I concrete. In order to be allowed to supply concrete of this quality, the manufacturer must comply with certain requirements which are stated in the above mentioned B-5 regulations. To be authorised a ready mixed concrete factory must fullfil the requirements stated in FAB /Regulations for the production and control of the ready mixed concrete/, that are in line with the requirements of B-5 regulations but are more severe in some aspects. The most outstanding features of FAB regulations are as follows:

- The supplies of aggregate shall be continuously supervised and testes by a person who is specially appointed for this post. Aggregates originating from different gravel pits shall be stored separately.
- The cement shall be subjected, once per 2000 tons, to the standard setting and strength tests and sometimes to the heat of hydratation test.
- Cement and aggregate shall be weighed on separate scales. The scales must undergo a thorough inspection and adjustment at least once each year, when a simple inspection shall be carried out at least four times a year.
- The consistence of the concrete in the mixer shall be checked by measuring the power input the mixer. Continuous determination of the water-cement ratio is also required.



- The mean strength of the concrete averaged over a long period of manufacture shall be at least equal to the values given in the table below:

	1	2	3	4	5	6
Specified nominal cube strength	K-150	K-200	K-250	K-300	K-350	K-400
Average over a long period	180	240	300	360	410	460

	7	8	9	10
Specified nominal cube strength	K-450	K-500	K-550	K-600
Average over a long period	510	560	610	660

- The operator shall conform to a mixing schedule, that shall also include the wattmeter readings which correspond to different sizes of batches and different consistences.

It is required that the consignment note shall accompany each load. That note have to contain all dates and tests results concerning the quality of fresh and hardened concrete.

The authorisation of a factory is decided by the Authorisation Committee of the Kontrollhånden For Fabriksbetong which has to ascertain whether the factory in question compiles with the FAB regulation.



To begin with, the factory that has applied for authorisation shall reply in writing to a questionnaire which comprises some 100 questions regarding to the organisational set-up of the factory, its equipment, the manufacture and quality control of ready-mixed concrete etc. After that an inspector appointed by the Committee /usually the CBZ - Controls Department Inspectors/ visits the factory and carries out an examination of the plant, together with the works manager. The results of this inspection are recorded in a written report. The Committee decides the question of authorisation on the basis of the report. The authorisation is granted for a period up to 2 years. After that period a factory must be examined again. Then the manufacturer has a right to use a quality mark.

During a current period of authorisation, the factories are reinspected about 4-5 times a year, so as to make sure that they still comply with the PAB regulation.

- Meet Mr. Torsten Lundin - Some improvement in Ve-Be consistency meter method have been performed in CBI, to make possible the accurate tests of concrete of earth-moist consistency. That kind of concrete is often used in Sweden for prefabricated elements in industrial building.

- Meet Mr. Ulf Belander. - The question of testing methods for the hardened concrete have been discussed. The Swedish standard methods of performing the strength



and impermeability test of concrete specimens have been presented/B-5 regulation p.4/ as well as some of the methods that are used by CBI in the research work. The non destructive ultrasonic and hammer testing methods and apparatus have been discussed, comparing the accuracy of both methods.

The criterise have been given for the statistical concrete quality control reffering to the results of average strength with regard to the number of series.  
/one serie - 3 specimens/.

- Meet Mr. Ake Skarandahl - discussion on polymers in concrete. The investigation is carried out in the Institute on applying the acrylic resin /metakrylan of methyl/ as well as styrene resin into the concrete for raising the impermeability, abrasion resistance, strength, chemical resistance etc. That kind of concrete can be applied in industrial flooring, acidresistant pipes, hydrotechnic constructions of variable water level. The performance of the resistance layer of a concrete product is based on filling 90 - 100% of its pores with a certain type of artificial resin. Thats why the outside layer of the concrete /few centimeters/ have to be dried out very accurately before the treatment .

- Meet Mr Per Jonis - The swedish Standards /requirements/ for concrete surface blemishes and roughness have been presented. The requirements for the roughnes are based upon values of standard deviations of measurements. As a contribution to proposed standards for concrete



surfaces a number of surfaces were measured at 20 points of 5 mm on centre and the same operations repeated perpendicular to the first set of points in order to obtain values of depth variations. The same area was photographed and reproduced in full size scale. Surfaces treated in the same way show considerable differences in appearance but by using the procedure accounted for, it seems possible for a buyer to specify a concrete surface of a certain appearance.

The apparatus for performing the measurements of surface blemishes such as pores, holes, crests, descents, grooves has been presented.

Visits to the Boards and Institutes concerned with the product approvals, quality control and building control procedures

- The National Board of Urban Planning "Statens Planverk" - meet Mr. Anders Sköld, head of Dpt.
- The National Institute for Building Research "Statens Institut För Byggnadsforskning" - meet Mrs. Marianne Gustavsson, information officer, and others.
- The Institute for Standardisation in Building "Byggnadsstandardiseringen" - meet Mr. Nils Willén techn. officer and others.
- The National Institute for Materials Testing "Statens Provningsanstalt" - meet Mr. Erik Seare, Chief Engineer and others.
- the Concrete Products Control Council "Kontrollrådet för Betongvaror" meet Mr. Irav Magnusson Chief Eng-



ineer.

- Chalmers Technical High School - Östeberg Institute of Technology, - Meet Mr. prof.R.Malinowski and others.
- Technical High School in Lund, Institute of Technology
  - meet: prof.Sten Wallin - the chief of the Building production division, prof. Arne Hilleorg - the chief of Building Materials division, prof. E.Plem - the Building Fire Resistance division - and others.

Brief statements on the procedures involved in building control, quality control and product approvals in Sweden.

Since 1968 all approval and control, both site and production control, relating to building construction has been coordinated and authorized by Statens Planverk /the Board of Urban Planning/

Approval:

Official approval of products, materials, and methods of construction can basically be done in one of two ways:

- Central 'general' approvals from Statens Planverk.

A 'general' approved product is one that has been tested for a specified use according to the requirements in the Building Regulations and is approved at a national level for a limited period of time. Such 'general' approvals must automatically be accepted by the local Byggnadsnämnden /building committees/, providing the product is used in the specified way.

- Approval by the local Byggnadsnämnden. For any proposed building construction all products, materials and construction methods must be approved by the local



Byggnadsnämnden in accordance with the Building Regulation requirements applicable to each, by examination and testing where necessary. The only exceptions to this are. products, materials or methods which have a 'general' approval from Statens Planverk, which, as stated above, must automatically be accepted to the extent covered by the approval certificate.

'General' approvals can be given for specific products, construction systems, constructional methods or dimensioning methods. Products can also include mass produced components of a standard shape which are controlled by routine testing to ensure that they satisfy the requirements in the regulations, e.g. bricks, blocks. 'General' approvals refer only to aspects which are covered in the building regulations, and all 'generally' approved products and methods must fulfil all the demands of the Building Ordinance and the Building Regulations.

Application for 'general' approval is entirely voluntary, although a manufacturer can be requested to apply for one by a Local Authority, but it is to a manufacturer's advantage to have such an approval as it is then nationally accepted without further testing.

The approvals are given by the Technical Division of Statens Planverk. The approval committee consists of five members all from this department; three of these are permanent members and the other two are specialists selected for each approval from about 30 peoples.

Application for a 'general' approval is made in writing to Statens Planverk and can be one or more manufac-



turers. The application must contain the following information:

- Details of how the product will be used and in what respect approval is required.
- If the proposed<sup>ed</sup> method of manufacture departs from the current regulations, in what way it does so and why. For products where there are no regulations the applicant must justify his application.
- Necessary drawings, technical descriptions, test reports, construction calculations, use instructions, installation and assembly requirements, where applicable.

The Board makes a preliminary examination including checking<sup>c</sup> the formal qualifications for the approval, checking that the application documents are complete and an initial technical study of the documents. They decide whether to proceed with the approval and what additional investigations, tests and expert reports are necessary. The applicant is informed of the results of this examination.

Where a product cannot be checked by theoretical methods only, further testing may be required. The manufacturer can choose the laboratory for the testing provided that it and the method of testing are approved by Statens Planverk. Where there are no existing testing methods they are formulated by Statens Provningsanstalt in collaboration with Statens Planverk.

A final examination of the application is made, with particular consideration of the area of use of the product, as specified in the application. Where necessary



Statens Planverk can permit controlled use of the product to ensure that it is suitable for a given purpose; such testing must have a certified report from, for example, a Local Building Committee.

The applicant is informed to the results, and if the application has been approved a certificate is issued.

The 'General' Approval Certificate describe the scope, conditions and permitted use of the product; it contains information under the following headings:

Product: description of the product type

Applicant

Designer

Producer

Related documents: eg drawings, technical descriptions.

scope of validity for the approval: what aspects of the product have been approved.

Conditions: control requirements

Marking

Notes: limitations on the use; reference to other regulations

Period of validity.

At present the certificate is a typed A4 sheet, with a standard format, but it is hoped to develop a card index system by 1975.

The certificate must have all relevant documents attached to it, and these are usually stamped by the Board. They include: drawings, technical descriptions,



construction calculations, test certificates, expert reports, installation and assembly requirements, use instructions.

