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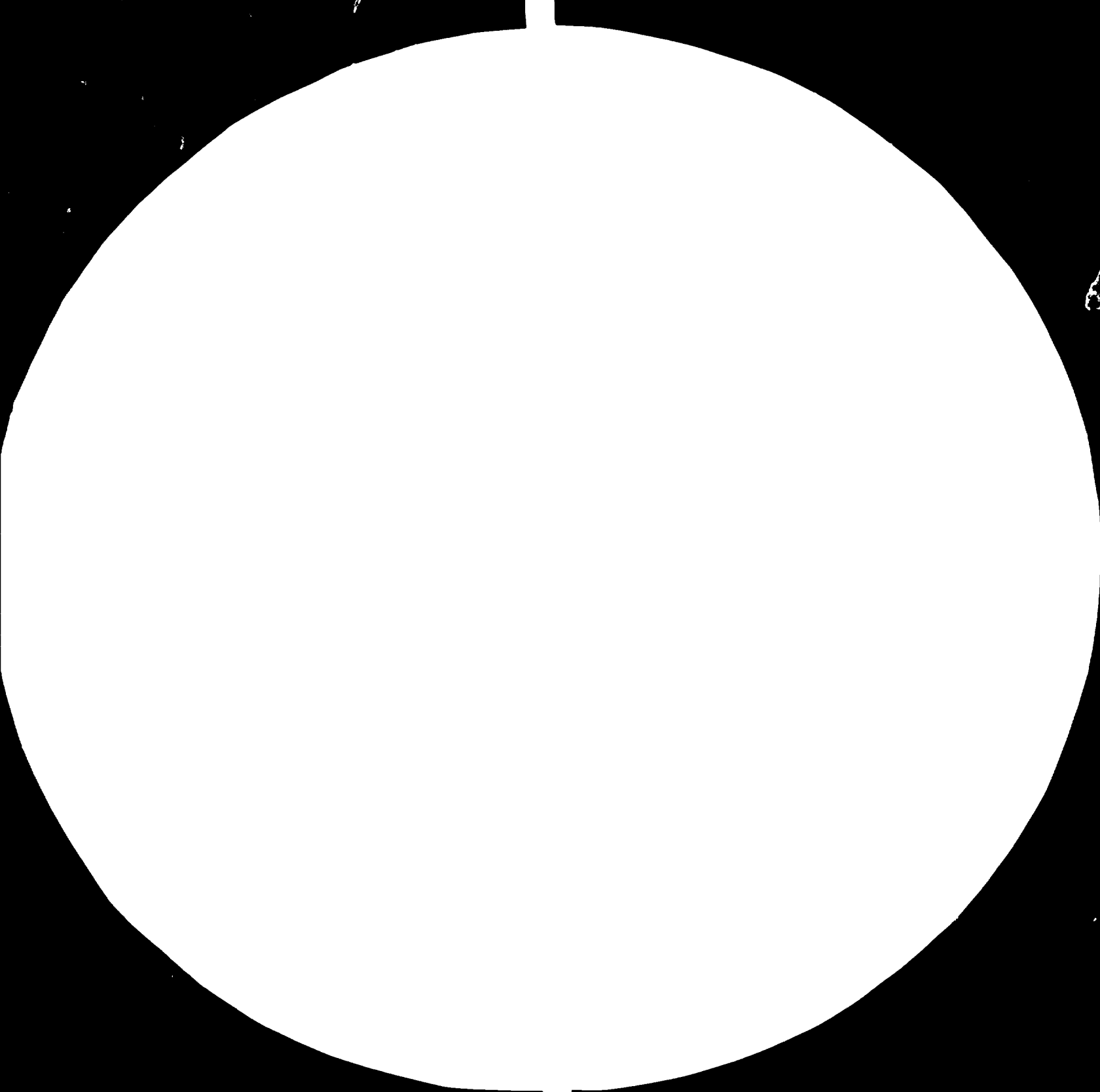
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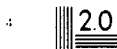
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(1 of 4)

**Steel Rationalization
in Brazil,**

Final Report.

Volume 1

GENERAL CONSIDERATIONS

UNIDO Contract : N° T 81/90

UNIDO Project : BRA/75/003

Project Director : Dr. B. S. Krishnamachar

**Steel Rationalization
in Brazil**

**Final Report
Volume 1**

GENERAL CONSIDERATIONS

FINAL REPORT OF STEEL RATIONALIZATION IN BRAZIL

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FINAL REPORT ON UNIDO CONTRACT No. T 31/99

In accordance with UNIDO Contract No. T 31/99, Instituto Argentino de Siderurgia (IAS) has carried out the following activities.

- (1) IAS engineers have visited Brazil between March 21 and April 3, 1962 and have organized meetings with the UNIDO team leader and the Brazilian counterpart, with a view to getting acquainted with the global situation of the Brazilian steel and iron market and the structure of the organizations which will put into practice the rationalization in Brazil, so as to enable IAS to devise a Rationalization Plan for Steel and Iron Products (according to quality, type, shape and size) adapted to the said situation and structure.
- (2) On April 20, 1962 IAS sent to the UNIDO team leader the Rationalization Plan for Steel and Iron Products (volume 2 of this report) prepared on the basis of conversations held on the occasion of the first visit, containing a general rationalization plan valid for any product, quality, shape, dimension or size.

The same indicates:

- (a) the object of the rationalization.
- (b) the scope the Plan should have, and the products and characteristics to be rationalized, etc.;
- (c) the policy as to the interests the rationalization should uphold, who should participate, how the rationalization tasks should be coordinated, how it should be promoted and divulged, how the users and producers should be made

aware of its importance, why the first phase of the rationalization plan should conveniently be applied by voluntary agreement, etc.;

- (d) the outlines of the guidelines to be borne in mind in a rationalization plan and the structure to develop same;
- (e) the methodology for establishing the general diagnosis of the market and the general plan of action, how the measure of variety is established, how the rationalization unit is established, the measure of concentration, how to establish whether it is more or less favourable to rationalize a product; the analysis of rationalization of specific cases, questionnaires for users and manufacturers, the principle of compatibility, etc.;
- (f) questionnaires for carrying out a market study of steel and iron products with a view to ascertaining their situation and to suggest the course of action for envisaging a long term rationalization plan. Feasibility and probability of carrying out a rationalization, etc.;
- (g) the economical considerations and advantages/^{of}rationalization, etc.

NOTE.- This Plan was forwarded to SAIPO on July 21, 1932 (Our Ref. No. 02/03/1441), as the First Report of the Contract, including phase I and part of phases 2 and 3 of the Program. It should be pointed out that the said Plan contains several contributions which although not contemplated in the contract, have been included in order to consider

all the aspects that must be taken into account in a Global Rationalization Plan of steel and iron products.

- (3) This Rationalization Plan prepared by IAS was analyzed and discussed at meetings held in Brazil from July 13 to July 15, 1982, between IAS engineers and representatives of the Brazilian Government (INMETRO), the President of the CB-1 Committee of ABNT, and the UNIDO team leader, all of whom voiced their full agreement and expressed their sincere praise, so much so that they decided to take it as the basis for the preparation of a National Rationalization Plan to be submitted for approval by the Government of Brazil, setting out, apart from the above mentioned guidelines, the duration of the Plan, the team of persons required to put it into practice, etc.
- (4) As a consequence of this First Report prepared by IAS, the Brazilian Government has already put into execution a National Rationalization PLAN FOR STEEL AND IRON PRODUCTS, the procedure of which is as follows: the President of CB-1 drew up said Plan (copy of which is attached) based on the Rationalization Plan of Steel and Iron Products prepared by IAS. This Plan was discussed in the first place by the UNIDO team leader and approved by the President of INMETRO, and after meetings organized by CONMETRO in the month of October 1983, it was unanimously approved as the National Plan of the Brazilian Government.

(5) At meetings held in Brazil between July 13 and July 15, 1982, engineers of the IAS, representatives of the Brazilian Government, the UNIDO team leader and the President of CB-1, analyzed the themes of the two pilot projects and, taking into account the current situation of the Brazilian steel market, decided to adopt the following course:

- Rationalization of steels for mechanical constructions, classified according to their chemical composition;
- Rationalization of steels for metal structures and mechanical constructions, classified according to their mechanical characteristics;

with IAS being in charge of the preparation of the methodology, the procedures and the questionnaires corresponding to the said Projects.

At the said meeting, IAS was requested to give lectures (not contemplated in the Contract) on the objectives and advantages of the Rationalization for users and manufacturers of steel products, in order to make them aware of the importance of this branch and it was agreed that the same will start as soon as INMETRO decides on the entities, associations and firms where they are to be delivered.

Furthermore, in the course of this visit a work time-table was agreed upon with the Government of Brazil, and the UNIDO team leader, copy of the agreement note being included as Annex 1.

(6) IAS prepared the methodology, the procedures and the questionnaires of the two Pilot Projects (volumes 3 and 4 of the instant report), including:

- exhaustive questionnaires for manufacturers and institutions of Brazil, related to the steels that are being manufactured, for each type of steel and shape of product, and the imported steels, in order to determine the internal consumption of Brazil and the export market;
- an exhaustive questionnaire for users in order to ascertain the type of steel they consume, the shape of the product they buy, the process they apply, the items they produce, their characteristics, etc., with a view of finding out some of the parameters deciding whether or not a certain steel can be replaced or substituted by another type of steel;
- the method of data processing and tracing consumption concentration curves;
- the criteria to be borne in mind in order to determine the rationalized lists;
- etc.

These documents were studied in Brazil between November 20 and December 3, 1982 jointly by IAS engineers, the UNIDO team leader, representatives of the Government of Brazil and the President of CS-1, the latter expressing their agreement and satisfaction with the work that had been carried out.

(7) between October 17 and November 13, 1982, Ing. Paulo Cesar

Over Tavares (Siderbrás - CB-1 ABNT) and Ing. Heliane Fonseca (INMETRO) visited IAS in order to comply with the training plan for Brazilian engineers stipulated in the Contract. The said engineers took a training course related to general aspects of the objectives, policy, outlines, methodology, technical and economical aspects, etc. of rationalization, regarding special aspects of the methodology, questionnaires, data processing, etc. for both Pilot Projects, as well as regarding the organization of technical committees and the conduction of a National Rationalization Plan.

They also participated in our Technical Commissions and Committees in order to see in practice the operative mechanics and the discussion between users and manufacturers of various rationalization projects.

The same training plan was complied with between December 12 and 23, 1982 in our Institute for the benefit of Ing. Regina Alves Vimarcati (INMETRO) and Ing. Luiz Octavio Ferreira Duarte (INMETRO), whereby the Training Plan for four Brazilian engineers provided for in the Contract was complied with.

The methodology and procedures of the National Rationalization Plan as well as the analysis of Data and criteria for drawing up the rationalized series were also discussed and explained to the representatives of the Brazilian Govern-

ment when IAS engineers visited Brazil.

(8) In accordance with requests made by the Government of Brazil through the UNIDO team leader, and in spite of the fact that they were not included in the contract, IAS engineers delivered, between November 26 and December 3, 1982, several lectures with slides, in Rio de Janeiro and Sao Paulo, with a view to explaining the importance of the rationalization of steel in the national economy and the collaboration the steel industry and consumers should give to the National Program, as well as the philosophy, methodology, etc. and the achievements both technical and economical this activity allows to attain. The said lectures were delivered in the following entities:

- IBS (Brazilian Steel and Iron Institute);
- SINAVAL (National Union of the Shipbuilding Industry);
- SICETEL (Union of the Ferrous Metal Drawing and Rolling Industry of the State of Sao Paulo);
- SIMETRE (Union of the Railways and Railroad Material and Equipment Industry of the State of Sao Paulo);
- ABCEM (Brazilian Association of Metal Structures Builders);
- CBF (Brazilian Forging Center);
- ANFAVEA (Association of Automotive Vehicle Manufacturers);
- SINDIPECAS (National Union of the Automotive Vehicle Components Industry).

Furthermore, IAS prepared and delivered to the UNIDO team leader lectures and slides in Portuguese and in English so as to enable them to carry on this task of making the Brazilian steel users and manufacturers aware of the importance and advantages of applying a Rationalization Plan to the Brazilian steel and iron market.

- (9) During their visit to Brazil in the months of November and December, 1982, IAS engineers, jointly with representatives of the Brazilian Government, the President of CS-1 and the UNIDO team leader, analyzed the time-table drawn up in the month of July. The representatives of the Brazilian Government stated that in view of the fact that the concept of rationalization is relatively new in Brazil, which means that it will take longer to convince the steel manufacturers and users and to secure their backing, they suggest and stipulate a new time-table ending in December 1983. This new time-table was submitted to UNIDO in the second report and accepted by telex on March 22, 1983.

- (10) During a visit of IAS engineers to Brazil between November 30 and December 1 and 2, 1983, at meetings with the Brazilian Government and the UNIDO team leader, the phases of the program which remain to be put into practice were analyzed, i.e.:

- (1) the preparation of the rationalized series of steels of

the two Pilot Projects based on data to be supplied by the Brazilian Government;

- (2) the participation of IAS in the Technical Committee of Brazil in order to conclude the study of the rationalized series of steels of the two Pilot Projects.

The representatives of the Brazilian Government state that unfortunately the said phases could not be implemented due to the fact that the collection of data is not completed yet and that the Technical Committee will meet only in 1984. They also state that the work at the national level is fairly advanced stage with regard to the following areas:

- construction steels
- tool steels
- stainless steels
- special steels.

They state furthermore that they are convinced that with the training and technical assistance provided by IAS, as well as due to the abundance of detail, completeness and clarity of the methodology, the procedures and the analysis for drawing up rationalized lists of steels, Brazil has the elements required to develop successfully the National Rationalization Plan. Therefore, and bearing in mind the foregoing, the Brazilian Government prefers to analysis the data and the Technical Committee concerned decide the list of rationalized of the two Pilot Projects, and requests, in the

event of difficulties with regard to these Projects, which it dismisses as improbable, that IAS lend its assistance to solve any such difficulty, a service IAS undertakes to give by mail or in the course of visits to Brazil without additional expenses. Furthermore, IAS undertakes to supply guidelines for data processing and analysis as well as to make recommendations related to the preparation of rationalized lists of steels.

This way IAS understand to have finished and completed the UNIDO Contract N° T81/90. In the same way the Brazilian Government and the UNIDO team leader agree that this task has been satisfactorily fulfilled. We also want to express our thanks to the Brazilian Government and UNIDO people that allowed us to end this task in the satisfactory way above said.

NOTES OF DISCUSSIONS RELATING TO RATIONALIZATION OF STEELS
WITH IAS AND BRAZILIAN NATIONAL COUNTERPART - 13/15 July '82

Engs .José Francisco Lopez and Blas Laterza visited Rio from 13 to 15 July 1982. Three meetings were held with these Engineers one of which was attended by Cel. Cyro Borges . President of CB-1 and INMETRO staff. The INMETRO staff also attended the concluding meeting on 15th July.

The report prepared by IAS on Basic Concepts of Rationalization Plan for Steel Products was discussed and appreciated.

The scope of contracting services was also discussed and approved in principle by all concerned.

Two pilot projects were identified. These are:

1. Steels based on chemical composition.
2. Structural Steels based on mechanical properties.

The following important decisions and plan of work for future was agreed.

1. The result of the preliminary inquiry related to steels at present produced based on chemical composition will be sent to IAS when ready.
2. Two Brazilians will be sent to Buenos Aires to study the detailed work and the methodology followed by IAS for rationalization of steels.
3. IAS will prepare detailed questionnaire to collect data for the two pilot projects identified.
4. IAS will deliver lectures in Belo Horizonte, Rio and São Paulo for different groups selected by the Brazilian counterpart in order to explain the importance of rationalization of steels.
5. IAS will prepare the lecture notes for item 4 above.
6. When the data is collected for the pilot projects IAS will analyse the same and make their proposals for rationalization.
7. IAS will participate in the meeting of the study commissions of CB-1.

8. After the completion of the study of the CB-1 IAS will prepare the final report and the recommendations.

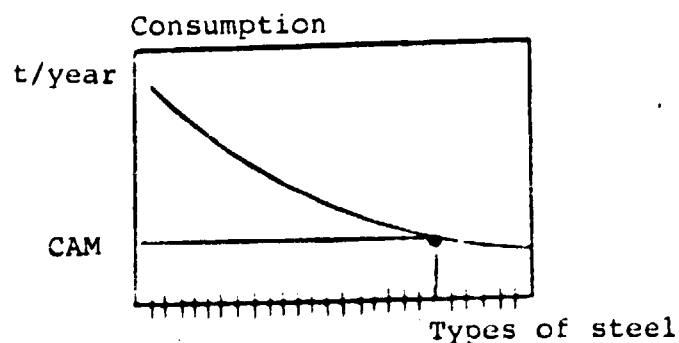
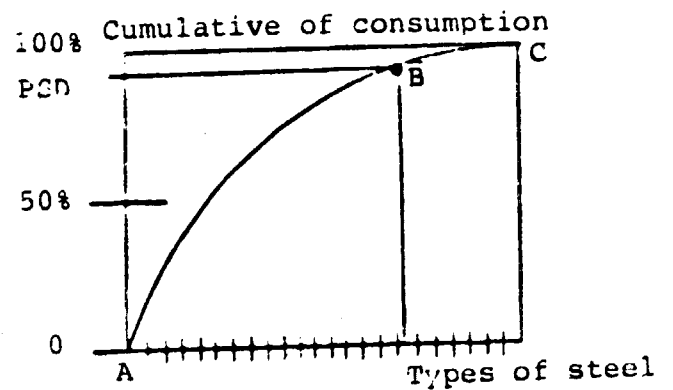
The questionnaires and the lecture notes referred to under items 3 and 5 would be sent to the UNIDO Team Leader in Spanish and English by end of August 1982.

The President CB-1 is preparing a National Plan for undertaking this activity. He would be discussing this plan with the UNIDO Team Leader and then send it to the President of the INMETRO. The intention is to get the Government approval for this plan so that the industry will fully support this activity.

METHODOLOGY FOR THE RATIONALIZATION OF PILOT PROJECT STEELS

The rationalization methodology consists in trying to reduce the variety of types of steel, with a view to replacing the lowest consumption by the highest consumption types (see notes 1 and 2). To this end, concentration curves are used, in which the types are arranged in accordance with the decreasing consumption.

Two types of curves can be seen below, differing in the way that consumption is expressed. In one case, it was done as a cumulative percentage, and in the other one, in tons. The types of steel are those in demand on the market.



The search is directed towards a Demand Satisfaction Percentage (DSP) close to 100% (for instance, 95%). This means that, in principle, the tendency will be to recommend as Rationalized Types of Steel those comprised in zone AB, with a view to satisfying a high percentage of the demand.

However, this value of the DSP must be made compatible with the minimum yearly consumption the manufacturers wish to attain so as to avoid incurring manufacturing surcharges (see note 3).

The objective is to find a compromise solution between both values, and at the same time, by means of a technical analysis of the replacement conditions of one type of steel by another one, to satisfy the demand of the non-rationalized types (zone BC) with rationalized types (zone AB) (see note 4).

Another objective is, as far as possible, to group together, whenever technically feasible, consumptions of similar steels, even in the case when both are high consumption items.

For this methodology to be applicable it is necessary then to possess information reflecting the consumption of the products scheduled for rationalization, so as to permit the first type of curve (that is, the one corresponding to the cumulative percentage consumptions) to be traced. Furthermore, the MAC value must be available; this can be expressed as a percentage of the total consumption. The target is a DSP of 95%.

So far the economics of the problem would have been solved,

but in order to cover the technical part additional information is necessary regarding the intended use of each type of steel and particularly the process to which it is to be submitted (forging-machining, heat-treatment, etc.) and if possible, its replacement.