A 'general' approval is normally valid for 5 years, provided that the product or method continues to fulfil the necessary conditions. Statens Planverk can reduce this validity if there are reasons to do so. If there is no satisfactory proof of the durability an approval can be given for limited use to gain experience, with a maximum validity of three years. An approval can be extended provided the applicant notifies Statens Planverk at least four months before the expiry date.

The control requirements in terms of the form of the control and who is to do it are specified in the approval certificate. The control is mainly done by Statens Provningsanstalt with the exception on concrete and timber products which are controlled by Kontrollradet för Betongvarer and Svensk Träforskningsinstitutet respectively. About 25 factories are controlled by the Building Department of Statens Provningsanstalt, including such products as: wood wool slabs, dome roof lights, wall ties, balconies, wall and slab elements for timber houses.

There are usually two unannounced control visits a year to check such things as the production method, internal control procedure and equipment, and to select and test samples, as specified in the approval certificate. Testing can be done at the factory if it has the necessary equipment, otherwise at Statens Provningsanstalt.



The results of the tests are sent to the applicant; Statens Planverk is only informed if there is anything wrong.

### Control

The possible ways of controlling building construction work are given in Svensk Byggnorm /SEN/ 57, 12:11, /a/: 'Materials and building products which shall comply with the requirements specified in the present regulations are subjected to stipulated inspection. Inspection is carried out to the requisite extent either in the form of inspection of building construction only... or in the form of limited inspection of building construction in combination with inspection of manufacture'.

Building control can therefore be carried out in two ways:

- Site control: This is carried out by the responsible supervisor/s/ and checked by the Building Inspectors in accordance with the Building Ordinance and Building Regulations. The control by the supervisor/s/ includes checking deliveries of materials, ensuring that the construction is carried out in accordance with the Building Regulations, requesting the prescribed tests and notifying the Building Inspector at the appropriate stages of work for inspection. The control by the Building Inspector is principally to check that the responsible supervisor is carrying out his work properly, and to check that the test results are satisfactory.
- Production control of prefabricated materials and products is based on the general conditions specified in



SEN 67, 12:12.

These conditions are:

- that the production process and manufacturing organisation are such that the quality of the product can be expected to be as specified.
- that the manufacturer carries out his own internal production control to the required extent, and keeps a record of it.
- that impartial inspection and random sampling and testing are carried out under the authorisation of Statens Planverk in order to check the internal control.
- that the materials or products under control are marked in a suitable way, making identification possible.

Therefore production control is composed of two types of control: internal control by the manufacturer, external control by an official organisation to check the internal control.

Internal control:

The general requirements for internal control are:

- the factory must have a competent supervisor in charge and responsible for the quality control of the production.
- regular testing as specified in the Building Regulations or special regulations for the product must be carried out according to a predetermined programme. The factory must therefore have suitable equipment for this or have an arrangement with a laboratory to carry out the testing.
- all products must be marked in an approved way: this usually includes: the manufacturer's name or mark, the product type, date of production or batch number.



- a log book must be kept recording daily production and all test results.

#### External control:

External control consists of:

- Spot check visits by an independent person from a control organisation or testing station to check production, internal control and marking of the products, and to select random samples for testing from the production or store. The frequency of these visits varies between 1 and 5 times per year.
- Testing of samples at an official laboratory and comparison of the results with the results from the internal control.
- Checking of the factory's testing equipment once a year.

#### Control associations:

At present there are nine control association in Sweden concerning with building products. Three of these are concerned with concrete products

- Kontrollrådet för Betong - prefabricated concrete elements, roof tiles and pipes,
- Kontrollnämnden för Fabriksbetong - ready mix concrete
- Gasbetongprodukter - lightweight concrete elements.

The control association is administrated by a council composed of representatives from Statens Planverk other official authorities and relevant manufacturer's associations. In addition to the Building Regulations and other statutory requirements, each control association has two other types of rules - general rules for the organisation of the association and special rules containing the



the control testing and marking requirements for each product type.

#### Testing stations, Laboratories:

- Statens Provningsanstalt /the National Institute for Materials Testing/ is the principal testing station in Sweden. It has three departments

A/ Building, sections: mechanical, fire, heating, ventilation, drainage.

B/ Chemical

C/ Electrical

Testing in relation to building products and components is almost all done in department A and can be classified into four groups according to its purpose:

- control and testing for production control for 'generally' approved products or control associations.
- Routing testing of products and materials from construction sites, as specified in the Building Regulations.
- Commissioned testing for manufacturers, clients and authorities.
- Testing to develop new testing methods, either completely new or adaption of foreign methods to suit Swedish requirements.

Statens Provningsanstalt are also responsible for supervising and checking the equipment of other testing laboratories in Sweden at least once per year.

- Chalmers Institute in Göteborg
- Industrial laboratories



## Visits to the Prefabricated Elements Factories in Sweden

### Visit to the Strängbetong Company

in Stockholm meet Mr. Tonny Liefvendahl

in Varberg meet Mr. Mr. Bo Wiberg and others,

in Kungsbacka meet Mr. Anderssons, the Chief of the Factory.

I had visited the factories in Nykvarn, Veddige and Kungsbacka. The Company is producing the higher quality elements of prestressed concrete - a technique for long spans. The most important product of the Company are the: SH-SPIROLL-Slabs - a hollow core units which can be used in span up to 13 m. - allows a large flexibility when it's applied to the housing constructions; TT slab floor units - they can be used in spans up to 20 m. - mostly for the industrial constructions for precast multistorey buildings.

The factories of AB Strängbetong are under continuous supervision and control of Kontrollradet for Betongvaror. Internal regulations are made according to the official regulations and the Kontrollradet Manufacturing Regulations "Tillämpningsbestämmelser för tillverkningskontroll av byggnadselement av betong samt rekommendationer och kommentarer".

The control of the products quality is maintained by foremen - in the production line as well as in the storage.

The control of the raw materials consists of the control of steel, cement, aggregate deliveries and of the control of the fresh and hardened concrete.

Tools, sets and testing equipment for the internal control are tested by an official testing laboratory.



Complete units are inspected especially when serious defects are discovered. There can be casting defects, non expected cracks, unanticipated deformations and major reports. When so is requested, the test loads are carried out after consultations with the designers.

Each factory has it's own laboratory to perform the internal tests of concrete and steel.

All the documents have been presented, concerning the internal and external quality control, as well as other details concerning the technology of production and the quality control.

Visit to G5teborgs Stads Bostadsaktiebolag Elementfabrik  
in Gothenburg /Linnarhult/

Meet Mr. Stig Stigring - the Chief of the factory and others.

The factory is the most advanced in precast concrete production that I have ever seen. The factory is famous of its volume block elements /box units/ into which the greatest possible number of installations are factory fitted. On site only a limited doreetailing of elements and a minimum drawing of conduits remain to be done. All surface treatment, of the volume elements, i.e. <sup>l</sup> <sup>r</sup> ~~fixing~~ <sup>fixing</sup>, painting and wall covering as well as the fitting of the partition walls and of the various details of equipment that go into the finished apartment, takes place at the works.

The great advantage of this type of box unit is its great flexibility in arranging the interior space using a light weight partition walls /wooden frame and gipsum boards/



At the moment the GÖtebergs factori<sup>j</sup> makes units that consists of the kitchen, hall, bathroom, <sup>sh</sup>working room, and toilet but the flexibility of the system allows to produce the box units for every purposes wanted. The internal, as well as the external quality control is performed in the way to have the product of the highest quality.

The internal quality control is the most important, and the system of it has been elaborated by the quality control service in the factory. All the documents and methods have been presented to me.

Visit to GÖteberg Stads Bostadsaktiebolag - INGEBACKS

Meet Mr. Ove Johanssons - Chief of the factory and others. The main products of the factory are wall and floor units manufactured in battery form. There are eight such forms in the factory, each consisting of 12 moulds. The special casting system /35 minutes for casting one form/, heat treatment and curing in curing chambers with sprayed hot water allows for transport of the ready units to the building site just after 3 hours manufacturing period. In that time the concrete strength reaches about 70% of the quality class required.

Visit to the BSS-BETONG Ready mixed concrete plant in Linnarhult /GÖteberg/

one of the most modern plant for the ready mixed concrete in Sweden - of the one year productivity of 240.000 m<sup>3</sup>. There are two steering rooms - the one for steering the concrete mixing and transport for the nearby factory/ the operator can watch the transport of the con-



crete on the 8 tv sets/ and the another one for the concrete for the building <sup>sites</sup> in Göteborg. The concrete is mixed in two drum mixers of the capacity 5 m<sup>3</sup> each and in one centre-flow mixer of 2 m<sup>3</sup>.

The quality control of the concrete is performed according to PAB regulations.

#### Visit to Skanska Cementgjuteriet in Kalmar

Meet Mr. Civil ing. Tommy Sernelin - the Chief for the designing office; Mr. Ivar Nilsson - Chief of the precast elements factory and others.

- Visit to the precast concrete elements factory of CSC in Kalmar - the methods for elaborating the mix proportion have been presented.
- Visit to the building sites in Kalmar
- Visit to the building sites of S.C.G. in Gothland
- visit to the Cement factory in <sup>site</sup> in Gothland  
/one of the three most modern factories in Sweden/
- Visit to the KALMAR'S KOK - the kitchen furniture factory - the biggest most modern and automatized of this type in Sweden
- Visit to the KAHRS INDUSTRIER in Nybro. The biggest sawmill for the oak all over the world. The factory produces also door and woden flooring units for building.