For this reason, two types of information are specified, one to be requested from the manufacturers and the other one from the users.

The information to be used for the rationalization is expressed in terms of percentages or quality, which means that those supplying same should not think that confidential data will be divulged. It is obvious that the original data must be in tons so that after processing it may be converted to a percentage indicating the relative demand, the disclosure of which will harm nobody.

After gathering the information and completing its analysis, as well as justifying the replacements and their eventual inclusion or not into the list, a document is drawn up to be used for deliberations and work.

This document will serve as the basis for discussions between users and suppliers. The same will comprise:

- (a) the original list;
- (b) the relative consumptions (in percentages) expressed as curve ABC;
- (c) the MAC sought by the manufacturers;
- (d) the DSP reached in the analysis;
- (e) the suggested rationalized list; its reduction in comparison with the original list and the justification of each inclusion or exclusion as well as the replacements;

- (f) the technical information of the users;
- (g) additional information regarding foreign commerce.

Moreover, a list of steels (if any) that are not recommended and have no replacement, could be attached so as to avoid their inclusion in future projects.

The discussion between users and manufacturers should be the last step before making public the proposal. The agreement, duly justified, shall be valid as a recommendation and will have to be updated periodically. To this end, the same method shall be employed.

NOTES CLARIFYING THE METHODOLOGY

1. The first aspect to which attention should be drawn is that its purpose is:

TO REDUCE THE VARIETY OF TYPES OF STEELS/DIMENSIONS, ETC.

To this end, it is imperative to define with precision when two types of steel are different, and when, appearances to the contrary, they can be considered identical. The same occurs in the case of dimensions.

Quite often two steels having the same chemical composition receive different designations due to the fact that they belong to different standards.

Similarly, quite often, due to the use of different rounding off criteria, the dimensions converted from inches to millimeters present a different quantity of digits and even differences in their numerical expression.

On the other hand, by resorting to simplifications, different types of steel are lumped together into one at the same commercial designation or standard. In such cases, reference is made to the chemical composition, for instance, disregarding other characteristics decisive for their application as, for instance, restricted levels of one or more components or other complementary tests the product must pass in order to be apt. This is the exact opposite of the foregoing case, inasmuch as it causes two things to seem to be different although they are not.

Certain practical conclusions for the rationalization task

can be drawn from this:

- (a) It is essential to define clearly the field of application, that is the RATIONALIZATION UNIT.
- (b) Very thorough analyses and consultations should be made whenever doubts regarding data or designations arise.
- (c) The additional technical information regarding the uses of the material in question is essential for a correct statistical evaluation of the variety.

2. Although the purpose is defined as REDUCTION OF VARIETY, in some exceptional cases, based on the analysis, it might be necessary to effect an increase. In spite of the fact that the market is supposed to be oversized as far as variety is concerned, due to different factors, among them the imports of technologies and products, it is possible that some products are inefficiently employed and that a correct utilization of the material could lead to an increase of the variety. This point should be duly analyzed and the sole reason it is mentioned here is to stress that it can really arise.

3. While, on the one hand, it is perfectly clear that the rationalization must be carried out to conform a market (manufacturer-user) and through negotiations between both, on the other hand it is essential not to overlook secondary factors capable of acting as additional elements of judgement or criteria in making decisions.

If we accept that point (1) has been solved, that is that

the steels/dimensions are different, then there only remains to indicate the substitutes which in all cases will generate certain changes. In this case, it is convenient to take into account, apart from the consumption, its supply condition. If the material is imported and if it is not the same as another material of local origin, then it could be convenient to analyze why it has not been substituted and whether the substitution is feasible.

If it is a low consumption product and its substitution is not feasible, the problem is not so serious, as it is perhaps less convenient to manufacture it than to import it. However, if possible it should be made, alternatively a substitute acceptable for local production should be recommended.

Quite often, the imported material represents an apparent variety and others with appropriate technical counseling are replaceable.

Another aspect, unrelated to the analysis of the consumer market, is a material manufactured for export. In this case, its MAC may be lower than the value that has been technically calculated based on the assumption that it would be manufactured exclusively for the local market. Export can act as a basis for this consumption and represent a target for the incorporation of this product into the local market, always provided that this is desirable.

To resume, it can be said that the application of the

methodology must be carried out with auxiliary data as to the origin of the consumed product and its situation as an exportable product.

4. Bearing clearly in mind the foregoing points, which is practice should be evidenced by the availability of TECHNICAL INFORMATION OF USERS, ADDITIONAL INFORMATION REGARDING FOREIGN COMMERCE AND CRITICAL AND CAREFUL PROCESSING OF STATISTICS, the next step is to analyze the replacements.

Priority must be given to marking zone BC of the curve.

The low consumption products must be eliminated from the market on a short- or long-term basis. If acceptable replacements can be recommended, then this will be a short-term solution, otherwise it would be a warning for the future. As they are not contained in a list of recommendable products, the new projects and developments will avoid them.

Even so, zone AB - the high consumption zone - warrants an analysis. A replacement within this zone is highly profitable due to the relative weight of the consumption and enhances even more the rationalization. Special attention should be paid to imported or exportable material.

For the above-said to be valid, it must be supported by a broad dispersion of replacement criteria and of the qualities of the rationalized steels. The technical transference is fundamental.

An ultimate aspect to be borne in mind is the concatenation

of the rationalization downwards or upwards with regard to the manufacturing process.

In the dimensional part it is important to take into account the products arranged in a downward sequence, for instance, DIMENSIONS OF SHEETS AND MANUFACTURE OF WELDED TUBES. The standards governing same stipulate the dimension of the wall of the tube having a peculiar shape which must be taken into account when the thickness of the sheets is rationalized. Desirably, the tubes should not require a different or special series, however, should this happen with certain dimensions, then it ought to be taken into account when the sheets and tubes are rationalized.

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**Steel Rationalization
in Brazil**

**Final Report
Volume 2**

RATIONALIZATION PLAN OF IRON AND STEEL PRODUCTS

UNIDO Contract : N° T 81/90

UNIDO Project : BRA/75/003

Project Director : Dr. B. S. Krishnamachar

**Steel Rationalization
in Brazil**

**Final Report
Volume 2**

RATIONALIZATION PLAN OF IRON AND STEEL PRODUCTS

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1. OBJECT.

To carry out a global analysis of the steel market and endeavour meeting to the greatest possible extent the actual requirements of the consumer sector, within the framework of a technically and economically optimum husbandry of materials, manpower resources and equipment.

2. SCOPE

The scope of the rationalization plan should be national. It should be related to mass production and mass consumption steel products rather than to qualities intended for special or highly specific strategic uses.

The said plan should be global and encompass the basic characteristics of steel and iron products, such as their types and grades, shape, sizes and dimensions and the various states they are supplied in.

3. POLICY

The aim of this rationalization plan being to safeguard the interests of the country in general and more particularly the interests of both consumers and producers, it is paramount that the rationalization activities be carried out with the participation and general assent of all sectors of the steel and metallurgical industry, so that, in the light of a joint analysis of the actual requirements of the consumer market, based on actual manufacturing possibilities, the necessary criteria

may be worked out in order to eliminate any imbalance existing in the internal market of the country and ensure a continuous and economical supply for the national steel and metallurgical industry.

Assuming that rationalization implies the optimization of a process, it is logical to think that it will be more in-depth if it carried out with the participation of all sectors involved and if the various interests are adjusted to each other.

In order to achieve this end, it is advisable that the entity coordinating the rationalization activities be a Committee, possibly called "Rationalization Committee", comprised of representatives of the Government, the entity in charge of the steel making activities and policy of the country, as well as representatives of institutions and organizations grouping together the steel manufacturing and processing industry, standardization institutes, whereby the general big interest of the various sectors of the steel and metallurgical activities of the country will be consolidated, whilst the private interests would be studied jointly with the specific rationalization subjects at a later date.

Said Committee should fix the general policy and global coordination of rationalization tasks, promote and divulge the rationalization, etc. (see functions of the Committee in 4. "Outlines").

It is of paramount importance to convince all parties involved that the rationalization is undertaken jointly and in the best interests of everybody, and to pay special attention in the initial phase to the consumer who will be the first to react to a rationalization plan, inasmuch as he may feel that it restricts his possibilities to purchase the product he requires. It is therefore necessary to divulge the idea:

- that the rationalization plan endeavours, in the first place, to put order in the steel market and is basically directed to mass consumption products without interfering with special use products,
- that the series of rationalized products cover, as the case may be, around 80% to 95% of the total of steel products, in tons, manufactured and applied to specific uses, and those not falling into the rationalized series have been excluded after an exhaustive analysis, carried out jointly by consumers and manufacturers, taking into account their practical uses, manufacturing characteristics, technical and economical conditions, substitutions, replacements, and so forth, all of which served to prove that it was convenient to exclude them, inasmuch as they can be substituted adequately by other products contained in the series, or because, as a rule, they are not used or manufactured, or else because their manufacture and uses are antieconomical, etc.,
- that the concentration of steel manufacturing in certain qualities and shapes, will offer the user, among other advantages, the possibility to purchase better quality products at a lower cost and will also make them available at the right moment and the right place,
- that the fact that there are series of rationalized steels does not prevent either the producer or the consumer from manufacturing or using other steels whenever this should be justified.

It is therefore advisable that the first stage of the rationalization plan be carried out voluntarily, by general assent, that is by preparing a set of "Rationalization Recommendations", until the initial fears have been dispelled and both users and manufacturers have understood that the rationalization does not harm anybody but rather favours everybody.

Likewise, in order to promote and simplify the use of the series of rationalized steels, it is convenient to divulge the properties of said steels, especially of those that are rationalized according to qualities so as to enable the user to select the type best suited to the

characteristics and practical use of the product he plans to manufacture.

Another basic aspect to bear in mind is that the rationalization should be given an organic and systematic character, enabling it to offer prompt and effective solutions of such problems as may arise in the industry due to the growth and diversification of consumption, the substitution of imports and the need to rely on an appropriate rationalization of measures. It should furthermore endeavour to create conditions of balance between manufacturers and consumers, and to implement a plan of action ensuring a better knowledge and effective use of the rationalized series.

4. OUTLINES.

The first stage of a global rationalization plan of steel products consist in making order in and providing guidelines for the market. However, to this end, it is necessary, in the first place, to become acquainted with said market by means of production and consumption statistics questionnaires referred to representative periods of time and moreover to know the causes and reasons that have led to the current situation (see questionnaire item 11), and thereafter to have at hand an operative method for analyzing the situation of the market and obtaining a realistic diagnosis of same (see methodology item 5).

Once the diagnosis of the situation in the market is known and a very clear picture has been obtained as to:

- the products that are really necessary;
- the possibilities to produce them in appropriate qualities and at appropriate costs;
- the products we wish and can import; and
- the products we can export,

a very exhaustive analysis should be undertaken in order to find out, in the first place, which products should and could be rationalized, setting down the order and priorities in work plans spanning periods of one, two or three years, with a clear indication of units of rationalization, and subsequently the rationalization units should be discussed in order to determine the series of types, shapes and dimensions of rationalized steel products.

This task should be carried out by a Rationalization Committee and by Study Commissions (the structure as well as the functions and assignments of which shall be specified hereinafter) in accordance with the following brief outline:

- The Rationalization Committee should draw up a working schedule based on the above mentioned ideas.
- Once the work schedule has been approved, the Rationalization Committee should establish the number of Study Commissions required for its development.
- Depending on the agenda prepared for each Study Commission, the Rationalization Committee should decide which firms, institutions and entities should be enrolled in the Commissions and invite them to participate.
- Once the Commissions have been appointed, the Rationalization Proposals should be prepared. To this end, the fullest possible compilation of statistical data should be carried out covering the manufacture and consumption during recent years of steel products and inputs which are to be rationalized. All such data should be processed and classified in accordance with preselected operative mechanics, and on the basis of same and taking into account the characteristics of practical use, manufacturing, technical and economical conditions, substitutions, replacements, and such like, the Commissions should decide which products will comprise the rationalized series.
- Once the Commissions have completed their studies, the same should be

submitted to the Rationalization Committee, and upon being approved, they should be published and forwarded for public discussion to all interested sectors of the country, during a fixed lapse of time, in order to secure the opinion of those who have not participated in the studies. Upon expiration of this deadline, the Rationalization Committee should evaluate the opinions thus received, and if they are deemed to be weighty they should be sent to the corresponding Commission to be discussed, otherwise the Rationalization Committee should approve the Rationalization Document. It is convenient that the Study Commission as well as the Committee voice their approval by unanimous vote.

- Once the "Rationalization Documents" have been approved, the Rationalization Committee should undertake to publish and distribute them and to ensure that they are complied with.

The Rationalization Committee should be made up of representatives of the institutions and entities referred to in point 3, "Policy", and its functions and attributions should be as follows:

- To establish the general policy and the global coordination of rationalization tasks.
- To promote the rationalization by pointing out the technical and economical advantage it creates for the country as well as for both the producer and user sector of the steel industry.
- To draw up and approve rationalization schedules, establishing priorities and the chronological order in which they will be discussed.
- To be responsible for implementing the means necessary to put into practice the approved work schedules.
- To set up Study Commissions for discussing the specific subjects of the work schedule and to stipulate the number of Commissions necessary for its development and appoint the members of each Commissions.
- To coordinate and supervise the tasks of the Study Commissions and to determine their functions.

- To study and approve the Rationalization Documents discussed by the Study Commissions.
- To publish and divulge the Rationalization Documents.
- To detect, counsel and suggest solutions whenever problems should arise in the industry due to the growth and diversification of the consumer market and the substitution of imports.
- To promote the understanding and application of Document of Rationalization and encourage studies and activities related to the rationalization drive, etc.

The Study Commissions should be made up of representatives of consumers producers, technical and scientific structures and public and private entities and enterprises of the country related to the steel industry. Priority should be given to ensuring an equitable representation of the consumer and producer sectors. The functions and attributions of the Study Commissions should be:

- To coordinate the tasks necessary for studying the Rationalization Documents, such as carrying out technical consultations and surveys, research work, tests, and such like, in order to find equivalent materials, substitutes, sizes and such like.
- To draw up and study Rationalization Documents and to submit the completed studies to the Rationalization Committee.
- To cooperate in drawing up work schedules by suggesting new subjects for discussion and drawing attention to the need to put up to date such Rationalization Documents as have become technically obsolete, etc.

5. METHODOLOGY

The proposed methodology is based on the principle of redirecting demand towards products which being better adapted to consumption substitute other products.

This principle determines the methodology for dealing with both parts of the rationalization program:

- I) General diagnosis and general plan of action;
- II) Rationalization analysis of specific cases, RATIONALIZATION UNITS;
- III) General compatibility principle.

5.1 General diagnosis and general plan of action.

5.1.1 Bases.

The diagnosis shall be based on:

- a) A measurement of the range of steel and iron products offered to the user. This measurement shall be absolute and related to the tonnage delivered.
- b) A measurement of the concentration of consumption in the opinion of specialists.
- c) An appraisal of the possibility to put into practice the rationalization in accordance with the characteristics of the market of each product.

The diagnosis should be such as to give an idea of:

- i) The current state obtained from point a) in its absolute form. This state will serve as reference for measuring the headway of a general rationalization program.
- ii) The products exhibiting the highest degree of disorder or irrationality.

This idea can be obtained from the relative measurement of point a) and the greater or smaller concentration of point b). The relative measurement will indicate which product exhibits the relatively highest degree of disorder, and the consumption concentration per item which will be easiest to rationalize

- iii) The probable success resulting from a comparison of the current situation -point a)- with a probable situation, obtained by combining the approximate concentration curves of point b) with the probability of putting into practice the rationalization, measured by point c).
- iv) A general plan of action based the foregoing points.

5.1.2 Specification of elements of analysis.

5.1.2.1 Measurement of range

It is obvious that an analysis based on catalogues of all steel manufacturers of Brazil will give an idea of the global range, of steel products used on that market.

In practice, such a figure is not particularly useful as it is devoid of analytical value, that is, it gives no information as to where the problem should be attacked.

If the concept of UNIT OF RATIONALIZATION is applied to this measurement of the range, then another step forward has been made in the sense that market-dependent differences are beginning to emerge. It will thus be necessary, at least, to discriminate between different steel products, and within these between different ways of specifying the type of steel from which they are made, which, in turn, is related to their uses or applications. Lastly, other specific attributes or parameters should be taken into account, such as the thickness of the lining, quenching, loss, and such like, inherent to some products.

Having thus defined the matrix of "Steel Products/Material Specification" which constitutes an adequate approximation to the concept of homogeneous market or rationalization unit, the next step should be to make sure that other concepts, such as the application or the consumer sector do not contradict said concept. Should this be the case, however, a further subdivision would be necessary.

The summary will be a matrix of the following type:

		SPECIFIC PARAMETERS						
		1	2	3	...	j	...	m
STEEL PRODUCTS	1	a ₁₁	a ₁₂					
	2		a ₂₁	a ₂₃				
	...							
	i					a _{ij}		
	n							a _{nm}

Where each element a_{ij} is a rationalization unit of product i (for instance, hot-rolled sheet) grade j (for instance, naval). Each Ratio rationalization unit will have a range or quantity of different items which, in principle, is expressed by:

$$\text{range} = \text{type} \times \text{sizes}$$

Actually, it would be given by the quantity of crosses that can be

ascertained in the matrix.

SIZES

	e 1				e 2				e i				
	a 1	a 2	...	a i	a 1	...	a j	a 1		a 2	a j			
	l1	l2	lk	l1	lk	l1	lk	l1		l2	lj			
Type 1														
⋮														
Type X									bx, j, k, l					

where element $b_{x, j, k, l}$ is the item existing of a product in type x of measurements j, k, l (thickness, width, length), and the sum of b's will yield the absolute range of the rationalization unit in question.

If for each rationalization unit i a j we know the range $v_{i, j}$ and if we divide the consumption expressed in tons/year C_{ij} by the range we shall obtain the average number of tons used per item. This is the relative measurement of the range that is:

$$\text{Quantity of items / ton / year}$$

To sum up: In order to measure the range with analytical sense it is necessary:

- i) To define the homogeneous markets or rationalization units into which the Consumption of Steel Products of Brazil can be broken down. This definition shall be carried out as a function of:
 - 1) Product classification;

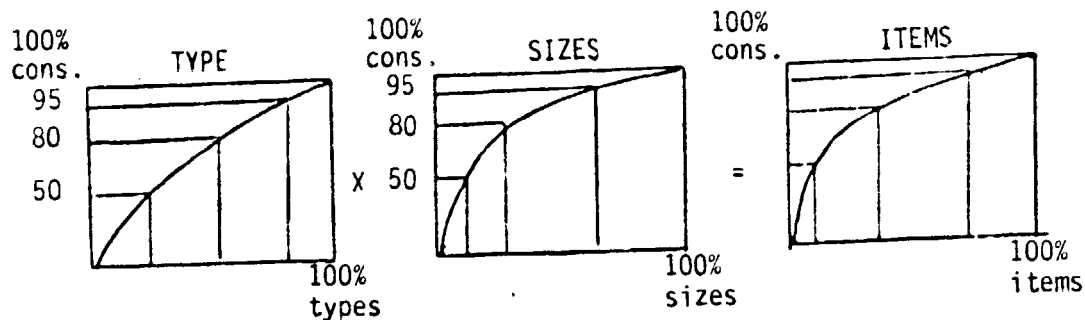
- II) Type of steel for each product;
 - III) Special parameters in the case of special products;
 - IV) Use, Sector of Use or Particular Application, if necessary.
- ii) To define for each homogeneous market the total range by counting the quantity of intersections of the matrix Types/Sizes.
- iii) To determine for a representative year the tonnage used in each homogeneous market or rationalization unit.