#### Visit to Skanska Cementgjuteriet in Malmö

Meet Mr. Lennart Nilsson and Mr. Lars Ljunggren and others.

- Visit to the precast concrete units factory in Uppåkra  
/floor slabs, beams, pillars/
- Visit to the light box units factory in Eslov.

Very interesting production of sanitary box units



consisting of concrete floor /3-4 cm thick/gypsum board walls, and of ceiling of honey-comb laminated wooden board. The most important part of the box is the "wet wall" - the 16 cm thick wall made of gypsum boards, expanded poliuretan and containing all the plumbing necessary for the bath<sup>room</sup> unit, as well as for the kitchen. The weight of the box unit is only about 1,5 T.

- visit to the S.C.C. factory in BILLEBERGA - the production of inner walls in battery forms.
- visit to S.C.C. building sites in Malmö.

## 2. Studies in Denmark - April 16th - May 10th 1974

- Visit to the Ministry of Housing - meet Mr. Torben Egede.  
The program of my studies in Denmark has been approximately established. The reports has been given about the general principals of the housing policy and building legislation in Denmark.

### - Visit to Larsen Nielsen Building Company

meet Mr H. Brusendorff - chief Eng. Mr. Z. Styczen - director, Mr Jes Lützhøft - consultant.

The principals of L.N. industrialized building methods has been presented including the structural principles, production and types of components, joints details, transport and erection.

The examples of L.N. building schemes have been shown in the Copenhagen environment such as Stjernen, Traneberghaven, Brøndby, Hvissinge, Gersøgerparken and the russian trade mission.



I have also visited the L.N. precast concrete factory in Glostrup. The chief of the quality control service has presented the regulations and proceeding of checking the quality of concrete, reinforcement, ready products and supplementary materials /door, windows etc./. The routine tests as well as the evaluation of the quality production quality by the statistical method have been presented.

Being interested in the school building, especially in the finishing I asked the L.N. representatives to show me a few modern "open system" schools. I have been shown the schools already finished and the schools being in erection.

Visit in Jespersen & Son International A/S meet dir. J.Holm.

The Jespersen System /also called Modulbeton A/S / is the "open system" and is the one with the broadest flexibility of application. In housing the usual arrangement consists of load bearing crosswalls supporting floor-slabs up to 7,20 m long, which span along the building, the facades, being non loadbearing can take any form the architect desires.

In the Jespersen System, as in an open one, the 80% of slabs and interior <sup>ter</sup>walls are absolutely standard and used on project after project. This allows for the highly mechanised mass production techniques. The factory that have been shown to me is the highly mechanised manufacturing plant I have ever seen. A floor slabs are cast horizontally in steel forms transported through the various work stations and the steam curing chamber by a close-circuit conveyor system. The various part of



the process are governed by central automatic control unit with built in memory. Wall units are casted vertically in special steel forms which are moved between the work stations and heat-curing positions by means of an overhead crane.

Visiting the plant I've got all the informations about the quality control system as well as the copies of tallies of the testing and measurements results for statistical quality control purposes.

Visit to the Boards, Institutes concerned with the product approvals, quality control and building control procedures and regulations.

- The National Institute for Materials Testing Statens prøvestation, meet Mr ing. Torben Paulsen.
- The Technological Institute meet the head of division for building Technology Mr. Knud Nielsen.
- The National Institute for Building Research - meet Mr Georg Christensen the head of building products testing division and Mr. J. Holst - the representative of Ministry of Housing for the products approvals.
- Building Research Committee BKF - meet Mr. P. Olesen.
- Association of Danish Manufacturers of precast concrete components meet Mr. Brink Larsen<sup>ur</sup> - director.



Brief statement on the procedures involved in products approvals and quality control in Denmark

1. Products approvals

The principal building legislation are enclosed in the Danish Building Act.

The detailed building requirements are compiled in the Building Regulations of August 1966. The Regulations allow for the use of materials other than those described or taken for granted<sup>W</sup> in the standard specifications /Danish Standards/ on the condition that such materials obtain the approval of a committee appointed for this purpose.

The Secretariat of the committee consists of two members. They enact about 100 approvals a year and make topical about 50. The Secretariat is situated in the National Institute for Building Research so when it's necessary the Secretariat can appoint the specialist from the Institute to solve some problems or perform the research or tests necessary for an approval.

The approval certificate is <sup>pr</sup>printed and delivered to all the local building authorities and consulting engineers. The approval is valid for three years, after that period the producer has to apply for making it topical.

2. The system of the quality control

The quality control in Denmark is not obligatory. The Association of Danish Civil Engineers elaborated the system of the internal quality control in precast concrete plants. The system is based on the principles<sup>lgs</sup> of the



**Statistical quality control.**

It has been approved by a Committee consisting of 3 members - the representatives of the Ministry of Housing, Technical High School and Civ. Eng. Association and of 2 members - consultants, from the building industry. The producer who decides to be subjected to the above mentioned system of quality control has to apply to the Committee for an approval that is given after the detailed checking of the production of the plant and the quality of products.

The approved plant must have a person responsible for the quality who have to be accepted by the Committee. The system of reports and documents has to be uniform for all the plants. The products have to be provided with a special mark.

Each plant is checked few times a year by a member of a Committee or by a representative of the Institute for Materials Testing.



IV. My views as to the practical use of the result of the studies.

Considering all the observation and results of studies that I made in Sweden and Denmark I present the following statement, remarks and views concerning my studies and the possibilities of the practical use of its results.

1. Statements and remarks

There is a big difference in the quality of production and the quality of the precast concrete products between Poland and the countries that I have visited.

The main reason of a bad quality of Polish building production comparing with Scandinavian countries are:

- the shortage of good and modern equipment - vibrators of different frequency, casting devices, tools for finishing,
- the bad quality of some of the building materials such as aggregates, door and windows fittings, form oil,
- the wrong organisation of quality control services,
- the wrong organisation of production.

The main reasons of a good quality of building production in Scandinavian countries are:

- the competitive character of building production, sharpening with the increase of the housing production crisis, demanding the permanent raise of the quality of products,
- very good organisation of production and labor work,



- very good quality of all the building materials and equipment
- the uniform minimum in quality requirements and the uniform system of the quality control and estimation for the majority of building products,
- the system of products approvals by the competent authorities as well as marking the products in an approved way gives the customer a guarancy of a great good quality of a product.

2. Views of the practical use of the results of my studies.

Considering the above statement and remarks I can say that the real contribution which my training abroad can make to the advancement of the polish housing production is:

- to deliver all the informations, <sup>papers</sup> ~~reports~~ and dates concerning the system of product approvals and quality control, as well as the ~~compulsory~~ regulations and standards, to the boards dealing with the building legislation in Poland,
- to apply in the precast concrete plants in Warsaw ~~at~~ some new methods that can improve the technology and control of production - basing on the dates I got during my training,
- to elaborate the regulations for the technology of production and the quality control for the ready-mixed concrete plants. Up to now there are no such regulations in Poland while several of those plants are already open,



- to elaborate the requirements for the finishing techniques and materials in the "open system" school building. Now the requirements for finishing in school building in Poland are the same as for housing, what's obviously wrong because of different conditions of exploitation of those two types of buildings,
- to use in my research work the knowledge I got about new finishing techniques and materials for precast concrete as well as about the testing methods for finishing.
- to maintain the contacts established abroad in order to continued the mutual exchange of the knowledge and informations concerning the development of building production materials and quality control.

*Jonah*



(H/R)

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ОБЪЕДИНЕННЫЕ НАЦИИ

ЭКОНОМИЧЕСКАЯ КОМИССИЯ  
ДЛЯ ЕВРОПЫ

UNITED NATIONS

ECONOMIC COMMISSION  
FOR EUROPE

~~Mrs. M.J. Shoukletovich~~  
Training and Fellowship Programme Section  
Office of Technical Co-operation, New York



RECORDS CONTROL  
JUN 20 1974

TE Registry  
(Country file)

*With the compliments  
of the Technical Assistance Office  
of the Economic Commission for Europe*

TE 323/1 POLA

28 May 1974



TECHNICAL ASSISTANCE OFFICE  
Economic Commission for Europe  
UNITED NATIONS

Date of award:

28.3. to 1 .6.74

Name and home country:

Mr. Josef SZMANSKI (Poland)

Field of study:

The Non wovens techniques

Country (ies) of study:

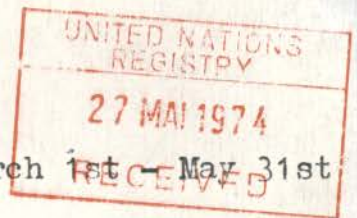
The United Kingdom



FINAL REPORT

Nonwoven Processes and Techniques

March 1st - May 31st



In my home country I am employed in a Research Centre of a Textile Machinery Manufacturer - "Befama", Bielska-Biala. I have been with this company for five years now. I joined the company after having spent a few years in a textile spinning mill, which was my first training after my graduation from Politechnic, Lodz, Poland, with M. Sc. in textile. During those few years I have had responsibility for supervision and control of a technological process in a spinning section as well as activity in order to develop technological process.