5.1.2.2. Concentration measurement

The concentration will be measurable separately and by "concurrence of experts" for grades and sizes, except in cases where deviations in the application of this provision can be assumed to exist.

Obviously, each plant knows how much of each type it sells (in the case of Brazil, the self-sufficiency is nearly 100%). The same result per sizes can be obtained from production schedules. An appropriate manner of expressing the concentration is by using curve ABC. (See II Analysis of Rationalization of Particular Cases). In this case, the objective shall be to find out the percentage of the range represented by 50%, 80% and 95% of consumption of a homogeneous market; if it is impossible to obtain all three points, the one corresponding to 95% should be ascertained.

This will yield two curves given by three points: one for type and the other one for sizes. It will be assumed, except if the opposite were to seem clearly better, that the concentration in the range is the product of the two curves.



Obviously, the information related to type, independent of the one related to sizes will establish clearer guidelines in the formulation of the rationalization plan.

This measurement of concentration, applied to the measurement of range, will give, without considering other obstacles or driving factors, an idea of the possible reduction of items both total and by product. While it is safe to assume that the elimination of items included in the last 5% of consumption is neither impossible nor momentous for the user industry, it will certainly show that it concerns a large quantity of items which valued solely at their inventory cost represent a lot of money.

5.1.2.3. Measurement of possibility

In order to measure the possibility, a Delphi test shall be carried out among persons of undisputed technical solvency, representing both producers and users, who on a list prepared in advance of factors obstructing and factors favouring the rationalization shall put a mark against those that in their opinion arise in each homogeneous market. Also, moved by this same list, they will be able to add additional factors. Based on their answers and on personal interviews carried

out by specialists in charge of the study, the possibility will be rated as

- 5 Very favourable
- 4 Favourable
- 3 Neutral
- 2 Unfavourable
- 1 Very unfavourable

This rating applied to each RATIONALIZATION UNIT will permit to define priorities in a plan of action, because rationalization is a task that must be put into practice by persuasion and consequently the success of the first and most favourable steps would permit the more difficult ones to be attacked with positive facts.

This appraisal of the possibility would permit furthermore to define numerically the expected reduction of the range of steel products.

It can be rendered operative to this end by assigning to level 5 - Very favourable, the probability of success 1 for a reduction of items in the sense of redirecting the demand of 5% of lowest consumption products in each rationalization unit. 0.8 shall be applied to level 4 and so forth, successively, down to 0.2 for level 1. With these factors, the concentration measurement will be penalized.

A similar application is possible by reducing by 0.2 the probability assigned to each point (i.e., 0.8 for level 5 and 0.0 for level 1) in cases where a more drastic reduction is performed at the level of the last 20% of lower consumptions.

5.1.2.4. Questionnaires

For Producers

. Should supply elements (catalogues) for defining alike the quantity

of different grades existing in each homogeneous market, and sizes. Next, by means of desk work, the range shall be determined. The survey should effectively cover all marketed items including those not shown in the catalogue.

. Should offer approximate or exact ideas as to the percentual participation of each type in the shipment of each product they manufacture, alternatively three points of concentration curve ABC of consumption per types.

. Should give three points of curve ABC for the concentration of consumption according to sizes. For instance, how many or what percentage of sizes fall into the first 50% of consumption; how many or what percentage fall into the first 80%, and how many or what percentage fall into the last 5%.

For Users

. Causes or factors favouring or obstructing the rationalization in each case. A Delphi Test shall be carried out, in which a cross opposite each factor will indicate whether it is pertinent or not.

There will be beneficial and adverse factors, to which the respondent should he so desire will be able to add his own ideas.

5.2. Analysis of rationalization of special cases

Operative mechanism to be adopted for the permanent updating of rationalized steels, sizes, types and/or grades.

5.2.1. Introduction

Rationalization tends to serve more efficiently a particular market. It is obvious that efficiency must be measured from the Producer's as well as from the User's point of view.

One manner of improving efficiency in production is by means of larger series of production (large scale economy) which indirectly leads to a better quality and directly to a major productivity of manufacturing equipments.

Ultimately, this is transferred to the user.

One of the foremost aspirations of users is attained when a range of elements is made available such that the use of the product can be optimized for each particular requirement and same can be obtained easily, without delays and at as uniform a relative cost as possible. Stated in this manner, the problem must obviously be solved by compromise.

5.2.2. Mathematical method for the first stage of rationalization

The rationalization is comprised of at least two stages.

- I) Sorting out the market by redirecting the demand away from products, the consumption of which is not convenient and which can be substituted by others.
- II) Developing products capable of substituting advantageously those already existing or expanding their possibilities of use. This is attained through research.

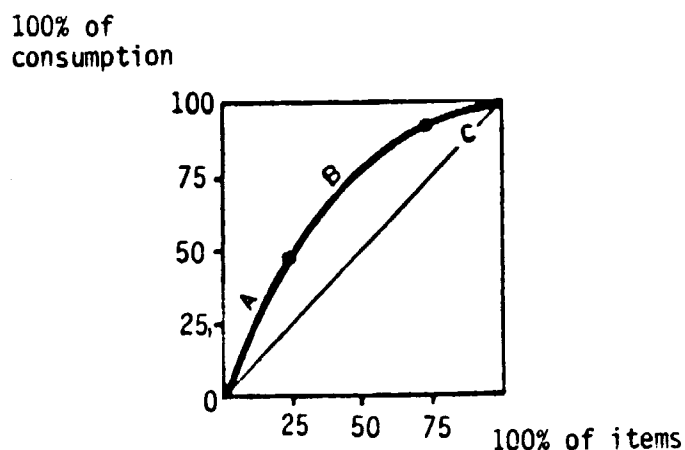
The proposed method serves merely as an auxiliary tool in making decisions for the first stage.

Market structure

The market to which the method is applied must be HOMOGENEOUS and DELIVERABLE statistics must be available stating in detail the types which are to be rationalized. Any market will present a structure similar to that of the example.

If the consumptions are arranged in decreasing order and the Accumulated Consumption Curve is traced, a function of the Lorentz curve type is obtained.

Accumulated Consumption Curve



If each element had the same consumption, there would be a straight line at 45° like the thin line and only a technical replacement analysis would be feasible. However, in practice, this does not happen and as a rule a concentration type curve is obtained like the one traced with a thick line. In this curve the need and convenience of rationalization are manifest.

5.2.2.1. Assumptions implied in the method

In order to apply this method several assumptions are pertinent:

- a) The market is HOMOGENEOUS;
- b) All the computed elements are different from each other;

- c) The consumption measuring unit is specific and representative of its production and use;
- d) Producers and users can define a minimum consumption value beyond which it would not be convenient to either consume or produce (or else, beyond which its production and consumption entail a high differential cost). MAC - Minimum annual consumption;
- e) The users can establish a minimum or desirable demand meeting percentage. DMP;
- f) It is more rational to recommend the demand of higher consumption products than to recommend the use of lower consumption products. This is the fundamental assumption.

5.2.2.2. Application

Having thus stated the method, its operation is as follows:

5.2.2.2.1. If it is the first time, it should be applied carefully. The consumptions are arranged in decreasing order, making sure that assumptions (a), (b), and (c) are complied with.

After obtaining the curve, the values referred to in (d) and (e) are determined and situated preferably in zone C of curve ABC.

If both values are compatible, i.e. the intersection from the point of view of the MAC's coincides with the market meeting minimum -DMP-, the problem is solved. If not, they should be reexamined with a view to finding a solution.

Thereafter a very thorough analysis should be made of whatever remains in the non rationalized part of the consumption curve. Furthermore, it is necessary to establish that this is advisable. It should also be possible to point out which rationalized product could substitute the product that has been discarded and what the relative disadvantage of this decision would be. On the other hand, the relative advantage of manufacturing and using the rationalized products should be established.

Once these steps have been completed, the results are arranged for their use, i.e., according to sizes, grade and so forth, stating their consumptions and whether they are rationalized or not.

5.2.2.2.2. In order to monitor and perform an ultimate followup of the rationalized product, the same procedure can be adopted, however, at this stage, precise guidelines are available as to the minimum quantity used -MAC- that is considered as rationalized and what the minimum percentage of demand is that must be met -DMP-.

To perform an updating, the same procedure as in 5.2.2.2.1. is adopted.

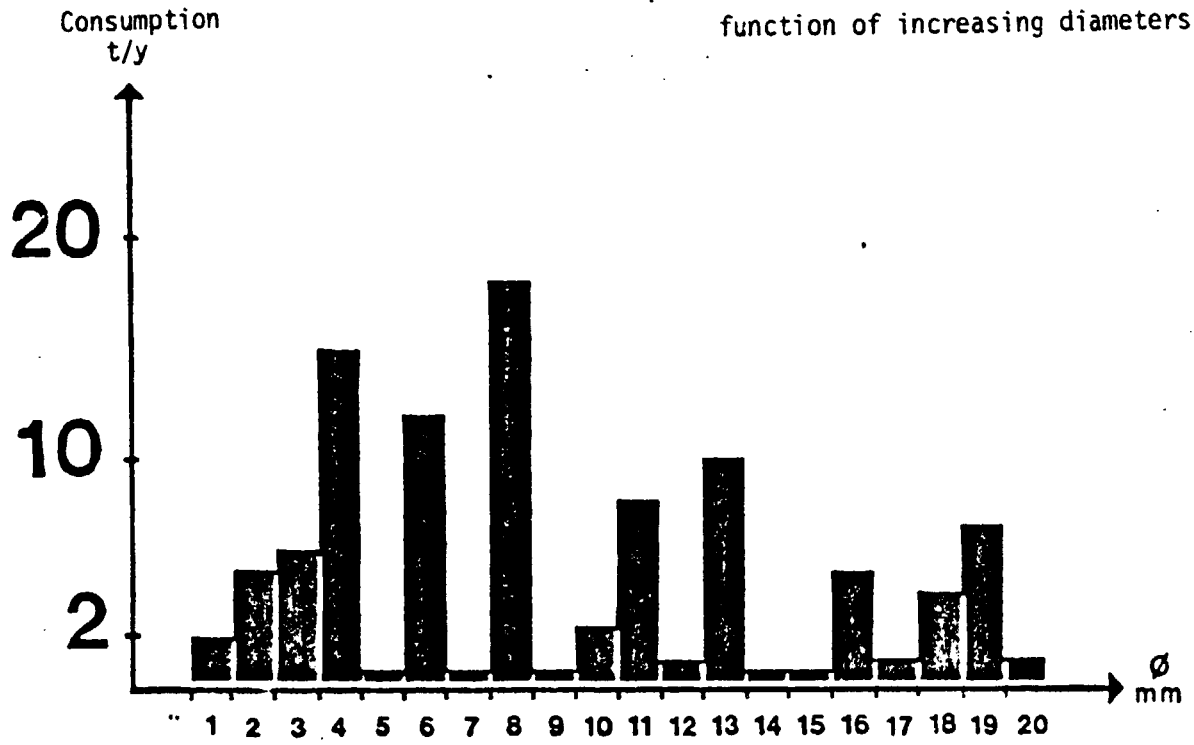
If there is a product exceeding the minimum consumption threshold -MAC-, the same could be inserted (in principle) into the list of rationalized products and vice versa.

If rationalization has been applied, then the original list should not suffer important modifications, however, there should be an increase of the Demand Meeting Percentage -DMP- by means of rationalized products. In the case of complete success, this value must amount to 100%, i.e., there is no consumption of non-rationalized products.

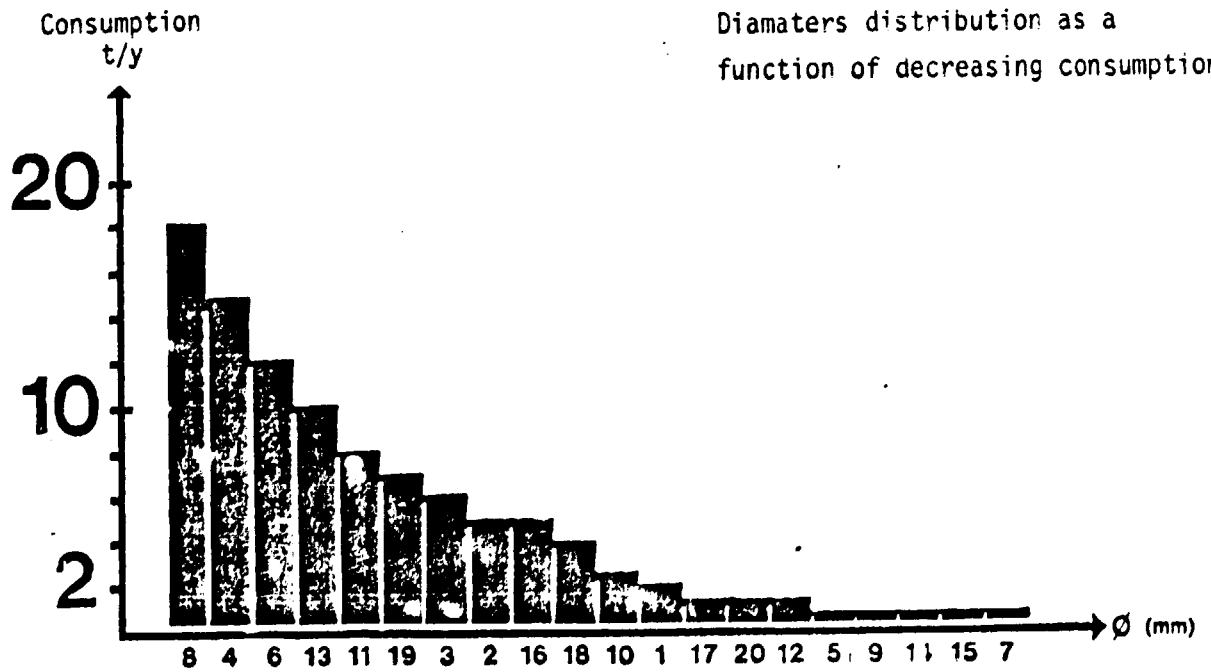
In any case, the not rationalized portion should be submitted to a fresh analysis in order to make sure that it is the same as before and if not, the divergences should be explained.

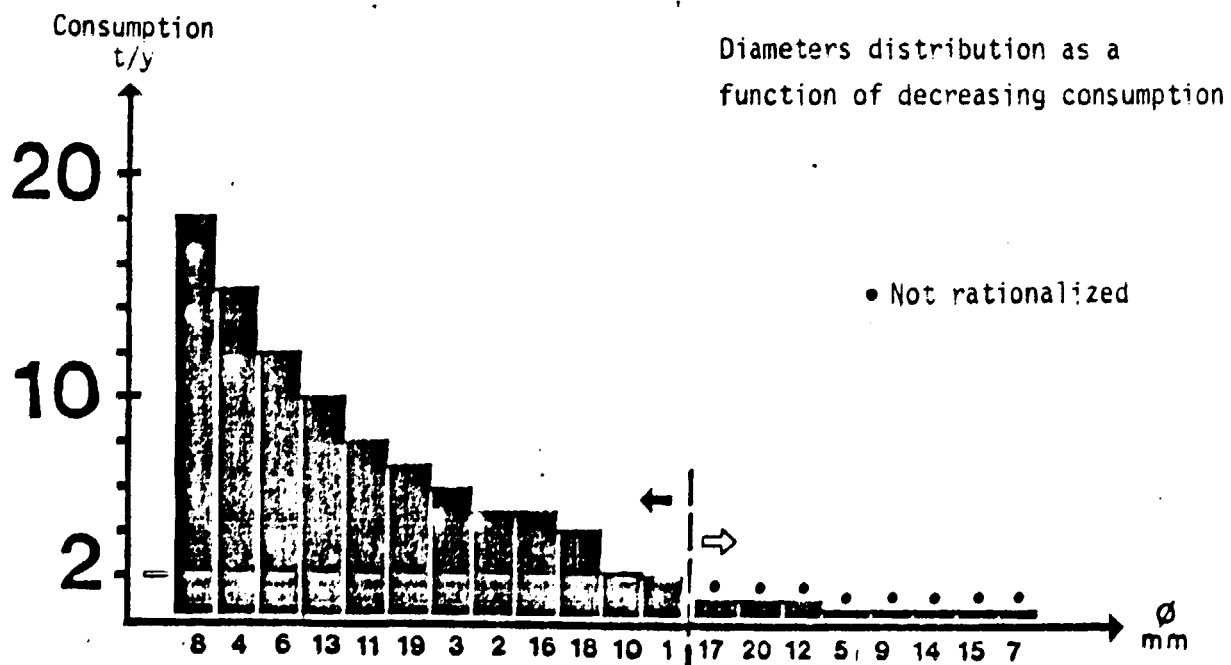
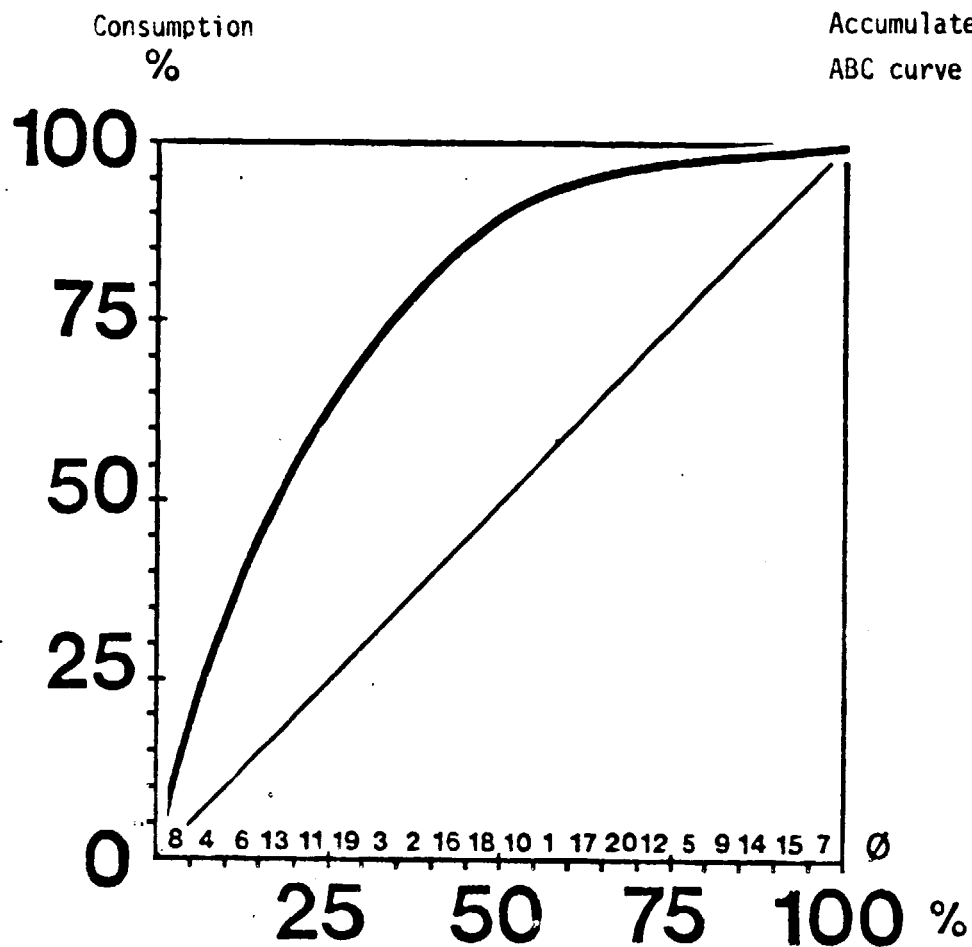
EXAMPLE OF APPLICATION

Consumption distribution as a function of increasing diameters

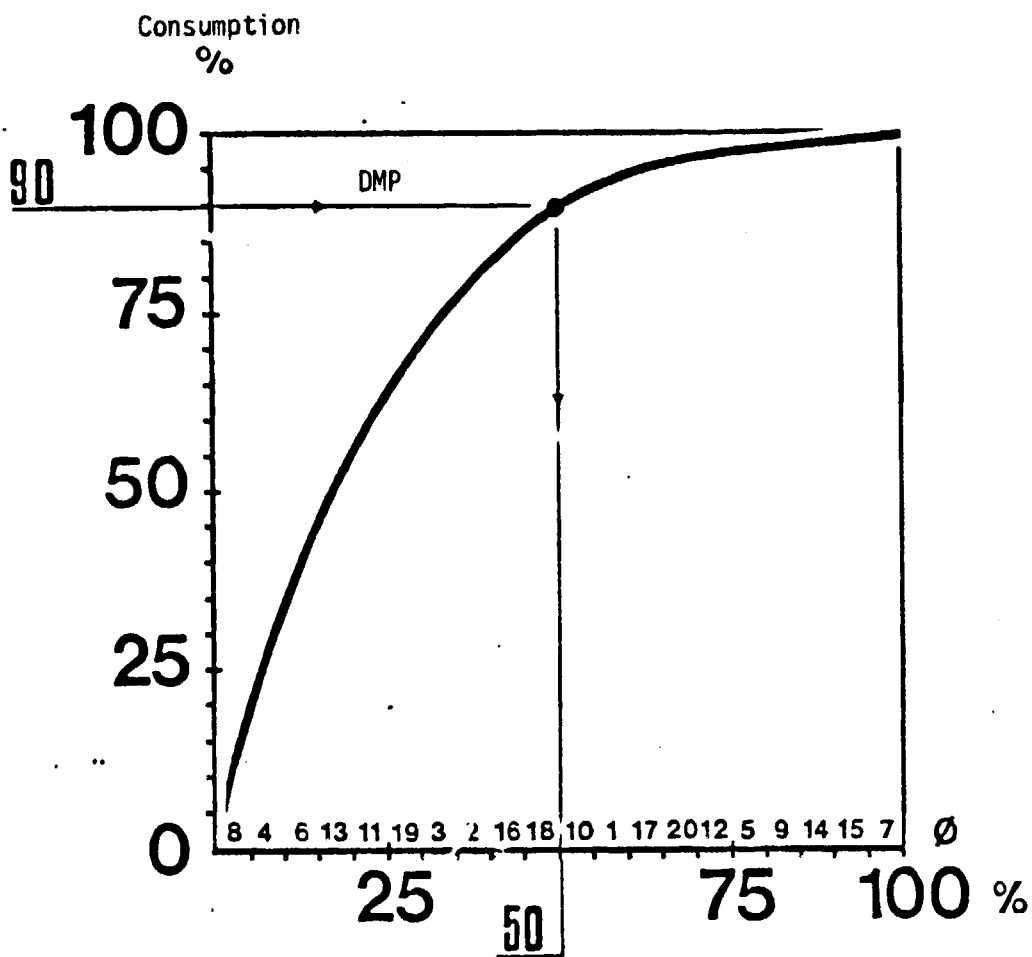


Diameters distribution as a function of decreasing consumption

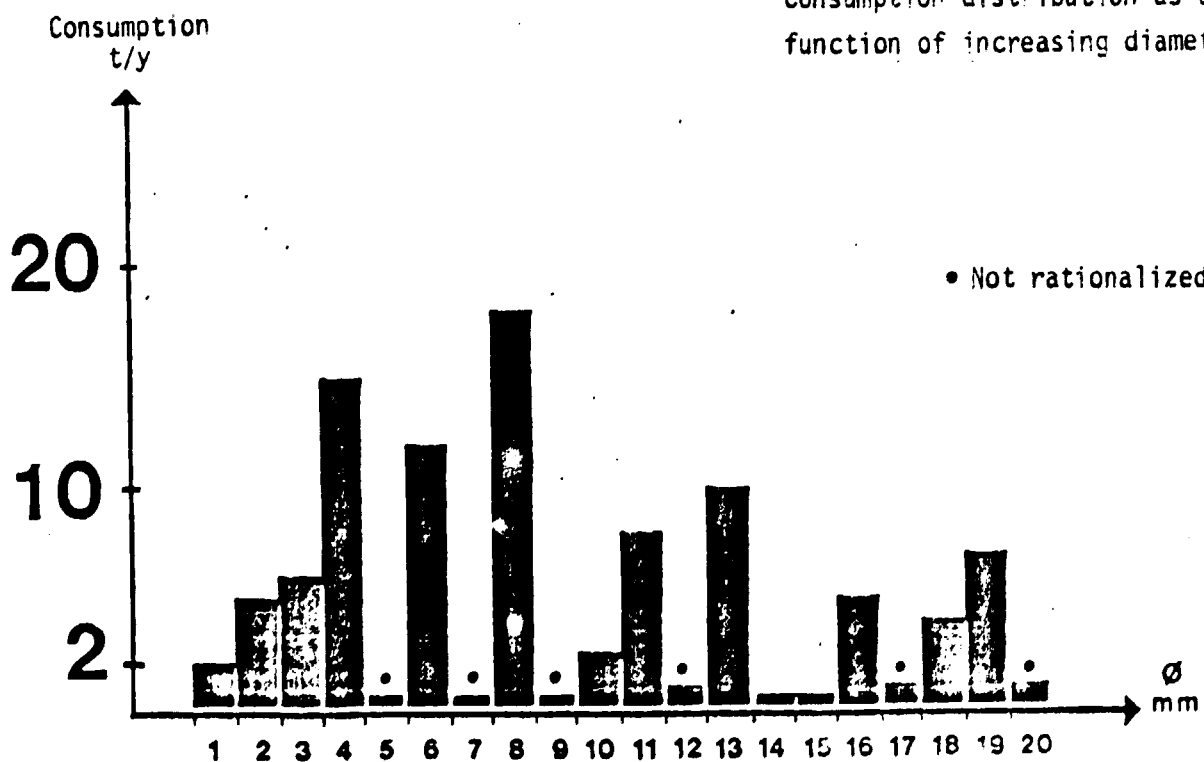




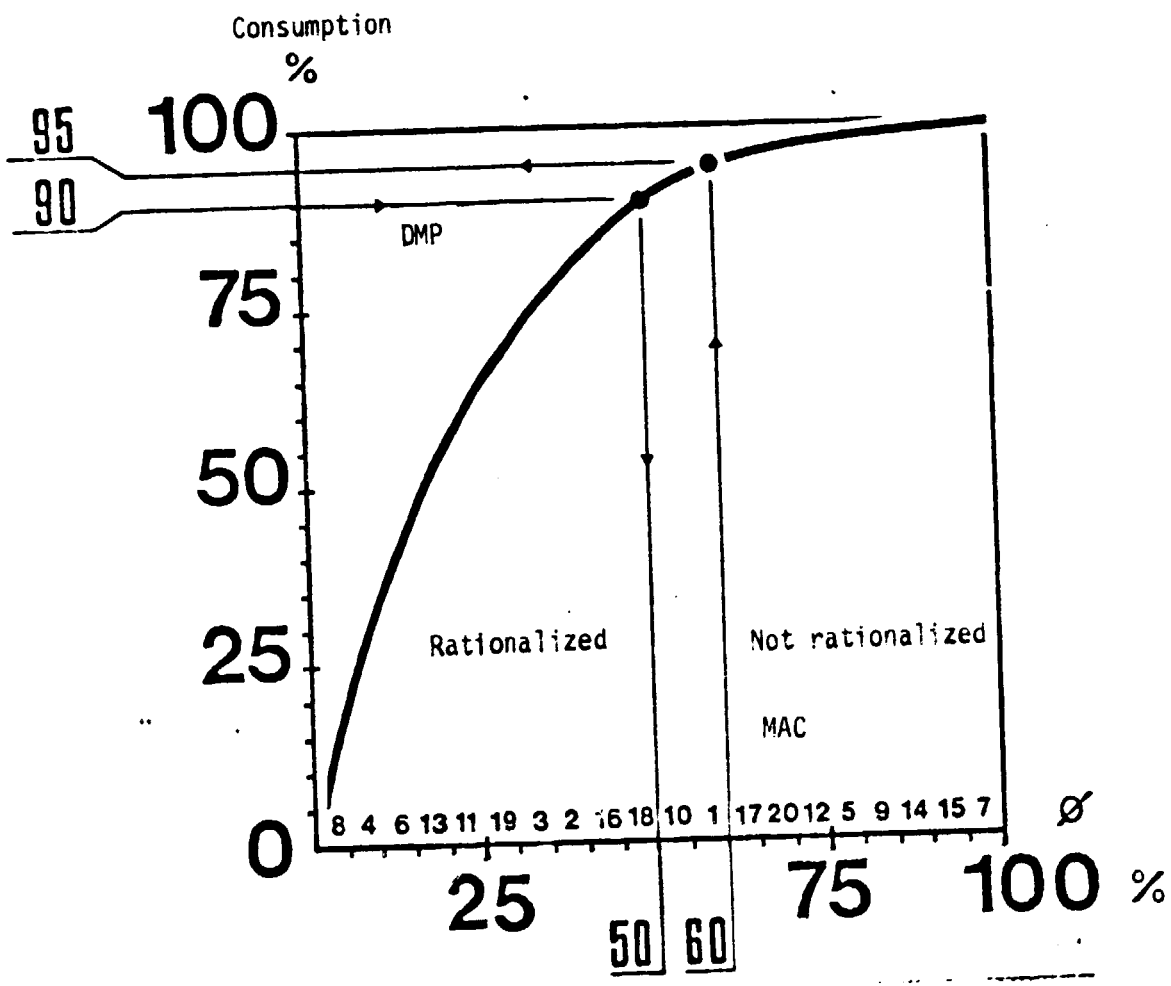
Accumulated consumption ABC curve
Desired % of demand satisfaction



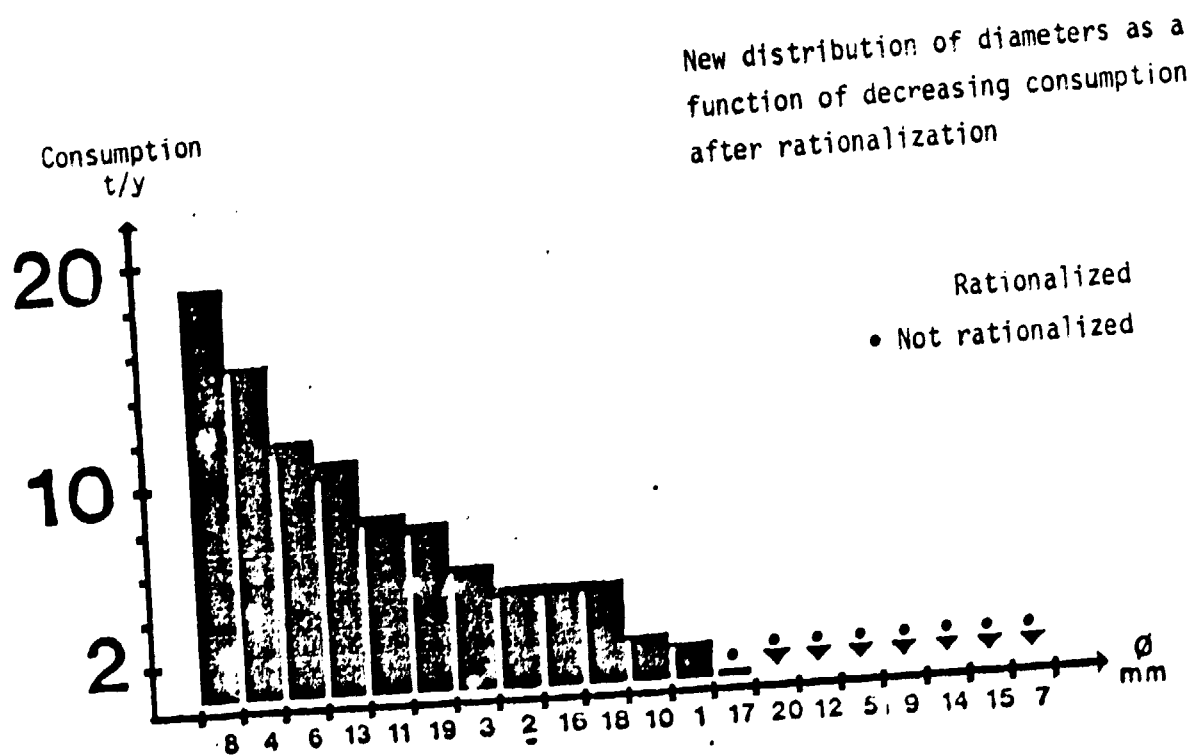
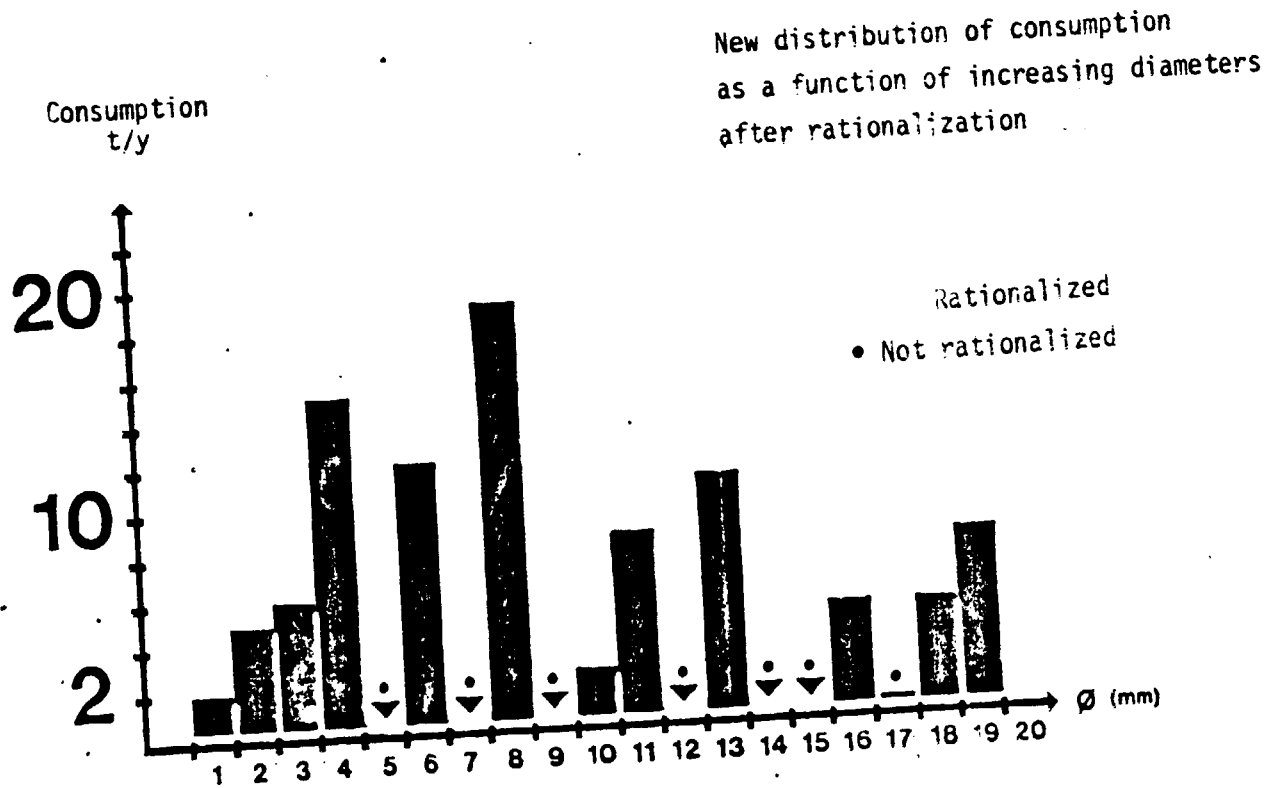
Consumption distribution as a function of increasing diameters