Now, in my present job I have full opportunity for activity in the field of research and development of textile machines as well as introduction of new technologies in the textile industry. "Befama" is the big manufacturer of machines and arrangements designed chiefly for woollen and worsted cards, spinning frames, machines for semi-worsted system and machines for nonwoven techniques.

The production of these machines is supported by a continuing programme of research in realisation of which I am also taking part. The roller cards constitute a group of machines which form the basis of "Befama's" production range. Therefore a considerable part of Research Centre's activity is connected with continuous development of the above machines.

For over a 100 years "Befama" was specializing itself in traditional woollen cards but now there is an essential need to extend and adapt this type of machine for other new techniques including nonwovens. Over the last few years this adaptation has been the most important problem to be solved, and the solution of it has not been easy, because of the always changing requirements of the textile industry.

Recent years have seen considerable development in machinery for textile industry, including different kinds of roller cards. Although the technology of woollen carding has not changed very much in the last few years, there is an increasing trend of improvement in modern cards.



It was possible to achieve the higher production rate with the machine designers, who with the use of more suitable materials, improved bearings, and higher engineering standards, generally have made higher speeds and more accurate settings possible. For example, our new woollen cards are able to reach the delivery speed of 40m/min and with the use of roller doffing system this parameter can be increased to 100m/min and more. Very often, those mechanical changes involved a great deal of technological problems which took a long time to be solved satisfactorily for the users of machines. I would like to describe a few problems which are still being investigated at our Research Centre.

1. Usually the high production of a card is accompanied by the rise of swift speed and simultaneously a carding action becomes more intense. This results in an increasing number of breakages of the fibres, because of this there is an increasing number of complaints from the card users.
2. The high production card is manifestly much more sensitive to the conditions of the preparation of raw materials than the conventional card. Therefore, the suitable selection of the oiling and antistatic preparation which is essential for the carding process, becomes more difficult and more complicated.
3. The air disturbance in the region of the card where there are high surface speeds involves the increase of the tendency to produce loose fibres and fly, therefore deterioration of the web quality, as well making it more difficult for the operators to work with it.
4. Actually, an important part of "Befama's" activity is an advancement in the field of the non-woven techniques. The growth and progress of the non-woven in the last years is one of the most spectacular and profitable developments witnessed by the textile industry.

Therefore, the knowledge that I had been awarded the fellowship in the field of non-woven in England-the leading Country in textile industry - pleased me no end.

I was interested especially in dry manufacturing process of non-wovens and fortunately Bowater-Scott Corp. is specialising in production of non-woven with use of this kind of technology.

As it's known, the forming of the web in this method is either:

- 1) Cards, mostly equipped for crosswise web deposition; 2) pneumatic equipment. Generally the webs are then subjected to one of the several bonding treatments. The Bowater-Scott automatic line consists of three double-cards sets which are laying the web on the common doffing conveyor joining the card section with the adhesive-bonding section. At the end the non-woven fabric is dried, rolled and slit into narrow biscuits the dimensions of



them depending on the final product.

I was chiefly interested in the process of the forming of the web and so the greatest part of my training I devoted to learning and understanding this particular subject. In the programme which was suggested by Bowater-Scott Corp. the following points have been prepared for this purpose.

1. The function and operation of the Process Dept.
2. Carding and carding process.
3. Fault finding and maintenance of the cardline.

There I would like to describe briefly the whole line for production of non-woven fabrics, which I saw in Bowater-Scott Corp.

1. "Temafa" blending unit, made in West Germany.

This modern Unit is a collection of a few separate opening and blending machines, joined together by means of an air-tube, transporting the fibre from one part to another.

The oiling arrangement is also included into the circuit of the unit, and the additional oiling of the fibre can be made if necessary. All cards are fed with the fibres from the mixing bin. The set of photo-electric cells controls the constant level of the fibres in the hopper-feeders during the operation of the line.

2. Three sets of double-compact card "Mak-Spinnban" / West Germany. Compact cards with small dimensions of the swift and doffer, usually are used when man-made fibres are to be processed with high outputs. They are fitted with all-metallic wire clothing only. The application of the metallic clothing and severe conditions of the design and erection of the machine allows the settings to be adjusted between the swift and workers with an utmost precision, e.g. 0.1 mm. It is possible to achieve most satisfactory results in opening of the fibres and converting them into a regular web. The web is taken-off by means of a safe roller doffing system with electric-control mechanism to avoid jam-ups. With adequate conditions, delivery speeds up to 120<sup>m</sup>/min can be achieved.

The required thickness of the end web / which is also called "the lap" / is obtained by doubling the webs from separate cards on the common doffing conveyor.

3. Finishing section, (Bowater-Scotts own design) Because the carded web is very weak it is necessary to make it stronger as well as to change its appearance according to end use in the finishing dept. The web is wetted in the padder section and after that passed to the adhesive section. The wetting process allows two or more webs to join together and enable picking-up the adhesive by the web. Of course, a most important point in that part of the technological process is a correct recipe for the adhesive bath. Then the fleece is dried and rolled in the reel-up section.



Thus, in the finishing process the card's web is converted into the non-woven fabric by giving to it various characteristics as for instance strength, stiffness, and opacity, heat sealability etc., if necessary.

It is worth pointing out that the whole plant including the first bale-breaker up to the cut reel-up section is working in a continuous flow line. The operators service the machine during normal running time, and supply the raw-material to the bale breaker, and take off the finished reels.

During the time when I joined the Technical control dept. and carding section I was able to learn all basic points in relation to the production of very light non-woven fabrics, usually disposables as for e.g. nappy liners, diapers, underpads etc. This kind of non-woven is not well known or common in Poland and, therefore, it was very advantageous for me to get on with learning about it and I hope to translate something to my country. Overall I tried to simulate some technical questions of the technological process particularly those I need at my present job in my country. I have been given full information regarding the setting up of the machines, the speeds of the working parts as well as a selection of the card clothing for the fibres which are processed. Besides, this I was able to be present at the maintenance and repairing of the machines. As I was taking part I was able to learn the design of the machines. In the technical control dept. I acquainted myself with the quality control of the end product and of the unfinished products as well. I was given the details of the testing procedures and of the instruments which are used. I have carried out the basic tests as for example: a measurement of a tensile, strength, heat sealability of non-woven etc.,

As it was mentioned above, Bowater-Scott Corp. produce the disposable fabrics. For disposables the maximum web weight is normally about  $50 \text{ g/m}^2$  and even a web from  $16 \text{ g/m}^2$  is sometimes produced. Using the very thin fibres ( Rayon 1.5 den. 50mm Staple length) which are usually very difficult for the carding process, the company have met some troubles especially on roller cards as for example flying of the fibres, web disturbance and electrostatics.

To minimise these problems an air-suction system was applied by the factory, in addition to the normal, protections which were made by the card's manufacturer. I found this very interesting. The most interesting part for me was the new design of card-machine e.g. Cardmaster with the tops instead of the workers and strippers. One roller card was partly converted into this new type and I could learn the main principles from it. The

provision of the swift and tops of a special Hollingsworth wire gives an improved carding action.



The card incorporates much less moving parts, thus the maintenance of it is easier and the tendency to the flying of the fibres is reduced as well.

A new plant is being erected in which this new kind of card will be applied. Management of Bowater-Scott Corp. expects to achieve approximately 100% higher capacity from this new plant than at present (the delivery speed will increase to 150m/min). Unfortunately for me, that plant will be ready a few weeks after my fellowship is ended and I was not able to see its completion.

In the Finishing Dept. I was acquainted with a few techniques of converting nonwoven and tissue into final products. The nonwoven fleece is converted chiefly into Diapers, Underpads and Nappy Liners. The technology of producing them - as for instance Babettes - is based on the new converting machine made by the Swedish Company, Dambi. It operates automatically at high delivery speed (about 200-250 diapers/minute). Bowater-Scott Corp. sells also "bulk rolls" (nonwoven and laminated paper) to other convertors.

One convertor who has realised the potential of "Bowtex" nonwovens and laminates is Beril Moller of Texilon Bemoller Textil AB Stockholm, Sweden. Among the most successful products are those made for hospitals, such as disposable pads for patients; a washing glove made from heat sealed tissue/polythene laminate; pillowcases made from tissue/polythene laminate; and a generous sized towel which is made from scrim reinforced tissue that is ideal as a bath towel for children.

I paid attention to the very wide range of uses of nonwoven and particularly disposables in hospitals. It was stated by science testing and searching that in many cases it is more economic and convenient to use and throw away a disposable than to use an expensive traditional goods with its washing, cleaning, mending, etc. All this information I found very reasonable and interesting.

For the complete acquaintance with the activities of the company I was given brief information regarding buying, planning and services functions.

For development of my studies in Bowater-Scott Corp. in London, the Management of the Company, together with the British Council have enabled me to visit The Shirley Institute in Manchester.