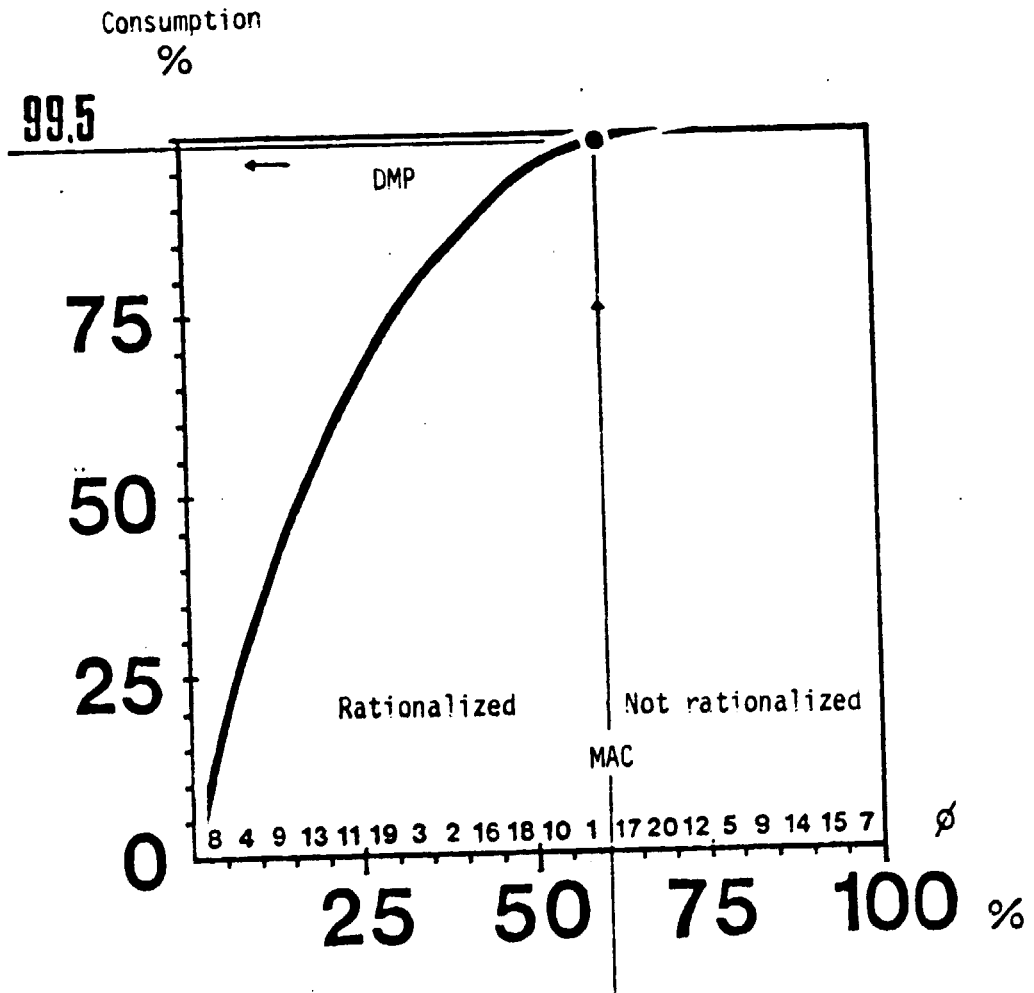
Accumulated consumption
ABC curve



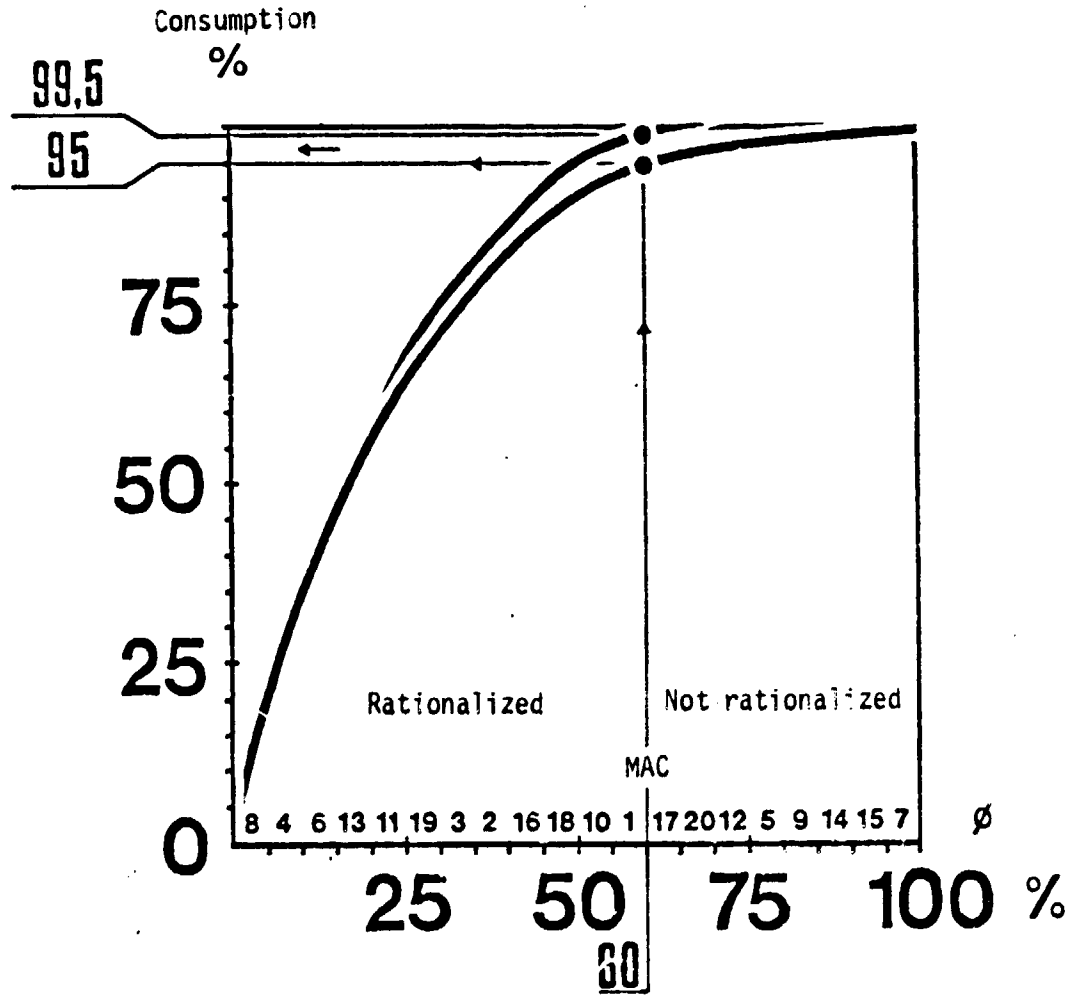
MINIMUM ANNUAL CONSUMPTION
VS.
DESIRED % OF DEMAND SATISFACTION



New accumulated consumption
ABC curve after rationalization



Comparison of ABC curves before
and after rationalization
Increase of demand satisfaction %



5.3. Principle of compatibility

An observation of the rationalization units shows that there are some attributes which should be rationalized and which are common to several products. For instance, steels marketed according to their chemical composition come in different shapes such as sheets, bars, and so forth.

The analysis must be carried out for each product in particular as the requirements of users of bars do not concur exactly with those of users of sheets.

However, it is hardly rational that a particular steel grade be recommended (rationalized) in one shape and another steel grade, possibly similar and replaceable by the former, in another shape. Therefore, the tendency should be to further as far as possible the compatibility between the results of the agreements deriving from particular analyses when these share the same characteristics.

An obvious case is that of products obtained from a prior product, for instance: welded tubes and strip. It is obvious that the rationalization or dimensions will have to take into account this fact and although its analysis must be carried out separately, it should be possible, during a second stage, to splice the series without causing diversification.

The application of this principle of compatibility will be conducive to a better production/consumption economy and a more flexible supply.

The fact that the steel industry is a manufacturing system and that its products are not obtained only at the end of the process but that some stages feed other stages, should not be overlooked.

On the other hand, a final product containing steel comes in the

shape of different steel products which must be welded, heat-treated and so forth, at as low a cost as possible, and this too is achieved by reducing the range of products.

6. CLASSIFICATION OF STEEL

A classification of steel always entails the difficulty of achieving a general assent because it allows differing and equally valid criteria, neither is it always possible to meet differing purposes with the same classification.

One manner of envisaging the classification bearing in mind the requirements of this task and the possibilities of obtaining statistical information would be as follows:

- 1) Steels according to their chemical composition;
- 2) Steels according to their mechanical characteristics;
- 3) Steels according to special characteristics.

Within the first two groups, in accordance with their established final uses, the following main subgroups can be specified:

According to chemical composition:

- . Mechanical construction steels;
- . Tool steels;
- . Stainless steels;
- . Valve steels;

According to mechanical characteristics:

- . Structural steels;
- . Mechanical construction steels.

The third group, which is actually a set of special cases, includes all those that cannot be defined only by their chemical composition or by their mechanical characteristics.

7. DEFINITIONS

The following is a list of definitions of steels given in the foregoing chapter.

1) Steels according to their chemical composition

These include all steels marketed according to their chemical composition as their basic requisite.

2) Steels according to their mechanical characteristics

These include all those steels which are marketed according to the mechanical characteristics they exhibit as delivered as basic requisite.

3) Steels according to special characteristics

These include all those steels which are marketed according to one or more special characteristics responding to their aptitude for use.

1) Chemical composition

1.1) Mechanical constructions

Steel adapted for use in mechanical constructions (manufacture of machinery and equipment parts). They are classified according to their chemical composition or other properties.

1.2) Tool steels

Carbon or alloy steel, apt for manufacturing dies, molds and cutting elements.

1.3) Stainless steels

Steels which, due to the addition of certain pasivation inducing alloying agents, have high corrosion and oxidation resistance; they contain approximately a minimum of 11% of chromium and a maximum of 1.2% of carbon.

1.4) Valve steels

Alloy steels developed to comply with the requisites of duration and functioning in the presence of inlet and outlet gases of internal combustion engines.

2) Steels according to mechanical characteristics

2.1) Structural steels

Steels intended for use in structures joined together by means of screws, rivets or welds. They are classified according to the mechanical characteristics they have as delivered and differ from each other in varying degrees according to their weldability and brittle fracture resistance.

2.2) Mechanical construction steels

Steels intended for use in mechanical constructions (manufacture of machinery and equipment parts). They are classified according to their mechanical or other properties.

8. IDENTIFICATION CODE

We do not doubt that the identification code to be used in rationalization should be the one that has already been adopted in standardization.

It should be stressed that when using the already known identification it would be convenient to show plainly the RATIONALIZED condition with the aid of a special distinctive device, as a means of facilitating the acceptance and use of said products.

9. BASIC LIST OF STANDARDIZED STEELS WITH REFERENCE TO INTERNATIONALLY STANDARDIZED STEELS

Conveniently, the basic list of standardized steels should be comtable with that of internationally standardized steels, as this would create, among other advantages, two that are of utmost importance for the domestic market, namely:

- the ability to manufacture steel products in order to supply the domestic market and to be in a position to export such products without substantial modifications;
- the ability to import without major problems steel products meeting the requirements of the domestic market whenever warranted and advisable due to special circumstances.

10. BASIC LIST OF STEEL STANDARDS ACCORDING TO THEIR USE

The following are considered to be the main uses:

- General use
- Mechanical construction
- Metal structures
- Naval sheepbuilding
- Pressurized containers

- Dishing stamping
- For electromagnetic use
- For tubes
- For oil
- For concrete
- For tools
- For valves
- For forging
- For drawing

Other uses, such as nuclear, aeronautical, and so forth, can be considered if warranted.

11. RATIONALIZATION QUESTIONNAIRE

In theory the instant proposal is consistent with the methodology suggested in 5. None the less, it should not be deemed final as some aspects must be adjusted to the reality of the market to which it is applied.

11.1. Introduction

The end pursued by the instant questionnaire is to carry out a market survey of steel products of Brazil, with a view to making a diagnosis of its situation and showing the courses of action in order to envisage a long range RATIONALIZATION plan.

Rationalization is understood as the function of cooperating with the natural economical forces of the market in the sense of facilitating its classification in such a way as to comply with all the requirements at a minimum global cost.

In the same way as there are natural forces that in a competitive

economy determine the allocations of resources, it is also true that there are impediments or obstacles causing that the one achieved is not necessarily the optimum allocations.

In this sense * is carrying out this program in order to show clearly which steel products could be supplied in a satisfactory and orderly -rational- manner and which could not.

The lack of rationality in the supply-consumption of steel products is evidenced either by the extravagant range of products to meet the requirements of use or by the absence of a given product which is being substituted by another product with some type of drawback. The rationalization of steel consumption tends to detect and highlight these problems, and to work out with the concurrence of both users and manufacturers technical solutions that contribute to an approximation to optimum conditions, which is the moment when a market receives the correct quantity of products meeting the requirements of users, whereby production costs are cut by reducing the range, and this in turn affects in a very special manner the subsequent storage-consumption cycle, as a smaller range is conducive to a decrease of stocks. Likewise, by supplying steel products in grades suited to their use, a reduction of manufacturing costs is achieved and unnecessary operations are avoided.

In order to analyze the situation of "rationality" of steel consumption, an analytical approach is necessary, and this is how the instant questionnaire endeavours to analyze the situation in parts which we will call "RATIONALIZATION UNIT" and which we could roughly define as a "Product made of a given type of steel".

This condition is not always sufficient and in some cases it is

* Name of the organism carrying out the rationalization study program

necessary to add a fitness or vocation of use. What is important is that within the RATIONALIZATION UNIT all the variables, except the one which is to be analyzed, remain constant or failing this that the variation be immaterial for the analysis of the variable in question.

See the Products/Types matrix defining in principle, for the purposes of the instant study the RATIONALIZATION UNITS.

To make reference to a common chronological basis, the situation currently prevailing on the Brazilian steel market during the year ** was deemed adequate.

The information that is requested should be as complete and as nearly accurate as possible.

However, bearing in mind that for both sides a cost is involved, it is requested that in case a question could not be answered because the studies involved have not been carried out and/or because of lack of time, means and the like, a sound estimate be given, if possible, based on agreement between experts (more than one).

In developing countries where the growth of industry is due to substitution of imports and where the contributions of technology issue from different sources, the "lack of rationality" is generally caused by a surfeit rather than by scarcity of variety, although both cases can exist at the same time (nevertheless, when rationalizing a market, each item is discussed separately).

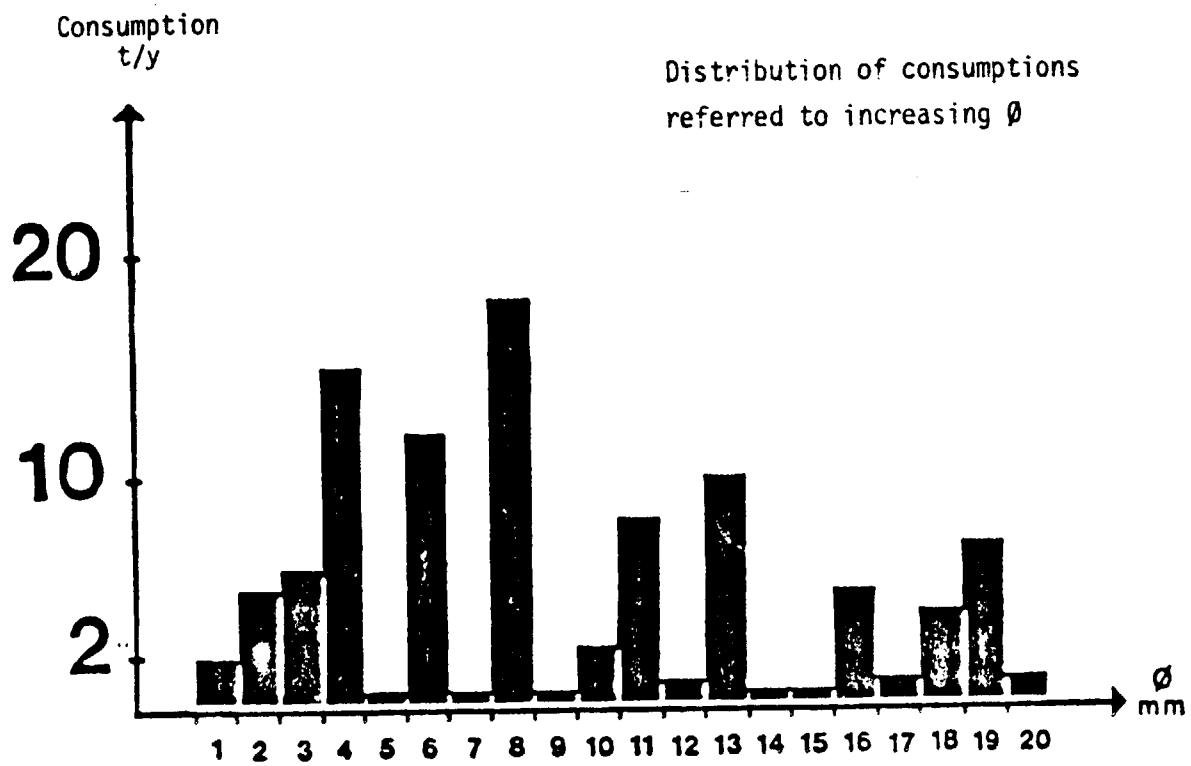
Although this does not mean that a standard has been adopted prior to gathering analytical data, a method will now be described for measuring the consumption concentration of a (population) RATIONALIZATION

** Indicate base year

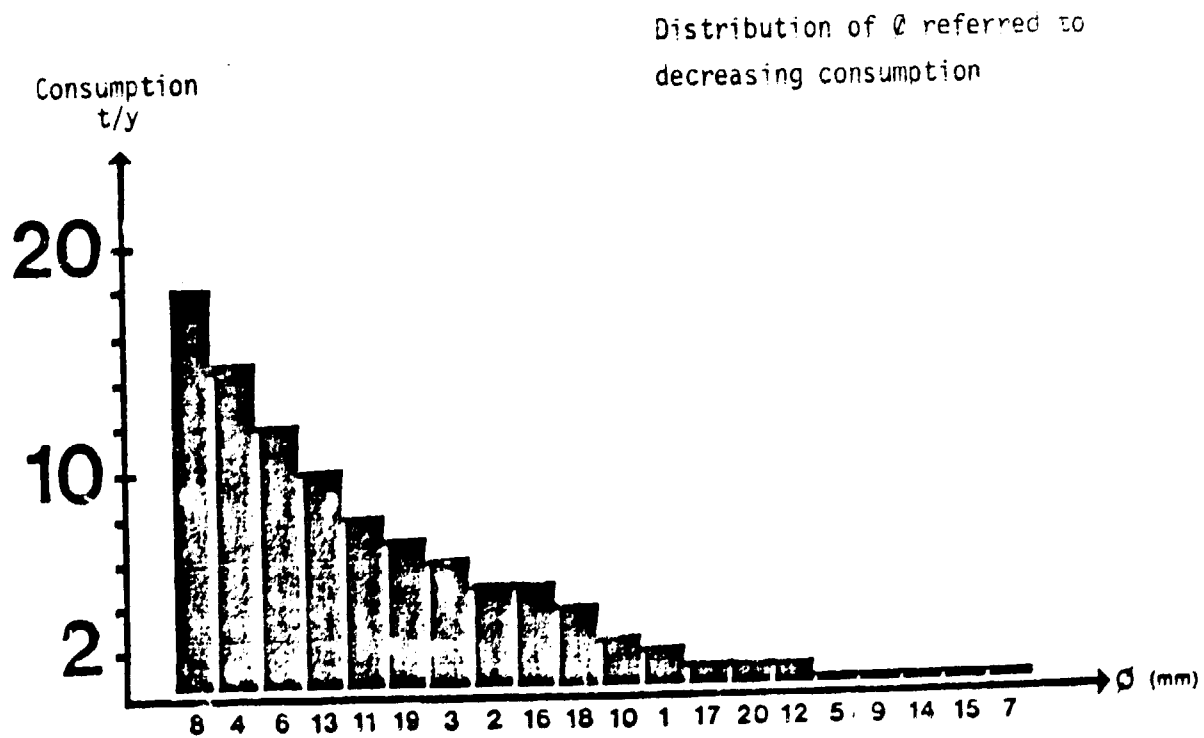
UNIT which we will call ABC curve.

In the figures we can see the plotted results of an example based on the consumption of a product, where the rationalization analysis is centered on the diameters of said product.

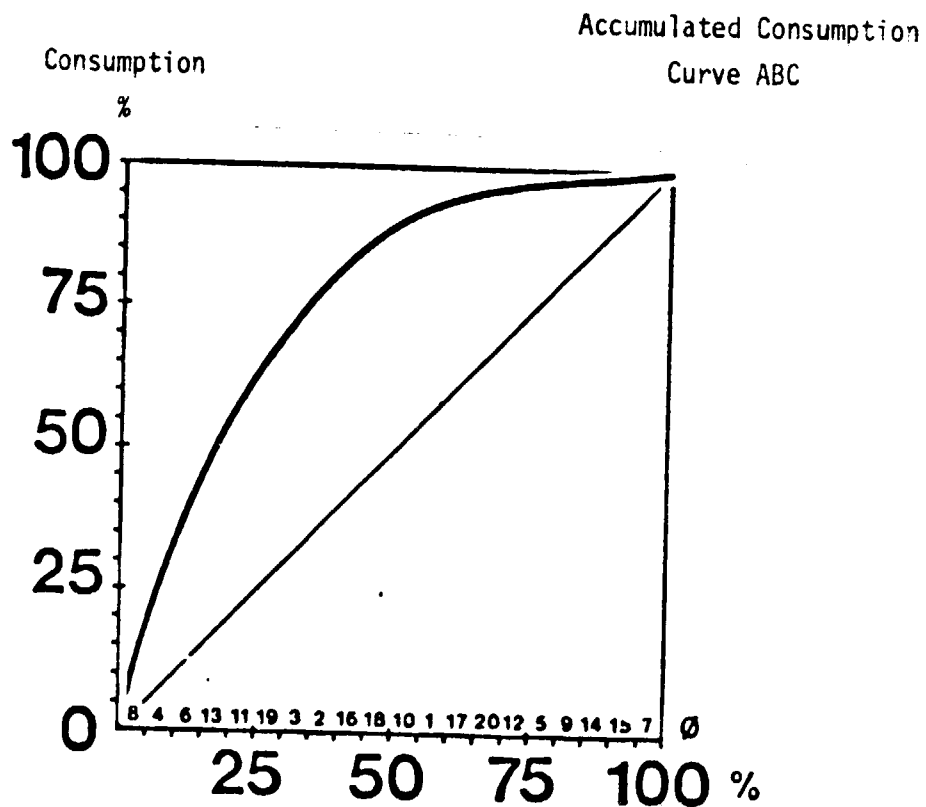
The first diagram is an illustration of consumption referred to the diameter, the latter being arranged in increasing order.



In the second diagram the same elements are arranged with reference to decreasing consumption, namely in decreasing order.



The third diagram is an illustration of curve ABC, showing on the ordinates the accumulated consumptions, expressed in percentages (or in tons by simply changing the scale), and on the abscissae the corresponding diameters in nominal form or in accumulated percentages of the total number of different diameters.



This diagram corresponds to the one before. In this one too the first 50% of higher consumption elements are shown and it can be appreciated that they tally with 90% of consumption of said elements in tons/year.

Thus we can see how curve ABC measures concentrations, as in the instant case it shows that the consumptions are concentrated on certain diameters (90% of consumption concentrated on 50% of items, which leaves for the other 50% only 10% of consumption).

In this questionnaire, concentration data related to RATIONALIZATION

UNITS are requested in three points, namely:

- | | |
|--------|--------------------------------------|
| Zone A | First 50% of accumulated consumption |
| B | First 80% |
| C | Last 5% of accumulated consumption. |

11.2. Products you Manufacture/Use:

On the following matrix, kindly mark with a cross the products manufactured by your firm. The preparation of this matrix took used into account a simplified approximation of what the rationalization units would be in the Brazilian steel market. The purpose is to break up the spectrum of different products into groups which with a view to performing a rationalization of types, qualities, grades, etc. and dimensional, can be deemed analytically valid and about which there are global statistical data. Should you object to this classification, kindly state this separately and in any event try to mark as best you can the enclosed matrix.

In the following questions reference will be made to the marks of this matrix.

PRODUCTS	MATRIX OF NATIONALIZATION UNITS										DISTINCTIVE PARAMETERS				SPECIAL CHARACTERISTICS				
	DESIGN CONCEPTION					MECHANICAL CHARACTERISTICS					MECHANICAL CHARACTERISTICS				SPECIAL CHARACTERISTICS				
	MECHANICAL CONSTRUCTIONS		TOOLS			Stainless	Valves	General use	mechanical construct.	metallurgy structures	erosion requiring structures	naval	pressure containers	dishing	for tubing	for oil	for concrete	electromagn. use	others
per. use		r/forge	r/drawing	r/springs															
Pieces for industrial use (3.1.251)																			
Thick hot rolled sheet																			
Thin hot rolled sheet																			
Thin cold rolled sheet																			
Thin plates (including crumpled and 3.1.251.253)																			
Galvanized and leaded sheets																			
Silicon sheets																			
Stainless steel sheets																			
High carbon and alloy steel sheets																			
Logs, beams and billets																			
Bars and accessories																			
Light shapes																			
Heavy shapes																			
Wire rods																			
Bars																			
Seamless tubes																			

PRODUCTS

MIN

11.3. Types of steel of the Rationalization Unit***

(This question is answered as many times as there are marks made in the matrix of point 2.)

- 3.a.) How many types (grades, standards, particular specifications) of steel are being used in Brazil for this RATIONALIZATION UNIT?

Please do not confine yourself to those that are manufactured by your firm nor to those detailed in the catalogue of your products or of your competitors. Try to the best of your knowledge to account for all types that have been marketed during base year 19.. , whether locally manufactured or imported. If you do not know exactly, kindly resort to the opinion of experts and give a sound estimate.

- 3.b.) Can these types be grouped together according to STANDARDS (domestic, American, German, etc.), ORIGINS, MANUFACTURER SPECIFICATIONS, etc.? Kindly show these groupings relating them to each other if you wish.
- 3.c.) In your opinion, does the described range meet the requirements of use? Is it deficient and should it be expanded? Is it excessive and should it be reduced? Is it at the same time excessive in some and deficient in other cases?
- 3.d.) In cases where you consider that the range is excessive, what is the cause?
- it is customary and it is difficult to back out;

*** Show the name of the Rationalization Unit to which the answer refers.

- it is due to the influence of the various foreign technological contributions;
- other causes, in your opinion; kindly expound.

3.e.) In cases where you consider that the range falls short, what would you add to the products in use? Why was that product not added until now? What would the advantages be if it were incorporated as a line or standard product? Kindly expound.

3.f.) If you consider that both aspects are present: excess range on the one hand and shortage on the other hand, please state so in writing here and do not omit answering questions 3.d.) and 3.e.) with reference to this one.

3.g.) Among all the types of steel you have specified in 3.a.), is there any preference in your domestic production or importation? In fact, are some of them manufactured and others imported? Which of those you consider to be important because of their consumption are imported?

3.h.) If you had to arrange the different types according to consumption during base year 19..

which would be the highest consumption type?

which would be the lowest consumption type?

Having thus classified the types:

how many types are required to cover the first 50% of total consumption during base year?

how many for the first 80%?

how many types of steel form the last 5%,
namely the lowest consumption steels? (x)

11.4. Dimensional aspects of steel products

(This question is answered as many times as there are RATIONALIZATION UNITS indicated in 2.)

RATIONALIZATION UNIT (*)

In this case the rationalization unit can have a wider range than the one shown in 2. For instance, the product as shown in the lines of the matrix can be deemed a unit. (This approach shall be adopted when there is no evidence that the parameter shown in the columns affects the series of sizes).

4.a.) If the adopted criterion is to answer this series of questions for each rationalization unit, kindly state the limitations or peculiarities existing in the series of sizes available on the market for the different steel grades or types. For instance: in certain types of steel the series of dimensions differs from the rest, or else certain thicknesses (diameters/widths, etc.) are not manufactured for a given type of steel whilst they are manufactured for the other types.

If you have chosen to consider the answer at a product level, state just how valid the hypothesis can be considered that all dimensions are $\frac{\text{manufactured}}{\text{consumed}}$ in all types of steel and that to

-
- (x) If a complete appraisal of all three points were not feasible, kindly make the best possible appraisal or estimate of this point.
(*) Indicate the rationalization unit to which the answer refers.

the distribution by types given in point 3) the same distribution by dimensions can be applied for all types. If you consider that this hypothesis is not valid, kindly refer to the more disaggregate concept of RACIONALIZATION UNIT for your answer.

4.b.) The dimensional series of Products/Rationalization Units are expressed in:

millimeters

inches

both

Which are the specifications and standards they correspond to
This fact arises from:

- users' orders
- origin of rolling mills
- a firmly established custom of the market
- other causes which please expound

4.c.) Which are the dimensions defining the Product/RACIONALIZATION UNIT of this answer?

--	--	--

4.d.) With regard to these distinctive dimensions are there limitations to their combinations which ought to be pointed out?

For instance, in a given thickness, a given width does not exist on the market, alternatively in a given diameter of tube, given wall thicknesses do not exist. Kindly specify such limitations with reference to the market in general and not solely to the products manufactured by your firm.
consumed

4.e.) Having thus circumscribed the possible combinations, what is their total number without taking into account the length?

(For a distinctive dimension -for instance, the diameter- state the total number of different diameters in use on the market).

Are these dimensions sufficient or should more be added?

How many should be added?

Are they excessive?

To how many could they be reduced?

4.f.) With regard to the first distinctive dimension specified in 4.c.) -if there were only one regarding same- which one has the highest consumption* level?

Which one has the lowest consumption level?

* Preferably, consumption should be measured in tons/year; linear or square meters should be employed only when indispensable.

Having many dimensions form the first
50% of total consumption of the Product/
RATIONALIZATION UNIT?

How many the first 80%?

How many dimensions are included in the
last 5% of total consumption of the
Product/RATIONALIZATION UNIT?

4.g.) With respect to the second distinctive
dimension specified in 4.c.)

Which one has the highest consumption
level?

Which one has the lowest consumption
level?

Having thus arranged the sizes in descending
order (see example of curve ABC):

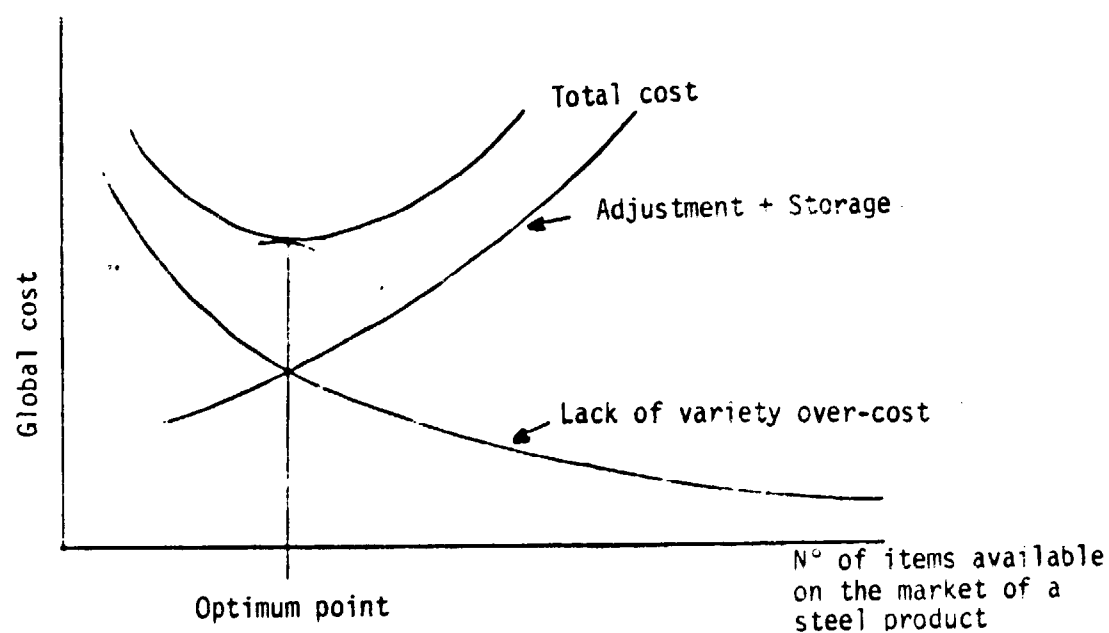
How many dimensions form the first 50%
of total consumption of the Product/
RATIONALIZATION UNIT?

How many the first 80%

How many dimensions are included in the
last 5% of total consumption of the
Product/RATIONALIZATION UNIT?

11.5. Feasibility and probability of carrying out a rationalization

The excessive range of steel products on a market generates costs which could be avoided by cutting down said range to the technically necessary. A subsequent reduction beyond this level would generate additional costs because the resulting range would not be adequate.



The extravagant range of products on a market is typical of developing countries and it is due to the variety of origins recognized by their industry and to having imported large quantities of their steel requirements.

It is possible that there are reasons that prevent becoming aware of such additional costs arising from the extravagant range. Thus,

for instance, it could well be surmised that the costs of variety affect everybody to the same extent and that few would be specially interested in envisaging an individual action which by the way could well make them lose the market to their competitors. As to the users of steel products, in view of the fact that the designs of their products are something they handle relatively because these are either purchased or licensed, they might fail to perceive the possibility of profiting by a reduction of costs.

In any event, faced with a situation that in fact can arise in any market, only as a result of a coordinated action of users and producers can economies become efficient. As a prior step it is necessary to pinpoint clearly the situation of rationality or irrationality in a market and to analyze the underlying positions and causes.

This is the reason why this part of the questionnaire endeavours to indicate for each RATIONALIZATION UNIT which factors of the accompanying lists act as accelerators or inhibitors of a possible rationalization action. You are requested not to confine yourself to the specified factors and to add in the corresponding list such as you deem necessary. Moreover, any comments that might be made to this end are welcome.

5.a.) Factors favouring rationalization on the market of

State Rationalization Unit to which the answer refers.

As many are answered as there are marks included in 11.2.

The prices of steel products reflect
production costs

There is strong manufacturers' pressure
to reduce the catalogue range

The costs of keeping minimum stocks have become higher (as a result of the interest rate).

Among the majority of users manufacturers of end products there is product design and engineering management, enabling them to adapt to the conditions of offer on the steel products market

5.b.) Factors obstructing rationalization of the market

The prices of steel products do not reflect the genuine production costs

Faced with the slump in demand manufacturers are willing to produce the goods requested by users even when they are not specified in the catalogue

Users of steel products do not have the faculty to change designs and consequently are unwilling to consider supply variants

The use of manufacturing licences imposes the use of special materials as to types of steel or dimensions

The users are few, large and with great purchasing power and are unwilling to draw up specifications in common for steel products

There is a possibility of importing steel products favouring the diversity of types and dimensions in use



12. ECONOMIC CONSIDERATIONS

In recently industrialized countries, the intermediate industrial product -for instance, steel product- markets quite often present an extravagant range. This phenomenon is the result of the different origins of their technology and of the fact that in the past the market was supplied by importing large quantities during long periods. This fact does not exclude the possibility of supply shortages of certain grades, types or dimensions, although, as a rule, not of a massive nature.

Both situations, excess as well as shortage of range, generate costs -as a rule difficult to pinpoint and measure- encumbering the cost of the end product.

In the case of steel manufacturing, in batch or discontinuous processes the cost reduction resulting from the repeatability of the operation does not become manifest due to the low production frequency of a range of low demand steel types. As the demand for steel types is usually concentrated in one of them, those at the "tail" end swell the number of items in the program, but as demand for them is small, every time they have to be manufactured they become special cases.

Therefore, the range of types at the steelworks from there on generates stock and administrative costs.

With the modern tendency of steel rolling to act as a thermomechanical treatment, the problem of the learning curve -typical of a batch process- becomes apparent in this production stage in addition to

the phenomenon typical of a continuous process.

The costs of adjusting a rolling mill must be split among the manufactured quantity, with a larger portion being charged to the account of smaller series products. The tooling costs are also important.

The variety created by milling, together with that coming from the steelworks, expands the range of products and from there onwards administrative and storage costs are generated.

This can be considered as the starting point of prejudice to the user. Diversity is compatible only with a fluid supply brought about by a stock in which the plant, the intermediary and the user himself participate.

The user must also put up with administrative expenses for handling a wide range of items.

This reasoning is obviously directed towards low demand products compared to mass production economies and becomes evident when, as happens quite often, excess variety can be reduced, because the substitution of types or adjustment of dimensions is feasible without additional costs.

The other aspect of rationalization is the one where the cost arises from the use of unsuitable products which in a way is a shortcoming of variety.

In this case, the costs are borne by the end product manufacturer who passes them on to the consumer.

One aspect to be taken into account is that the costs described herein are general market costs affecting all the producers and all the users. Nobody enjoys a differential situation that could set him

apart and consequently there is little individual initiative could do.

Furthermore, it should be pointed out that the benefits of rationalization are for the country.

13352-E

(3 of 4)

**Steel Rationalization
in Brazil**

**Final Report
Volume 3**

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL CONSTRUCTION STEEL
(BY CHEMICAL COMPOSITION)

NECESSARY INFORMATION AND STANDARDS FORMS

UNIDO Contract : N° T 81/90

UNIDO Project : BRA/75/003

Project Director : Dr. B. S. Krishnamachar

**Steel Rationalization
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Volume 3**

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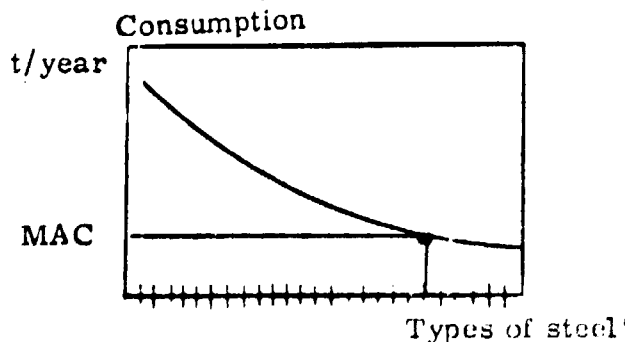
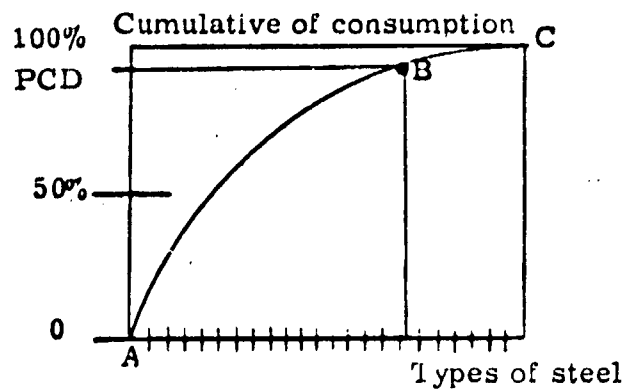
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1. Introduction.

The present volume contains the specification and methodology for obtaining the information required to envisage the Pilot Project for the Rationalization of Mechanical Construction Steel by Chemical Composition.

The rationalization methodology consists in endeavouring to reduce the variety of steel types by trying to substitute lower consumption types by higher consumption steels. To this end concentration curves are used in which the types are classified by decreasing consumption.

Two types of curves are shown hereafter differing in the manner in which consumption is expressed. In one case it is shown as the cumulative percentage and in the other one in tons. The types of steel are those used on the market.



The object is to find a Percentage Commensurate with Demand (PCD) close to 100% (for instance, 95%). This means that essentially those contained in zone AB shall be recommended as Rationalized Steel Types, in order to meet a high percentage of demand.

However, this value of PCD must be made compatible with the minimum annual consumption desired by producers if manufacturing surcharges are to be avoided.

A compromise must be found between the two values and at the same time, by means of a technical analysis of the conditions for substituting one type of steel by another, ways and means should be sought to meet the demand for not rationalized types (zone BC) with rationalized types (zone AB).

Moreover and as far as possible, another object is to group together if technically feasible, consumptions of similar types of steel even in the event of both being high consumption items.

To enable the application of this methodology it is therefore necessary to have at hand the consumption information regarding the products to be rationalized so as to enable the first type of curve (i. e. the one corresponding to the cumulative percentage consumptions) to be traced; furthermore the value of MAC must be available which can be expressed as a percentage of total consumption. A PCD of 95% is aimed at.

So far the economic part of the problem would be solved, but in order to cover the technical part additional information is necessary regarding the intended use of each type of steel and specially regarding the process to which it will be subjected (forge-machining, heat treatment, etc) and, if possible, a potential substitute.

Therefore, the instant volume specifies two types of information, the first to be requested from the producers and the second from users.

The information to be used for the rationalization refers to percentages or quality which should not be construed by those supplying as giving away confidential data. Obviously, the original data must be expressed in tons and once processed it shall be converted to a percentage showing its relative demand which can be made public without damage to anybody's interests.

2. Information for the Rationalization of Mechanical Construction Steels
by Chemical Composition

2.1 Information to be requested from producers and institutions.

Tables containing information regarding the internal consumption in Brazil of different types of steel for different products will now be given.

The types of steel have been grouped together in four groups:

1. Carbon steels
2. Manganese steels
3. Free-cutting steels
4. Alloy steels

For each group the yearly consumption per product (in percentages) is requested. The term consumption is to be understood as the apparent consumption obtained by adding together the SHIPMENTS TO THE LOCAL MARKET by Brazilian producers and IMPORTS.

The products comprising this study are basically:

1. Hot-rolled sheets
2. Cold-rolled sheets
3. Rolled round bars
4. Rolled square bars
5. Rolled rectangular bars
6. Rolled hexagonal bars
7. Wire rods
8. Forging Billets

Furthermore, for each group the distribution of types of steel in percentage form, spread by product, is requested.

Summing up, the requested information can be shown diagrammatically as follows:

		Products j							
		1	2	3	4	5	6	7	8
Group i	1	t11	t12	-	-	-	-	-	t18
	2	t21	t22	-	-	-	-	-	t28
	3	'	'		tij				'
	4	t41	t42	-	-	-	-	-	t48

each t_{ij} is a chart in tons of the yearly consumption of each type of steel (k) of group i for product j.

		tij
tipo		t
1		xx
2		xx
'		'
		Cijk
'		'
n		xx

The summation of the Cijk's

$\sum_k Cijk = Cij$ is the total consumption

of group i for product j and each

$\frac{Cijk}{\sum_k Cijk} \times 100 = C(\%)_{ijk}$ is the

percentage consumption of each type k

within group i for product j.

Another matrix can thus be prepared, i.e.:

		Products j							
		1	2	3	4	5	6	7	8
Group i	1	P11	P12	-	-	-	-	-	P18
	2	P21	P22	-	-	-	-	-	P28
	3	'	'						'
	4	P41	P42	-	-	-	-	-	P48

where each p_{ij}

is a chart.