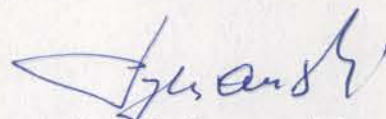
A two day carding course in the Shirley Institute was arranged to acquaint me with some scientific and theoretical topics of the carding process and nonwoven techniques. I was there able to have discussion regarding some important problems in the range of:

1. Opening and blending of raw materials.
2. Carding and fleece preparation for nonwovens considering different methods as for example, web laying, aerodynamic deposition as well as investigations which are being developed in order to improve the fleece preparation.
3. Quality control procedures for the web.
4. Rigid and semi-rigid wire card clothing and its maintenance including some theoretical aspects of mounting and grinding of the wire, which were expressed by photographs as well.

In conclusion of this report I would like to say that the whole of my training in Bowater-Scott Corp. was very useful for me. The subjects I have learned and I have described above were both interesting and very often new to me. I hope some of them, particularly concerning carding processes and the card line for production of nonwoven will be very helpful for my further activity after returning to Poland.

I found also how immense interest has been aroused during the past years in disposable textile products, and that it should be given high development priorities in Poland.

I am very grateful to the UNIDO, the British Council and Bowater-Scott Corp. for enabling me to have this fellowship.

  
Jozef Szymanski



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UNITED NATIONS  
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FOR EUROPE

Mrs. Shoukletovich

Training and Fellowship Programme Section,  
Office of Technical Co-operation, New York



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SEP 23 1974

27 May 1974

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*With the compliments  
of the Technical Assistance Office  
of the Economic Commission for Europe  
For your information.*

*TE 323/1 POLA*

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UNITED NATIONS

TECHNICAL ASSISTANCE OFFICE

ECONOMIC COMMISSION FOR EUROPE

Name and home country: Mr. W. MICHALOWSKI, Poland

Field of study: Application of mathematical methods in  
transport problems.

Country(ies) of study: United Kingdom

Date of award: 19 September 1973 - 31 May 1974



## FINAL REPORT

United Nations fellow Wojciech Michalowski from the Road Transport Research Institute, Warsaw, Poland, attached to the Transport and Road Research Laboratory, Crowthorne, Berks., U.K. for period from 19. IX. 1973 to 31. V. 1974.

While applying for a United Nations fellowship I was employed by the Road Transport Research Institute, Warsaw, Poland as a research officer in the Department of Applied Mathematics. The project on the application of mathematical methods to transport problems, in which I was involved, was a continuation of my research started during my last university years (I have an M.A. degree in econometrics at the High School of Planning and Statistics in Warsaw, obtained in 1972).

Because of the vast range of the subject in which I am interested, I have concentrated my research effort on the particular problems of forecasting and econometric modelling. As a result of progressing industrialisation and the constant growth of population, the transport system has to fulfill new, previously unknown demands. Hence forecasting of actual trends and prediction of the future shape of the transport system is of increasing significance. There is also a need for a more scientific approach to the forecasting of human behaviour patterns, thus eliminating the uncertainty and guess work found in many current predictions.

These aims can be achieved by applying to research a sophisticated mathematical methodology, connected with well developed computer technique. That is why, in the research which I conducted in Poland, I stressed the importance of establishing and developing a prediction method proper to transport forecasting. This method, based on the mathematical representation of intertransport relations, should also have place for "the human factor". It is very important to keep this in mind, because future transport systems should operate on the basis of maximum satisfaction of human needs.

Because of the specific character of the research institute where I work, my aim was to find out the most suitable method (or methods) for the prediction of the future requirements of only one branch of the transport system - i.e. freight transport by roads.

The forecasting research in Poland is still in its infancy and its development is not helped by the relative lack of computing facilities and consequent slow development of computing techniques. These elements, as well as the planned opening of a computer centre by the Road Transport Research Institute were the deciding factors in my being



put up for a United Nations fellowship. The purpose of this fellowship was to help me to gain experience in the application of mathematical methods to transport problems in countries with a long tradition of this kind of research, with the eventual aim of adapting and later applying these methods to Polish conditions. Great Britain is the leading country in Europe, in this field and therefore, after consultation, it was decided to choose this country as the place of my studies. Due to the suggested character of my training program (theoretical research with a look at its practical application), the possibility of completing my studies in one of the transport enterprises was rejected. Various kinds of research establishments only were considered. From these, the Transport and Road Research Laboratory, a leading research centre in the transport field, was chosen and I was attached there for training. In the Transport and Road Research Laboratory I joined the research team of Freight Section led by Mr A W Christie, which is part of the Transport Operations Department under Dr A Hitchcock. The main purpose of my training program was to be actively involved in the research conducted by Freight Section, along with learning about the activities of the other TRRL departments and of different research centres in the United Kingdom.

When I started my training at TRRL on 24 September 1973, I joined the team under Dr Cundill's supervision dealing with the "Swindon Freight Study" project. One of the project's aims was to forecast the impact on the environment of different patterns of traffic flow in Swindon. This was only possible to achieve by utilising very sophisticated mathematical techniques. The effects of the impact of various traffic flows were measured and compared by theoretically determined noise level factors. I was attached to a team dealing with this particular aspect of the general problem. The model is designed for the computation and projection of noise levels associated with given traffic patterns and later for the selection of the best solution minimising the environmental disbenefits. Besides the environmental model described above, a congestion model and cost model were also incorporated into the general Swindon Freight Model. With a view to obtain a general picture of Swindon project, I acquainted myself with the main assumptions on which these other two models were based, but I was not involved in developing them. My involvement in the Swindon project enabled me to:

1. Learn about the theoretical approach to the very complex problems which one meets while building general freight models;
2. learn about the application of computer techniques to solve these large problems;
3. see the possibilities of the use of different mathematical techniques;
4. study the methods of theoretical research in Great Britain and the ways in which they are applied in practice.



As mentioned above, in addition to participating in Freight Section activities, my training program has included learning about general transport problems in the United Kingdom and about the research being conducted in different British transport research centres. This part of the program may be divided into two groups:

- a) my own research;
- b) meetings and visits.

The main part of my research program falling into the first category was an analysis of the available publications appearing in different journals and in reports. In doing this I gained considerable help from a list of publications for the years 1969-74 prepared on my request by the TRRL library on econometric models of freight transport and on the mathematical forecasting methods. By use of this list I was able to get acquainted with different publications, fundamental to the transport field and to learn much more about the application of mathematical methods to transport problems. During my stay in England, I also entered into correspondence with different British research centres. These included: London University, London Graduate School of Business Studies, London School of Economics and Political Science, University of Wales, Liverpool University, Sussex University, Glasgow University, Nottingham University, Sheffield University, Cranfield Institute of Technology and the Centre for Environmental Studies. In establishing these contacts I was greatly helped by my status as a United Nations fellow. I have received from the above mentioned research centres, different kinds of working papers or reports, which were quite often unobtainable through libraries or bookshops. On the basis of such research, ie analysis of all the available publications, I was given the opportunity to form my own opinions on the range and character of transport research conducted in Great Britain. Thanks to my having access to different types of source I could improve and deepen my knowledge of the application of mathematical techniques to transport problems.

The other part of my training program consisted of meetings and visits to leading transport research centres. I had valuable discussions with scientists working in TRRL and the other research institutes. In particular I wish to mention the meetings with the following people:

1. Dr A Hitchcock, who explained much about transport research and transport management in Great Britain;
2. Dr Webster, who gave me his views on the directions in which public transport research was developing;



3. Mr Tanner, who, as a one of the authors of the CRISTAL model (A Strategic Model for Urban Transport Planning), told me about the application of a econometric methods and mathematical analysis to transport planning;
4. Mr Tulpule, who is one of the authors of the TRRL transport forecasts.

Meeting these people and participating in the lectures organised by TRRL gave me a good understanding of the problems in the forecasting and transport planning field.

Thanks to Dr Hitchcock's help, I had the opportunity to visit several transport research centres in Great Britain. These visits were approved by my program organiser from the British Council and were to the following establishments:

1. London University College, where I visited the Research Group in Traffic Studies headed by Prof. Smeed. This group carries out research into traffic studies and transport economics. During my visit there, I met Mr Kirby who is one of the leading researchers in the field of the application of gravity models to transport forecasting;
2. University of Birmingham, where I visited the Department of Transportation and Environmental Planning headed by Prof. Kolbuszewski. This Department conducts research into "cooperation" between the development of transport systems and environmental protection. Their research is similar to that at present being conducted in the Freight Section of TRRL. This visit was very helpful to me in that it enabled me to compare the academic approach to a particular problem (represented by the University of Birmingham) with a more practical one (represented by TRRL). During my stay at the University of Birmingham, I had several meetings with Professor Kolbuszewski and some of his colleagues;
3. The University of Leeds, where I visited the Institute for Transport Studies (Director - Prof. Gwilliam). During my stay there, I met Professor Wilson, who is one of the authors of a modern theory of the application of gravity models to transport research. Besides talks with Prof. Wilson, I met some of his colleagues working on general transport economics problems and on the projection of transport changes;
4. Department of the Environment, where I learned about the practical implementation of transport policy, and about ways of defining future transport research.



In summary, active participation in Freight Section research, meetings with different British scientists and visits to leading transport research institutes, led me to complete and improve my knowledge in a field of application of mathematical techniques to solve different transport problems. The choice of TRRL as the main centre of my attachment was very beneficial. The large number of different projects undertaken by the TRRL team and the close contacts which TRRL has with other transport research centres made the Laboratory an ideal base for my studies. My visits to the research institutes mentioned above arose directly from Dr Hitchcock's personal contacts with other leading scientists in the transport research field. Also, his help and advice gave me a much better understanding of various problems in the transport research field. This understanding provided a basis for later success of my training. In addition to the positive aspects, the choice of the TRRL had certain disadvantages. A large number of different departments, divisions or sections is not something which helps people like me to adjust to completely new conditions. For fellows accustomed to smaller research institutes, like mine in Poland, this first contact with so large an organisation creates some problems of a psychological nature, which are not always easy to overcome. It is also difficult to follow all the projects in which one is interested, due to the large number of different kinds of research carried out by TRRL. A large amount of available information is of course a good thing, but it can be a disadvantage when it is so extensive and diffuse that contact can not be maintained with all the information. I think, that it would be a great benefit for a United Nations fellows due to be attached to the TRRL, to be supplied beforehand with some information on the structure and types of research at TRRL. This would enable them to orientate more quickly to their new environment and save them some time which they have to sacrifice for adjustment to the new working conditions.

As I mentioned previously, my training program consisted of three different parts: my own research; participation in some TRRL research and learning about achievements in transport research of leading British research institutes. These three parts, although different, were strictly correlated with each other. Thus it is possible to deal with all three parts of my training program jointly, without distinguishing between any in particular.

One of the questions, which a United Nations fellow has to answer, is on "the contribution which training abroad can make to the advancement of your country in your particular field of study". In my opinion it is very difficult to give a simple answer to this question. The reason for this is that there are no immediate results to be gained from the training, but one can only consider the long term effects. In my case, I would define the advantages of my training abroad as:

1. advantages due to the theoretical aspects of my training program;
2. advantages arising from the practical application of the knowledge that I have gained.



ad.1 Participation in TRRL research and my own research, led me to learn more about the application of mathematical techniques to transport problems. Learning about cooperation between research departments and the TRRL computer centre, was very helpful for me in connection with the planned opening of a computer centre in the Road Transport Research Institute in Warsaw. The gaining of information on this subject will help in defining the type of research which can be supported by computer techniques and an analysis of TRRL experience in this field could help to avoid some mistakes which might occur while introducing something new and not considered before. All of these factors can have an influence on the increase of efficiency of the newly opened computer centre. Greater complexity of research and the increase in the fields of interest as a result of this, should be a fairly immediate advantage of my fellowship. Learning about transport forecasting achievements in a country leading this field in Europe, is another important aspect of my studies. As is well known, accuracy and reality of forecasts, depend to certain extent on the character of the mathematical tools which are applied. That is why research on forecasting methods is so important. But this kind of research is very expensive and time consuming. The development of this kind of research in Poland is still at an early stage and evolution of proper transport forecasting technique would require considerable financial investment and the setting up of a large interdisciplinary scientific team. The opportunity of getting acquainted with British achievements in this field would help to avoid the "middle" part of the research process and to minimize the investment necessary needed to reach a proper solution. Analysis of transport forecasting techniques worked out in Great Britain should result in the choice of the best method and the definition of its future adaptations to specific Polish conditions. The development of the transport system in a given country is closely linked to the stage of advancement of research on this problem in that country. In this particular field of human activity, Poland is a country less developed than Great Britain. To follow the stages of transport development in Great Britain, should lead to defining a possible optimal path of this development in Poland. Thus permitting the determination of the kind and density of research necessary for the definition of the most suitable transport scheme.

ad.2 In addition to mathematical modelling and forecasting, the prepared training program contained general transport problems. This was one of the main factors which enabled me to experience the practical application of the knowledge that I had gained. The results of analysis and the conclusions for the future of the actual shape of the transport system in Great Britain are applicable to a revision of the direction of transport development in Poland. On the basis of this analysis one can try to define the proper direction for this development in Polish conditions, especially as far as private car transport is concerned. Due to the different schemes of operation and



different structures of freight transport by road, I do not see the possibility of an automatic application of the British experience in this field to Polish conditions. But, I think that it would be interesting to compare the two schemes and after certain adaptations, to apply some of the British solutions to Polish transport enterprises (at least as far as the application of computer techniques is concerned).

One can define the benefits of my study in Great Britain on the application of mathematical methods to transport problems, as follows:

1. the indication of problems that do not yet exist at the present stage of development of the transport system in Poland, but for which a successful solution depends on considering these problems well in advance;
2. the experience gained during my studies in the United Kingdom would enable me to carry out transport forecasting research more quickly. The main advantage of this, besides minimizing necessary expenditure, is the possibility of building an accurate transport development forecast in a shorter time. It is obvious that such a situation would have a positive impact on the transport system as a part of the national economy and as a system dealing with people for people. The ability of the early directing of the path of transport development onto its proper course is a factor of great importance;
3. during my stay in the United Kingdom I gained experience of the intensity and character of transport research carried out by different research centres. Taking advantage of this experience could improve the efficiency of transport research carried out by the Road Transport Research Institute in Poland;
4. my knowledge gained in the United Kingdom could help in solving everyday operational problems of the car transport enterprise PKS (the biggest car transport enterprise in Poland) for which the Road Transport Research Institute acts as a advisory body.

#### Acknowledgements

I wish to acknowledge the financial support of a United Nations fellowship. In addition I would like to thank the Directorate of the Transport and Road Research Laboratory for providing the facilities for carrying out my studies. I also wish to thank the members of Transport Operations Department within TRRL, for their help in the realisation of my training program, and Dr A Hitchcock in particular for a number of very helpful discussions.



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ECONOMIC COMMISSION  
FOR EUROPE

Mrs M.J. Shoukletovich  
Training and Fellowship Programme Section,  
Office of Technical Co-operation, New York



TE/Country file  
TE 323/1 POLA

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of the Economic Commission for Europe*

15 mai 1974

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Palais des Nations  
GENÈVE



TECHNICAL ASSISTANCE OFFICE  
Economic Commission for Europe  
UNITED NATIONS

Date of award:

3 months 11.2.to 11.5.74

Name and home country:

Mr Kaziniererz WROBEL (Poland)

Field of study:

Automation of coal preparation plants

Country (ies) of study:

Finland 11.2. to 11.5.74



Mgr. inz. Kazimierz Wróbel  
Research and Design Centre  
of Coal Preparation Processes  
POLAND

United Nations  
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I I work in the Scientific Department of "Design and Research Centre of Coal Preparation Processes" where I am the chief of "the Control Systems Laboratory".

I am dealing with the problems of automation of coal preparation processes. Previously I worked at the problems of construction of measurement instruments for coal preparation processes and designing local automation systems.

I took part in designing of the following control systems:

- stabilization of heavy liquid density
- stabilization of density of slurry
- stabilization of supplying of coal preparation plant

and the measuring instruments as follow

- level meters for slurries and coal
- ash content meter
- density meters for slurries and heavy liquids.

Recently I am dealing with designing of control systems. As a research worker I am especially interested in the problems of data acquisition systems and computer control. The sphere of my activity is rather limited to the conceptional works, but I am also responsible for practical realization in some cases.



II Main problems which led my Government to nominate me for a United Nations Fellowship were:

- Problems of instrumentation for preparation processes
- Data acquisition systems
- Possibilities of applying computer control at the coal preparation plants
- Automation of flotation processes
- Problems of mathematical models of processes.

These problems and possibility of resolvings will be detaily described in the next part of report.

III The study program devised by United Nations and Department of Economical Co-operation of Ministry of Foreign Affairs of Finland has covered all problems I was interested in.

I would like to underscore the considerable help which I have received from Outokumpu Oy company in the preparing of detailed program of study, and during the realisation of my program.

Program of study in Outokumpu Oy  
company Finland

8-9 Feb.	The arrival and introductional formalities
11-14 Feb.	The preparing of study program
14-23 Feb.	The making acquaintance with the instrumentation applied in the ore dressing plants (flowmeters, belt weighers, density meters, level meters)
25 Feb. - 16 March	Study on the instrumentation manufactured by Outokumpu Oy (Courier, Cemixan, Metor)



18 March - 2 April Study on the application of the Proscon System

3-4 April The visit at the "Kotalahti" mine

5-27 April Study on the possibility of application  
the "Proscon" System at the coal  
preparation plant.

- 28 April - 11 May Visits at the Vuonos and Keretti mines and  
the Hanasaari B power plant and the preparing of  
the final report.



DATA ACQUISITION SYSTEM FOR  
COAL PREPARATION PLANT

Presently we have control rooms at the preparation plants. They are equipped with analog instruments and display lamps. Recently in our new plants all the signals from measuring and control equipment are available in the main control room. We have the possibility of recording about 30 parameters on the analog paper tape recorders, but the form of stored information is very uncomfortable for further computation.

The next step which must be done is the installing of digital data acquisition system based on the computer.

In present conditions we don't expect economical advantages from substituting classical automation by computer system. The most important problems for us are improving quality parameters and decreasing losses of coal in the waste stone.

We expect that the application of data acquisition system allows to built more sophisticated control systems and increase efficiency of coal preparation processes.