Where each P''_{ik} is a percentage distribution chart of the different qualities k for group i taking into account all the products

P''_{ik}

Type	%
1	
2	
⋮	
⋮	
k	
⋮	
⋮	
n	
Total	100

As stated in the foregoing paragraphs, these distribution curves must be traced with the aid of consumption data; however, there are two important aspects, i.e.:

- a) If the consumption is provided with imported material
- b) Which types of steel are exported

When substitutes are analyzed it is important to know these aspects because in the first case tendency shall be to recommend whenever technically feasible the substitution of the imported type by a locally produced type. In the second case it can happen that a steel that is being exported is a useful substitute of a low consumption steel (supposedly not recommendable as rationalized). This fact could lead to recommending the use of the steel that is exported also on the local market.

From this point of view the following complementary information is requested:

- a) List of types of imported steel and percentages regarding consumption if the value is significant
- b) Percentage distribution of types of exported steels

Another additional complementary information requested from the producers is related to the principal uses of each type of steel produced in the country.

The standard forms for requesting information as well as the consolidation charts follow at the end.

2.1 Information to be requested from users

Information shall be requested from users of Steel for Mechanical Constructions by Chemical Composition regarding the intended use of each steel. From this point of view it is important to know the type of steel and the shape of product they buy (for instance, rolled rounds SAE 1038) and the parts they manufacture from this material (for instance, steering bars for cars) as well as a brief description of the process (for instance, forging, machining, quenching and tempering).

The user shall complete a little card for each type of steel, shape and groupe of parts or part with one and the same process manufactured from this steel.

In order to enable rationalization this information must be known with user's identification code.

Information required
for Rationalization

Information about
Local Consumption

UNIDO-IAS

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Carbon Steels

LOCAL CONSUMPTION BRAZIL
Year

PRODUCTS	%
1. Hot-rolled sheets	
2. Cold-rolled sheets	
3. Rolled round bars	
4. Rolled square bars	
5. Rolled rectangular bars	
6. Rolled hexagonal bars	
7. Wire rods	
8. Forging billets	
TOTAL	100, -

UNIDO-IAS

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Carbon steels
PRODUCT: Hot-rolled sheets

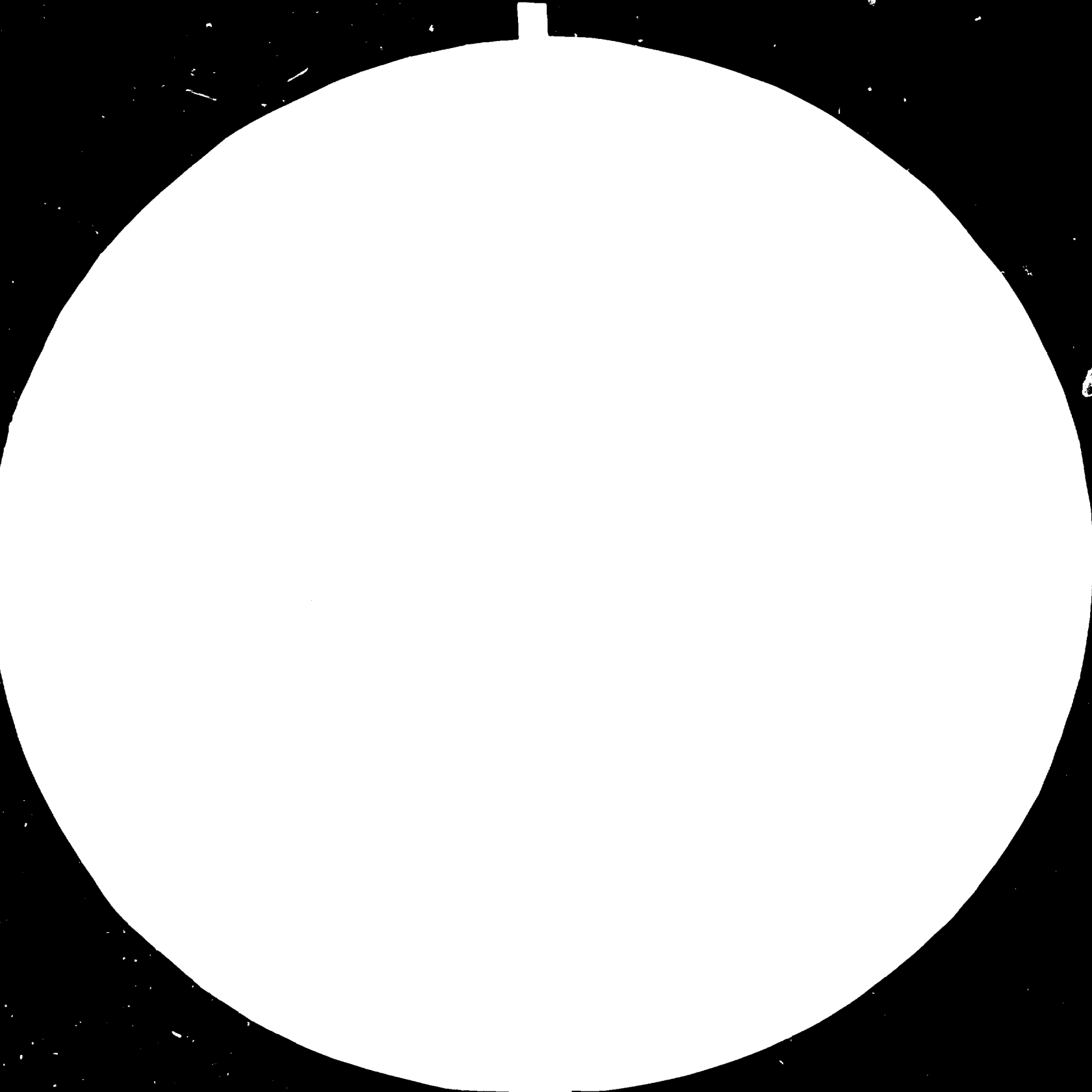
LOCAL CONSUMPTION BRAZIL
Year

TYPES (1)	%
TOTAL	100, -

MINIMUM ANNUAL CONSUMPTION
DESIRED BY PRODUCERS% OF TOTAL

(1) Indicate types which are being imported and imported percentage if significant.

84.04.04
AD.85.0





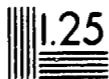
2.8



3.2



3.6



MICROCOPY RESOLUTION TEST CHART

NATIONAL BUREAU OF STANDARDS
STANDARD REFERENCE MATERIAL 2500
APR 1963 (REV. 10-1968) NBS 1963-308

Standard Form
UNIDO-IAS

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP : Carbon Steels
PRODUCT : Hot-rolled sheets

Survey Pooling Sheet
LOCAL CONSUMPTION

TYPE (1)	Shipped by Producers to Loc. Market						Im- ports	Total :	%
	Plant 1	Plant 2	Plant 3	Plant 4	Plant 5	Sub- total			
TOTAL									100

D O M C

(1) Show types which are being imported

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Carbon steels
PRODUCT: Cold-rolled sheets

LOCAL CONSUMPTION BRAZIL
Year

TYPES	%
TOTAL	100, -

MINIMUM ANNUAL CONSUMPTION
DESIRED BY PRODUCERS% OF TOTAL

Standard Form
UNIDO-IAS

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP : Carbon Steels
PRODUCT : Cold-rolled sheets

Survey Pooling Sheet
LOCAL CONSUMPTION

TYPE	Shipped by Producers to Loc. Market						Im-ports	Total t	%
	Plant 1	Plant 2	Plant 3	Plant 4	Plant 5	Sub- total			
TOTAL								100	

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Carbon Steels
PRODUCT: Rolled round bars

LOCAL CONSUMPTION BRAZIL

Year

TYPES	%
TOTAL	100, -

MINIMUM ANNUAL CONSUMPTION
DESIRED BY PRODUCERS OF TOTAL

UNIDO-IAS

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Carbon Steels
PRODUCT: Rolled square bars

LOCAL CONSUMPTION BRAZIL
Year

TYPES	%
TOTAL	100, -

MINIMUM ANNUAL CONSUMPTION
DESIRED BY PRODUCERS% OF TOTAL

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP : Carbon Steels
PRODUCT : Rolled square bars

Survey Pooling Sheet
LOCAL CONSUMPTION

TYPE	Shipped by Producers to Loc. Market						im-ports	Total t	%
	Plant 1	Plant 2	Plant 3	Plant 4	Plant 5	Sub- total			
TOTAL								100	

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Carbon Steel
PRODUCT: Rolled rectangular bars

LOCAL CONSUMPTION BRAZIL
Year

TYPES	%
TOTAL	100, -

MINIMUM ANNUAL CONSUMPTION
DESIRED BY PRODUCERS OF TOTAL

Standard Form
UNIDO-IAS

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP : Carbon steels
PRODUCT : Rolled rectangular bars

Survey Pooling Sheet
LOCAL CONSUMPTION

TYPE	Shipped by Producers to Loc. Market						im-ports	Total t	%
	Plant 1	Plant 2	Plant 3	Plant 4	Plant 5	Sub- total			
TOTAL									100

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Carbon steels
PRODUCT: Rolled hexagonal bars

LOCAL CONSUMPTION BRAZIL
Year

TYPES	%
TOTAL	100, -

MINIMUM ANNUAL CONSUMPTION
DESIRED BY PRODUCERS% OF TOTAL

Standard Form
UNIDO-IAS

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP : Carbon steels
PRODUCT : Rolled hexagonal bars

Survey Pooling Sheet
LOCAL CONSUMPTION

TYPE	Shipped by Producers to Loc. Market						Im-ports	Total t	%
	Plant 1	Plant 2	Plant 3	Plant 4	Plant 5	Sub- total			
TOTAL									100

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Carbon steels
PRODUCT: Wire rods

LOCAL CONSUMPTION BRAZIL
Year

TYPES	%
TOTAL	100, -

MINIMUM ANNUAL CONSUMPTION
DESIRED BY PRODUCERS OF TOTAL

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Carbon Steels
PRODUCT: Forging billets

LOCAL CONSUMPTION BRAZIL
Year

TYPES	%
TOTAL	100, -

MINIMUM ANNUAL CONSUMPTION
DESIRED BY PRODUCERS OF TOTAL

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP : Carbon steels
PRODUCT : Forging billets

Survey Pooling Sheet
LOCAL CONSUMPTION

TYPE	Shipped by Producers to Loc. Market						Im-ports	Total t	%
	Plant 1	Plant 2	Plant 3	Plant 4	Plant 5	Sub- total			
TOTAL									100

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Manganese Steels

LOCAL CONSUMPTION BRAZIL
Year

PRODUCTS	%
1. Hot-rolled sheets	
2. Cold-rolled sheets	
3. Rolled round bars	
4. Rolled square bars	
5. Rolled rectangular bars	
6. Rolled hexagonal bars	
7. Wire rods	
8. Forging billets	
TOTAL	100, -

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Manganese Steel
PRODUCT: Hot-rolled sheets

LOCAL CONSUMPTION BRAZIL
Year

TYPES	%
TOTAL	100, -

MINIMUM ANNUAL CONSUMPTION
DESIRED BY PRODUCERS% OF TOTAL

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Manganese Steel
PRODUCT: Cold-rolled sheets

LOCAL CONSUMPTION BRAZIL
Year

TYPES	%
TOTAL	100, -

MINIMUM ANNUAL CONSUMPTION
DESIRED BY PRODUCERS OF TOTAL

UNIDO-IAS

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Manganese Steel
PRODUCT: Rolled round bars

LOCAL CONSUMPTION BRAZIL
Year

TYPES	%
TOTAL	100, -

MINIMUM ANNUAL CONSUMPTION
DESIRED BY PRODUCERS% OF TOTAL

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Manganese steel
PRODUCT: Rolled square bars

LOCAL CONSUMPTION BRAZIL
Year

TYPES	%
TOTAL	100, -

MINIMUM ANNUAL CONSUMPTION
DESIRED BY PRODUCERS% OF TOTAL

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Manganese steel
PRODUCT: Rolled rectangular bars

LOCAL CONSUMPTION BRAZIL
Year

TYPES	%
TOTAL	100, -

MINIMUM ANNUAL CONSUMPTION
DESIRED BY PRODUCERS% OF TOTAL

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Manganese Steel
PRODUCT: Rolled hexagonal bars

LOCAL CONSUMPTION BRAZIL
Year

TYPES	%
TOTAL	100, -

MINIMUM ANNUAL CONSUMPTION
REQUIRED BY PRODUCERS OF TOTAL

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP. Manganese Steel
PRODUCT: Wire rods

LOCAL CONSUMPTION BRAZIL
Year

TYPES	%
TOTAL	100, -

MINIMUM ANNUAL CONSUMPTION
DECLARED BY PRODUCERS OF TOTAL

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Manganese Steel
PRODUCT: Forging Billets

LOCAL CONSUMPTION BRAZIL
Year

TYPES	%
TOTAL	100, -

MINIMUM ANNUAL CONSUMPTION
DESIRED BY PRODUCERS % OF TOTAL

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Free-cutting steels

LOCAL CONSUMPTION BRAZIL
Year

PRODUCTS	%
1. Rolled round bars	
2. Rolled square bars	
3. Rolled rectangular bars	
4. Rolled hexagonal bars	
5. Wire rods	
6. Forging billets	
TOTAL	100, -

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Free-cutting steels
PRODUCT: Rolled round bars

LOCAL CONSUMPTION BRAZIL
Year

TYPES	%
TOTAL	100, -

MINIMUM ANNUAL CONSUMPTION
DESIRED BY PRODUCERS% OF TOTAL

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Free-cutting steels
PRODUCT: Rolled square bars

LOCAL CONSUMPTION BRAZIL
Year

TYPES	%
TOTAL	100, -

MINIMUM ANNUAL CONSUMPTION
ORDERED BY PRODUCERS% OF TOTAL

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Free-cutting steels
PRODUCT: Rolled rectangular bars

LOCAL CONSUMPTION BRAZIL
Year

TYPES	%
TOTAL	100, -

MINIMUM ANNUAL CONSUMPTION
DELIVERED BY PRODUCERS% OF TOTAL

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Free-cutting steels
PRODUCT: Rolled hexagonal bars

LOCAL CONSUMPTION BRAZIL
Year

TYPES	%
TOTAL	100, -

MINIMUM ANNUAL CONSUMPTION
DESIRED BY PRODUCERS OF TOTAL

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Free-cutting steels
PRODUCT: Wire rods

LOCAL CONSUMPTION BRAZIL
Year

TYPES	σ_0
TOTAL	100, -

PERCENT ANNUAL CONSUMPTION
DESIRED BY PRODUCERS OF TOTAL

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Free-cutting steels
PRODUCT: Forging billets

LOCAL CONSUMPTION BRAZIL
Year

TYPES	%
TOTAL	100, -

MINIMUM ANNUAL CONSUMPTION
DESIRED BY PRODUCERS OF TOTAL

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Alloy steels

LOCAL CONSUMPTION BRAZIL
Year

PRODUCTS	%
1. Hot-rolled sheets	
2. Cold-rolled sheets	
3. Rolled round bars	
4. Rolled square bars	
5. Rolled rectangular bars	
6. Rolled hexagonal bars	
7. Wire rods	
8. Forging billets	
TOTAL	100, -

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Alloy steels
PRODUCT: Hot-rolled sheets

LOCAL CONSUMPTION BRAZIL
Year

TYPES	%
TOTAL	100, -

MINIMUM ANNUAL CONSUMPTION
DESIRED BY PRODUCERS% OF TOTAL

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Alloy steels
PRODUCT: Cold-rolled sheets

LOCAL CONSUMPTION BRAZIL
Year

TYPES	%
TOTAL	100, -

MINIMUM ANNUAL CONSUMPTION
DESIRED BY PRODUCERS OF TOTAL.

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Alloy steels
PRODUCT: Rolled round bars

LOCAL CONSUMPTION BRAZIL
Year

TYPES	%
TOTAL	100, -

MINIMUM ANNUAL CONSUMPTION
DESIRED BY PRODUCERS% OF TOTAL

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Alloy steels
PRODUCT: Rolled square bars

LOCAL CONSUMPTION BRAZIL
Year

TYPES	%
TOTAL	100, -

MINIMUM ANNUAL CONSUMPTION
DESIRED BY PRODUCERS OF TOTAL

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Alloy steels

PRODUCT: Rolled rectangular bars

LOCAL CONSUMPTION BRAZIL

Year

TYPES	%
TOTAL	100, -

MINIMUM ANNUAL CONSUMPTION
DESIRED BY PRODUCERS% OF TOTAL

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Alloy steels
PRODUCT: Rolled hexagonal bars

LOCAL CONSUMPTION BRAZIL

Year

TYPES	%
TOTAL	100, -

MINIMUM ANNUAL CONSUMPTION
DESIRED BY PRODUCERS% OF TOTAL

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Alloy steels
PRODUCT: Wire rods

LOCAL CONSUMPTION BRAZIL
Year

TYPES	%
TOTAL	100, -

MINIMUM ANNUAL CONSUMPTION
DESIRED BY PRODUCERS% OF TOTAL

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Alloy steels
PRODUCT: Forging billets

LOCAL CONSUMPTION BRAZIL
Year

TYPES	%
TOTAL	100, -

MINIMUM ANNUAL CONSUMPTION
DESIRED BY PRODUCERS% OF TOTAL

Information Related
for Exports

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Carbon steels

EXPORTS BRAZIL
Year

PRODUCTS	% (1)
1. Hot-rolled sheets	
2. Cold-rolled sheets	
3. Rolled round bars	
4. Rolled square bars	
5. Rolled rectangular bars	
6. Rolled hexagonal bars	
7. Wire rods	
8. Forging billets	

(1) Percentage of exports with respect to Local Consumption

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Carbon steels
PRODUCT: Hot rolled sheets

EXPORTS BRAZIL
Year

TYPES	%
TOTAL	100, -

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Carbon steels
PRODUCT: Cold-rolled sheets

EXPORTS BRAZIL
Year

TYPES	%
TOTAL	100, -

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Carbon steels
PRODUCT: Rolled round bars

EXPORTS BRAZIL
Year

TYPES	%
TOTAL	100, -

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Carbon steels
PRODUCT: Rolled square bars

EXPORTS BRAZIL
Year

TYPES	%
TOTAL	100, -

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Carbon steels
PRODUCT: Rolled rectangular bars

EXPORTS BRAZIL
Year

TYPES	%
TOTAL	100, -

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Carbon steels
PRODUCT: Rolled hexagonal bars

EXPORTS BRAZIL
Year

TYPES	%
TOTAL	100, -

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Carbon steels
PRODUCT: Wire rods

EXPORTS BRAZIL
Year

TYPES	%
TOTAL	100, -

UNIDO-IAS

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Carbon steels
PRODUCT: Forging billets

EXPORTS BRAZIL
Year

TYPES	%
TOTAL	100, -

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Manganese steel

EXPORTS BRAZIL
Year

PRODUCTS	%	(1)
1. Hot-rolled sheets		
2. Cold-rolled sheets		
3. Rolled round bars		
4. Rolled square bars		
5. Rolled rectangular bars		
6. Rolled hexagonal bars		
7. Wire rods		
8. Forging billets		

(1) Percentage of exports with respect to Local Consumption

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Manganese Steel
PRODUCT: Hot-rolled sheets

EXPORTS BRAZIL
Year

TYPES	%
TOTAL	100, -

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Manganese Steel
PRODUCT: Cold-rolled sheets

EXPORTS BRAZIL
Year

TYPES	%
TOTAL	100, -

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Manganese Steel
PRODUCT: Rolled round bars