My task in this problem is to choose the suitable system for data acquisition. In Outokumpu Oy I became acquainted with the Proscon system, one of the group of industrial computer application systems.

I can say that the Proscon may be applied in our coal preparation plants, after some introductional works.



Actually we want to record parameters as follows

1-2	density of heavy liquid	set point 1,8	0-50 mA
3-4	density of heavy liquid	set point 1,8	0-50 mA
5-15	levels of liquid in bunkers	pneumat.	0,2-1,4 atu
16-32	levels of coal in bunkers		0-10 mA
33-41	flows of slurries		0-10 mA
42-50	flows of slurries (accumulative measurements)		digital 0-12 v
51-59	flows of material (belt weighers)		0-10 mA
60-68	quantity of material		digital 0-12 v
69-72	density of slurry		0-50 mA
73-74	ash content		digital TTL
75-76	moisture content	0-10 mA or	digital TTL
76-146	state of more important devices		digital (contact)
147-150	weight of loading wagons		digital (TTL)

This is only general presumption but I expect that the system designed for defined plant would not be too different.

I don't expect so many problems with normalization of the signals. We have designed the normalization circuit, which are suitable to apply in Proscon's analog to digital converter.

The advantages of the system from the point of view of data acquisition problem are as follows

- easy to use input/output control subroutines
- changing of software priorities to required level
- flexibility in buffering.

The next advantage is that the control of Courier system can be easily changed to the control of ash content meter.



Minimum hardware configuration is

PDP - 11 processor with 4 k of core memory

KL - 11 real time clock

EAE - 11 extended arithmetic unit

Operator console

printer.

I think that for covering our present requirements we need more equipped system.

Computer hardware	1. PDP 11/05 processor with 8 k memory ME11-L 2. KE-11 extended arithmetic unit 3. KW-11L line frequency clock (50 Hz)
-------------------	--

Peripheral devices	1. VT05 - alphanumeric display terminal 2. ASR teletype/keyboard 3. PC11 high speed paper tape reader and punch 4. Report printer IBM 735
--------------------	--

Interface hardware	1. AFC-11 analog input subsystem 2. DR11B direct memory access controller 3. DR11C - process operator's console interface 4. DR-11C - loading system interface 5. DR-11C - ash content meters interface
--------------------	---

Process operator's console  
for 200 variables  
with information panel.

I daresay the organization of "Proscon" system is quite suitable to our requirements.

The Minex Software covers all our requirements in the process control.

Finally the magnitude of the system is satisfactory.



## Possibilities of applying computer control at the coal preparation plants

In present conditions, main tasks of computer control we need, are as follows

- control of supplying devices
- control of loading system
- control of heavy liquid processes
- control of flotation processes

I become acquainted with the computer control systems at the ore dressing plants. It is possible to find many similarities between coal preparation and ore dressing processes in general. Especially the control problems are similar.

### Control of supplying devices

Preparation plant is supplied normally by one or more shafts. The raw coal is transferred directly to the small supplying bunkers and further via vibration (or pulsation) feeders to the introductory screens.

The work of shaft is rather unregular and the quantity of raw coal is a stochastic function of time. All the preparation processes are continuous and results are strongly depended on quantity of material.

Control of supplying devices should assure continuous supply as well as nominal work conditions of belt conveyors. Normally we have accumulating bunkers and we can supplement the quantity of raw coal on the input of coal preparation plant.



It is extremely difficult to control supplying devices manually and resolving this problem via relay circuits is very complicated.

The similar problem has been resolved at Vuonos concentrator. It is the problem of control of hoisting and crushing plants. The three type of ore are crushed in three sequential phases, the products being stored in 12 silos. The longest distance between different equipment controlled by the computer is about 2 km.

Control of crushing is very simple for the process operator. The control system is designed for operation by a computer. The operator selects the type of ore by pressing the appropriate button, and the computer attends to the necessary logic, the starting and stopping of machines and delays. In the event of malfunction in the crushing equipment, the computer either directs the material via an alternate path or makes an emergency stop. No unnecessary starting or stopping of machines takes place. Everything that happens at the plant is recorded by a typewriter.

#### Control of loading system

The problem of loading does not occur at the ore dressing plants. Our problems with loading systems are completely different and in this area I could not find any similarities.



## Control of heavy liquid processes

Our control systems of heavy liquid processes are based on analog pneumatic equipment. At the ore concentrators heavy liquid process is not applied, but the control problems are similar. In general I can say that the problem of control is the problem of stabilization of flow and levels in the bunkers. The similar problems occur in the flotation control systems. The time constants are similar and structure of regulators is similar.

All the procedures we need are available in software applied in Proscon systems and I do not expect especial difficulties in designing the heavy liquid control system based on the computer.

## Control of flotation process

However our flotation processes used the different reagents, the basic principles of process are similar. The control system is similar too. The most significant variables in flotation are pulp, water and air flows, pulp density, dosage of reagents, pulp levels and ash contents.

The control of the flotation process <sup>*is divided*</sup> into three hierarchical levels

- DDC - direct digital control
- Supervisory control
- Optimizing control.



Problems of mathematical models  
of processes

Presently we have some ideas about economical optimization, but our equipment installed at the preparation plants does not allow to put in work any automatical optimization system.

Optimizing control at the ore dressing plants is based on an economical criterion, which takes into account cash flow and the control strategy aims at maximizing this factor.

The efficiency of copper flotation is gauged by the criterion of economic recovery, which takes into account copper recovery, zinc losses to the copper concentrate and transportation costs. Because the model is good only over a limited area, measured process values are continually compared with values calculated by means of the mathematical model. For coefficient adjustment a record of the thirty most recent values of the model and the measured variable is continuously stored in memory. Based on these values correction coefficients are calculated and added to the coefficients of the original model.

It is rather difficult to say something about advantages from applying this method of optimization at the coal preparation processes.

The most important factor is price of coal, and the nickel and zinc concentrate. Theoretically the problems are similar, but really economic effect is in this moment difficult to compute. Maybe it will be the future of coal preparation processing.



I daresay put in work optimization system will be possible after introductional experiments done by the computer of line.

The computer control package working at Kotalahti include two computers - one to stabilize control at the lower level and another for optimizing control and management information tasks.

Practical results of computer control in mines are as follows

- economic results
- assistance to the process operator
- better understanding the process.



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Training and Fellowship Programme Section,  
Office of Technical Co-operation, New York



RECORDS CONTROL  
MAY 20 1974

17 April 1974

TE 323/1 POLA

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of the Technical Assistance Office  
of the Economic Commission for Europe*



UNITED NATIONS  
TECHNICAL ASSISTANCE OFFICE  
ECONOMIC COMMISSION FOR EUROPE

Name and home country:

Mr. J.S. SZWED, Poland

Field of study:

Auxiliary installations in power-stations  
coal mills and their accessories.

Country(ies) of study: Finland

Date of award:

3.1.74 - 6.4.74



Eng. Jerry Szwed  
POLAND

UNITED NATIONS  
Economic Commission for Europe  
Technical Assistance Office  
Palais des Nations  
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FINAL REPORTS

Introduction

In accordance with my United Nations Fellowship the main aim have been to know "the Auxiliary installations in thermal power-stations, especially coal mills and their accessories".

In last years stated in my native country that some lowering of Power-Stations output had been caused by outages coal grinding installations, esp. coal mills.

The time few weeks which had been necessary to renew this installation with change worn and spare parts, was so long because in this period another mills had to be regulated and controled. In this incident beyond lowering the output of aggregate existed the menace of boiler (damage pressure and construction elements), which was operated without two or three mills.

Government of my country had taken into consideration this problem and nominated me for United Nations Fellowship to know various designs and technological methods of overhauls in another countries.

The known designs and technology method overhauls are expected to assist in elaborate new solutions in this field in our country.

When I'll come back to my home country my responsibility will be depended on introduction of new ideas and designs which I have acquainted during my Fellowship studies.

My study programme and training were be based on acquaintance various constructions of grinding coal machines and their auxiliary installations in power-stations, compare the designs of coal mills and



fans - both from drawings and during overhauls, marking the life of individual their parts and materials used for this construction, recognition overhaul technology and tools used in this operations.

### I--Thermal Power Plant Naantali

Power-station Naantali consists of three blocks each 133 MW.

- |   |                           |
|---|---------------------------|
| - Turbo-generators                                  | - AEG/W. Germany/,        |
| - Once-through boilers<br>with coal and oil burners | - SULZER/Switzerland/,    |
| - Coal mills  | - ICL-LOPULCO/England/,   |
| - Air heaters                                       | - LJUNGSTRÖM/W. Germany/, |
| - Remainder designs                                 | - IMATRAN VOIMA/Finland/. |

The blocks had been ready and took in operation:

- block nr. 1 - December 1960,
- block nr. 2 - October 1964,
- block nr. 3 - July 1972.

The whole operation hours of every boiler at the 31 December 1973 are:

- block nr. 1 - 37 176 h
- block nr. 2 - 38 268 h
- block nr. 3 - 10 615 h



## COAL MILLS

Every boiler has three coal mills and their auxiliary installations/  
/mill fans, distributors, dust-pipe lines, coal feeders/.

All mills are ICL - England designs.

The mills belong to boilers nr. 1 and 2 are suction types and have the three grinding rollers each. The grinding ring consists of ten parts (boiler nr. 1) and eight parts (boiler nr. 2). The coal is dropped by feeder - through central chute on the grinding table inside mill. The grinding table is driven with constant speed/by electric motor and gear box/and here the coal is thrown under the grinding rollers, which pulverize this fuel. The hot air/from airheater/dry coal the first and then lifts the pulverized coal to the rotary classifier which is at the top at the mill body. The classifier separates the bigger not pulverized coal parts, which fall down and mix with raw material on the grinding table for further pulverizing. Inside the mill is under pressure atmosphere. The ground coal is sucked through dust-pipe to the mill fan which has two pressure stages. From fan and distributors air-coal dust is sending by pipe-lines to the boiler burners.

Mills and mill fans which work with boiler nr. 3 are also ICL - England design, but the recent advances and different from previous installations in Power-plant. These are pressure mills. The raw coal is dropped into the mill in the same way, but mill has only two rollers. The hot air from air-heater through mill fan is flown into the mill with about 1000 mmH<sub>2</sub>O (WG).

The sealing air has a pressure about a 100 mmH<sub>2</sub>O (WG) higher than is inside the mill. This air protects a gear box and bearings in the rollers from coal-dust. The grinding ring is consisted of four parts. The pulverized coal is lifted by air current through classifier and dust-pipe-lines to the burners.



## Roller springs

The pressure upon the grinding rollers are brought about by two twice steel springs in every roller in mills assembled with boilers nr. 1 and 2.

In mills belonged to boiler nr. 3, the gap between rollers and grinding ring are caused by hydraulic system (oil pressure pump, oil hydraulic cylinders, swinging arms, oil control cabinet).

## Life and material of individual mill and mill-fan parts

The individual mill and fan parts are different worn and torn times.

List of work hours worn parts which had to be changed:

		Mills belong to boilers:			Remark
		Nr. 1	Nr. 2	Nr. 3	
Type -		LOPULCO LM-14/3	LOPULCO LM-16-PR	LOESHE LM-16/1220D	
Output coal t/h		14.7	21.5	21.5	Nominal
Mills:	Material:	900-	900-	2000-	
Fire roller-	NI-HARD	-1200	-1200	-2800	
2. Grinding ring-	NI-HARD	1000- -2000	1000- -2000	2600- -2800	
3. Dam ring-	steel	15660	-	?	
4. - Ring	Essembling steel	-	-	3500	untypical
5. - Screw	tire roller steel-DIN-3000 -1.1141	3000	3000	-	
6. Bearings (in roller)		-	-	3500	untypical
7. Packing, gasket, seals		with changed main parts			
8. Armour ring - grey cast iron		welded every 2000			
9. Louvre ring - grey cast iron		welded every 10.000			
Mill-FANS:					
10. Rotor		1000	1000	-	
/Changed by repaired in Work-shop/					
11. Fan-Body	cast iron	1000-	1000-	-	
inside parts	or NI-HARD	-3000	-3000		
12. DUST DUCTS	cast iron				
	or NI-HARD	20.000	20.000	?	

The remaining parts of coal mills and fans have not been changed at all and I don't remark about it.



### Operation time between mill overhauls

The time between next overhaul is depended on worn parts time. The further operation these parts could cause a big damage and renewal cost would be a many times higher than profit of produce of mill. The principle parts which investigate this cycle, according with a worn data are the tire rollers and grinding rings.

The average periods between one and the next mill overhauls are:

- Lopulco mills (boiler 1 and 2) - 900 - 1200 h
- Loeshe mills (boiler 3) - 2000 - 2800 h

During the mill overhaul the all component parts of belonging installation are checking and the worn elements are exchanging or repairing.

### Tools and equipment use for repairings

Every type of mills is equiped of special pneumatic, hydraulic or electric tools and equipments.

- Over every mill and fan are the cranes of 5 or 8 ton crane ratings. Crane trackes are assembled by this means that all elements of mill installations can be take out in easy way. (Propulsion - pneumatic, electric or by hand).
- The mobil-crane of 8 ton weighting is used during overhauls of brink mills (boiler nr. 2) because the space over these mills are occupied by air-ductes.
- Jack-lift trucks have hydraulic system taking up and down wood pallets with weightings.
- Portable hydraulic-jack is used to go down and up grinding rollers with their equipments - eleminated cranes (boiler nr. 3).
- Ram with equipment for regulation compressed springs of the grinding rollers (boiler nr. 1 and 2).
- Air-pressure wrentch (impact tool) to screw on and out nuts.



## Overhaul technology

Producer of pulverizing installations had delivered full instructions of operation and maintenance these aggregates.

Maintenance instructions contain general indications concern exchange and regulation separated unites of installation, descriptions of succession services and sometimes about using special tools.

Skilled maintenance staff of power-station have utilized these instructions, their experience and modern tools, repair pulverizing installations in very short times.

## Statement

Naantali power-station is a modern plant in which installations, esp. almost all grinding aggregates were been designed for easy of approach to overhaul and control, and equiped with special tools for facility and mechanization job.

Observation and study was covering my program in Naantali Power-Station as a result of making accessible all necessaries materials as drawings, discriptions, data of operation and maintenance of all the staff and direction of Naantali Power-Plant.

## II Thermal Power-Plant Inkoo

Inkoo Power-station will be the biggest thermal plant in Finland at 1977, but it is under construction now. It will be consisted of four blocks, each 265 MW.

The first block had been ready on 1973, November 30, and took into operation.

At the first day of March 1974, this block had 1755 operation hours.

The block nr. 2 is under construction and it will be ready on August 1975 in accordance with plan.

Inkoo power-station installations:

- |  |                    |
|--|--------------------|
| - Turbo-alternator - 265,5 MW                                    | - VK/W. Germany/,  |
| - Once-through boiler - 761/820 t/n<br>with oil and coal burners | - VKW/W. Germany/, |
| - Coal mills, each - 34 t/n                                      | - VKW/W. Germany/, |



- Air heaters
- Remainder designs

- Imatran Voima/Finland/

### COAL MILLS

Mills and their auxiliary installations are VKW/W. Germany/ designs.

Every boiler has four coal mills and their auxiliary installations as mill-fans, dust-pipe line, distributors, coal feeders, and two common seal fans.

There are pressure mill type and very simple construction.

The main working parts into mill are:

- The grinding ring consists of 12 parts,
- The three arm star-piece pusher,
- The three rollers (tyre type),
- The press-ring with fasten ring (to the down spring-ring),
- The union two rings and 20 springs, each ring has three resistance elements,
- The three steel ropes which tens the upper ring,
- The body of the mill with 2 x 3 resistance elements cooperated with similar of rings.

There are ones of the bigger coal mills these types, but they have been working in Inkoo Power-Plant for three months only and now it is difficult to define all the advantages and fails.

The rollers and press-ring had manufactured of NI-HARD -I material and were worn after 1 200 - 1 300 operation hours, as the all resistance elements assembled into mill body as in spring-ring were worn, too. The life time this materials was short so therefore purveyer of these mills ordered to replace the rollers and press ring of NI-HARD -III material.

Full informations about using materials and operation times between overhauls will be able to elaborate at least after the next three exchanges of these elements at it will be possible at the next year.



Replacement technology and tools and equipments used for these works.

I must confirm that every mill as well as constructions over the mill were projected of many auxiliary elements and installations which are indispensable for these type works.

After opening the gate of mill in upper part, to the begin all works there are mounted the auxiliary construction "in" and "on" mill body. The auxiliary construction has ratings 12,5 tons as same as cranes "demag" type which are assembled between every two mills.

Remaining tools are similar as in Naantali Power-Station.

Mill designer took into consideration almost all technical possibilities which can make easier and hasten works connected with replacement grinding elements into the mill.

The first exchange grinding elements of mill had taken about eight work days, the next one took the six days only, and the work time depend only on skilful crew and necessary tools.

These results get superiority among all ball or roller and ring mill types.

This attainment is possible also by using mobil-crane of 10 tons capacity, and as a result foreseeing by designers so many vacant spaces in front of mills for these works.

Conclusion

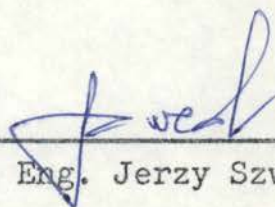
Climate and assurance the maximum conditions for maintenance are finding into the modern installations and building design in Finland.

The large building and using many tools for mechanization works are more expensive than in another southern countries, but to restore full technical conditions of installations in a very short time and to increase the efficiency cause to reach so high effects in power plants.



I had a possibility to know constructions, technologies and methods of work in two the biggest thermal power-stations of Imatran Voima Oy in Finland, and I had an opportunity to visit some water (hydro) and thermal power plants in Finland as a result of favourable disposition of managers of Power-Plants and Head-office Imatran Voima Oy.

Many of these solutions which I have known in Power Plants in Finland and collected materials will be very helpfull in my next professional activity in my native country. I hope I'll deliver a lecture for our specialists about designs, tools and methods which I could know during my Fellowship, and after that I start improve devices in our Power-Stations.



---

Eng. Jerzy Szwed

Zakłady Energetyczne Okręgu Południowego

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