EXPORTS BRAZIL
Year

TYPES	%
TOTAL	100, -

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Manganese Steel
PRODUCT: Rolled square bars

EXPORTS BRAZIL
Year

TYPES	σ_0
TOTAL	100, -

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Manganese Steel
PRODUCT: Rolled rectangular bars

EXPORTS BRAZIL
Year

TYPES	%
TOTAL	100, -

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Manganese Steel
PRODUCT: Rolled hexagonal bars

EXPORTS BRAZIL
Year

TYPES	%
TOTAL	100, -

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Manganese Steel
PRODUCT: Wire rods

EXPORTS BRAZIL
Year

TYPES	%
TOTAL	100, -

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Manganese steel
PRODUCT: Forging billets

EXPORTS BRAZIL
Year

TYPES	%
TOTAL	100, -

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Free-cutting steels

EXPORTS BRAZIL
Year

PRODUCTS	% (1)
1. Rolled round bars	
2. Rolled square bars	
3. Rolled rectangular bars	
4. Rolled hexagonal bars	
5. Wire rods	
6. Forging billets	

(1) Percentage of exports with respect to Local Consumption

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Free-cutting steels
PRODUCT: Rolled round bars

EXPORTS BRAZIL
Year

TYPES	%
TOTAL	100, -

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Free-cutting steels
PRODUCT: Rolled square bars

EXPORTS BRAZIL
Year

TYPES	%
TOTAL	100, -

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Free-cutting steels
PRODUCT: Rolled rectangular bars

EXPORTS BRAZIL
Year

TYPES	%
TOTAL	100, -

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Free-cutting steels
PRODUCT: Rolled hexagonal bars

EXPORTS BRAZIL
Year

TYPES	%
TOTAL	100, -

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Free-cutting steels
PRODUCT: Wire rods

EXPORTS BRAZIL
Year

TYPES	$\frac{\sigma}{10}$
TOTAL	100, -

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Free-cutting steels
PRODUCT: Forging billets

EXPORTS BRAZIL
Year

TYPES	%
TOTAL	100, -

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Alloy steels

EXPORTS BRAZIL

Year

PRODUCTS	% (1)
1. Hot-rolled sheets	
2. Cold-rolled sheets	
3. Rolled round bars	
4. Rolled square bars	
5. Rolled rectangular bars	
6. Rolled hexagonal bars	
7. Wire rods	
8. Forging billets	

(1) Percentage of exports with respect to Local Consumption

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Alloy steels
PRODUCT: Hot-rolled sheets

EXPORTS BRAZIL
Year

TYPES	%
TOTAL	100, -

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Alloy steels
PRODUCT: Cold-rolled sheets

EXPORTS BRAZIL
Year

TYPES	%
TOTAL	100, -

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Alloy steels
PRODUCT: Rolled round bars

EXPORTS BRAZIL
Year

TYPES	%
TOTAL	100, -

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Alloy steels
PRODUCT: Rolled square bars

EXPORTS BRAZIL
Year

TYPES	%
TOTAL	100, -

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Alloy steels
PRODUCT: Rolled rectangular bars

EXPORTS BRAZIL
Year

TYPES	%
TOTAL	100, -

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Alloy steels
PRODUCT: Rolled hexagonal bars

EXPORTS BRAZIL
Year

TYPES	%
TOTAL	100, -

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Alloy steels
PRODUCT: Wire rods

EXPORTS BRAZIL
Year

TYPES	%
TOTAL	100, -

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

GROUP: Alloy steels
PRODUCT: Forging bars

EXPORTS BRAZIL

Year

TYPES	%
TOTAL	100, -

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25

Producers and
Institutes

3. Standard Forms and Calculation Sheet

3.1 Forms for Producers.

The attached form is an example of the one to be submitted to the producers of Mechanical Construction Steels by Chemical Composition.

One Sheet shall be completed for each Product-Group manufactured. The same shall show the Product (for instance, Bars) and the Group (for instance, Free-cutting).

In the box the type and tonnage shipped in the base year shall be specified, indicating Local Market and Exports. At the same time, the principal uses assigned to each type shall be stated (for instance, SAE 1212 machined in automatic lathes, without heat treatment).

The answers of the various producers shall be transferred to the calculation sheet to be added at country level.

Endeavours should be made to poll all the producers. Should this be impossible the sampling survey should be made sufficiently representative.

3.2 Form for Imports

In a sheet similar to the foregoing, data should be requested from whoever is competent regarding imports of Mechanical Construction Steels by Chemical Composition, indicating tonnage shipped to the market by type of steel within each Product/Group. This information

is transferred to the calculation sheet, and each imported type is ticked off. This tick is transferred to the summary of percentage consumption, and if the imported percentage is significant, then this too is shown.

3.3 Forms for Users

Each user of these products should complete a card similar to the attached, indicating the Product/Group and Type of Steel he uses. Furthermore, the user shall state the kind of parts he manufactures from this material and specify the overall manufacturing process of the part in question. If for one and the same Product/Type the user manufactures parts with differing processes, then he shall complete as many cards as necessary.

Standard Form

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

Survey of producers

GROUP:
PRODUCT:
PLANT:

SHIPMENTS YEAR
(quantities in t)

TYPE	TO LOCAL MARKET	FOR EXPORT
TOTAL		

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS (BY CHEMICAL COMPOSITION)

Survey of producers

GROUP:
PRODUCT:

SHIPMENTS YEAR

TYPE	PRINCIPAL USES

State to the best of your knowledge the principal uses of each type of steel, minimally the sector of use and if possible the transformation process.

Mechanical construction steels specified by the chemical composition can be marketed under various shapes. These are:

1. Hot-rolled sheets
2. Cold-rolled sheets
3. Rolled round bars
4. Rolled square bars
5. Rolled rectangular bars
6. Rolled hexagonal bars
7. Wire rods
8. Forging billets

The rationalization analysis requires detailed information about each one of these shapes.

Such information can be broken down by the mechanical construction steel group as follows:

1. Carbon steels
2. Manganese steels
3. Free-cutting steels
4. Alloy steels

A separate specification of these groups is necessary for the rationalization.

The purpose being to rationalize the local consumption in Brazil, it is necessary to have a distribution of the different types of steel used (in a base period).

This is accomplished with the total of shipments to the local market made by Brazilian producers plus imports during the same period.

By way of marginal information, export data is required as a useful aid in the analysis of substitutes.

Standard Form

PROJECT PILOT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS BY CHEMICAL COMPOSITION

Questionnaire for
Foreign Trade Entity

GROUP:
PRODUCT:

IMPORTS YEAR

TYPE	t
TOTAL	



Standard Form

PILOT PROJECT FOR THE RATIONALIZATION OF MECHANICAL
CONSTRUCTION STEELS BY CHEMICAL COMPOSITION

Survey of Users

Firm:

Type of Steel (1):

Manufactured part (2):

Shape of raw material (3):

Abstract of process (4):

Possible type of steel to act as substitute (5):

Remarks (6):

Notes:

- (1) If the steel complies with an internationally known standard (SAE, DIN, ABNT, AFNOR, etc.) specify which as well as corresponding type (for instance: AFNOR 18CD4). Otherwise, kindly specify the chemical composition.
- (2) Specify type of part. If they are different, complete one form for each type.
- (3) Bars, sheets, billets, etc.
- (4) Without going into details.
- (5) If in your opinion there is none, kindly put (-).
- (6) As you deem fit.

Standard Form

Example of completed form

Firm: N.N.

Type of Steel (1): SAE 5160

Manufactured part (2): Suspension springs

Shape of raw material (3): Bars

Abstract of process (4): Rectification - Hot forming - Quenching -
Tempering - Shotpeening

Possible type of steel to act as substitute (5): SAE 9262

Remarks (6): If the type of steel is changed, the heat treatment will
also have to be changed.

Notes:

- (1) If the steel complies with an internationally known standard (SAE, DIN, ABNT, AFNOR, etc.) specify which as well as corresponding type (for instance: AFNOR 18CD4). Otherwise, kindly specify the chemical composition.
- (2) Specify type of part. If they different, complete one form for each type.
- (3) Bars, sheets, billets, etc.
- (4) Without going into details.
- (5) If in your opinion there is none, kindly put (-).
- (6) As you deem fit.

4. Definitions and Controls.

4.1 Definitions.

- a) The Mechanical Construction Steels by Chemical Composition are those that are being commercialized principally in accordance with this requirement, with the exclusion of Tool and Die Steels, Stainless Steels and Electromagnetic Circuit Steels. Steels commercialized as commercial quality are not to be included even if they have an approximately constant chemical composition. Neither should equivalences be made of steels by mechanical characteristics with a chemical composition.
- b) The definition of the products of this work shall be made in accordance with the practice and customs of the Brazilian market, however, in general, they should be compatible with each other and permit that the tonnages of various products be added together. Therefore if wire rods are taken, then it is not possible to take also Wires for example. If drawn Bars are included, they should be summable with rolled Bars. Therefore, it is best to define a panel of manufacturing firms and take their shipments to the market.

4.2 Controls.

In order to check the results of the survey, the verified tonnage shall be contrasted with statistical data which may be more general but can give an idea of the representativity.

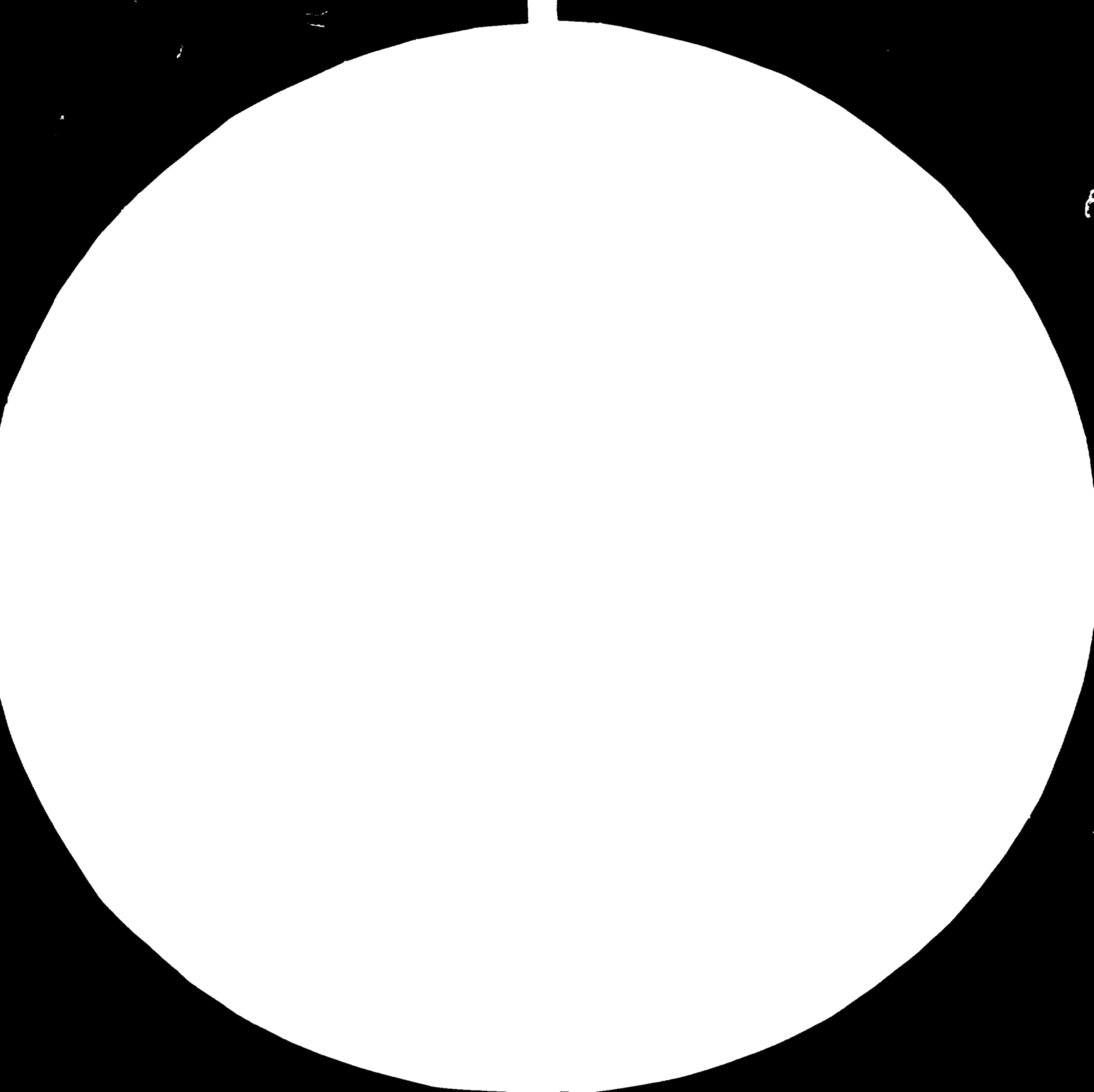
The tonnages are not necessary for the rationalization; none the less it ought to be possible to suppose that the distribution curve of types represents the universe.

Another control that must be effected consists in comparing the lists of types of steels derived from surveys among users and producers and imports. Any difference shall be cleared up (for instance, a type of steel X Y Z has declared by a user but not by producers or imports).

vc.

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36



40



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS
STANDARD REFERENCE MATERIAL 1010a
(ANSI and ISO TEST CHART No. 2)

13352-E
(4 of 4)

**Steel Rationalization
in Brazil**

**Final Report
Volume 4**

PILOT PROJECT FOR THE RATIONALIZATION OF METAL AND MECHANICAL
CONSTRUCTION STEEL

(BY ~~CHEMICAL~~ CHARACTERISTICS)
mechanical

NECESSARY INFORMATION AND STANDARDS FORMS

UNIDO Contract : N° T 81/90

UNIDO Project : BRA/75/003

Project Director : Dr. B. S. Krishnamachar

Steel Rationalization in Brazil

Final Report Volume 4

PILOT PROJECT FOR THE RATIONALIZATION OF METAL AND MECHANICAL
CONSTRUCTION STEEL

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mechanics?

NECESSARY INFORMATION AND STANDARDS FORMS

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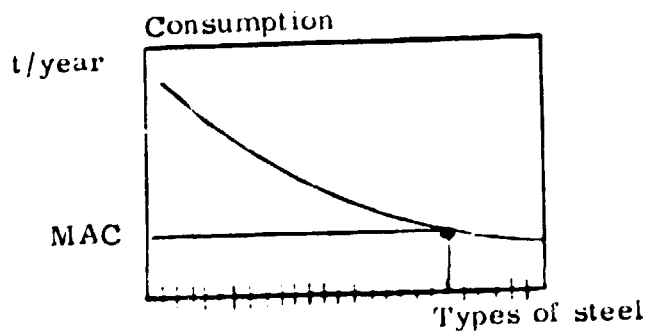
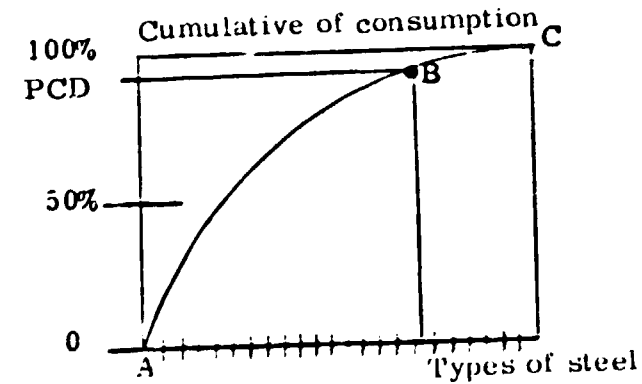
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1. Introduction

The present volume contains the specification and methodology for obtaining the information required to envisage the Pilot Project for the Rationalization of Metal and Mechanical Construction Steels by Mechanical Characteristics.

The rationalization methodology consists in endeavouring to reduce the variety of steel types by trying to substitute lower consumption types by higher consumption steels. To this end concentration curves are used in which the types are classified by decreasing consumption.

Two types of curves are shown hereafter differing in the manner in which consumption is expressed. In one case it is shown as the cumulative percentage and in the other one in tons. The types of steel are those used on the market.



The object is to find a Percentage Commensurate with Demand (PCD) close to 100% (for instance, 95%). This means that essentially those contained in zone AB shall be recommended as Rationalized Steel Types, in order to meet a high percentage of demand.

However, this value of PCD must be made compatible with the minimum annual consumption desired by producers if manufacturing surcharges are to be avoided.

A compromise must be found between the two values and at the same time, by means of a technical analysis of the conditions for substituting one type of steel by another, ways and means should be sought to meet the demand for not rationalized types (zone BC) with rationalized types (zone AB).

Moreover and as far as possible, another object is to group together, if technically feasible, consumptions of similar types of steel even in the event of both being high consumption items.

To enable the application of this methodology it is therefore necessary to have at hand the consumption information regarding the products to be rationalized so as to enable the first type of curve (i.e. the one corresponding to the cumulative percentage consumptions) to be traced; furthermore the value of MAC must be available which can be expressed as a percentage of total consumption. A PCD of 95% is aimed at.

So far the economic part of the problem would be solved, but in order

to cover the technical part additional information is necessary regarding the intended use of each type of steel.

Therefore, the instant volume specifies two types of information, the first to be requested from the producers and the second from the users.

The information to be used for the rationalization refers to percentages or quality which should not be construed by those supplying it as giving away confidential data. Obviously, the original data must be expressed in tons and once processed it shall be converted to a percentage showing its relative demand which can be made public without damage to anybody's interests.

2. Information for the Rationalization of Metal and Mechanical Construction Steels by Mechanical Characteristics.

2.1. Information to be requested from producers and institutions

Tables containing information regarding the INTERNAL CONSUMPTION IN BRAZIL of different types of steel for different products will now be given.

The types of steel have been grouped together in two groups :

1. For Metal Constructions
2. For Mechanical Constructions

For each group the yearly consumption per product (in percentages) is requested. The term consumption is to be understood as the apparent consumption obtained by adding together the SHIPMENTS TO THE NATIONAL MARKET by Brazilian producers and IMPORTS.

The products comprising this study are basically :

1. Hot-rolled sheets
2. Cold-rolled sheets
3. Rolled bars
4. Structural sections

Furthermore, for each group the distribution of types of steel in percentage form, spread by product, is requested.

Summing up, the requested information can be shown diagrammatically as follows :

		Products j			
		1	2	3	4
Group i	1	t 11	t 12	-	t 14
	2	t 21	t 22	-	t 24

each t i j is a chart in tons of the yearly consumption of each type of steel (k) of group i for product j.

		t i j
type		t
i		xx
2		xx
'		'
		Cijk
'		'
n		xx

The summation of the Cijk's

$\sum_k Cijk = Cij$ is the total consumption of group i for product j

and each $\frac{Cijk}{\sum_k Cijk} \times 100 = C(\%)_{ijk}$

is the percentage consumption of each type k within group i for product j.

Another matrix can thus be prepared, i.e. :

		Products j			
		1	2	3	4
Group i	1	P 11	P 12	-	P 14
	2	P 21	P 22	-	P 24

wherein each pij

is a chart

Pij

type	%
1	xx
2	xx
'	'
k	C(%)ijk
'	'
Total	100

in order to be able to coordinate all this information specified at group level, the

$$\frac{C_{ij}}{\sum_j C_{ij}} \times 100 = C(\%)_{ij}$$

is also requested leading to another percentage matrix

		Products j				Total
		1	2	3	4	
Group i	1	P'11	P'12	-	P'14	100
	2	P'21	P'22	-	P'24	

wherein P'ij = C(%)ij

By multiplying each C(%)ij x C(%)ijk and adding

$$\sum_j C(\%)_{ij} \times C(\%)_{ijk} = C(\%)_{ik}$$

i.e. a new matrix P''ik

		Type k				
		1	2	-	-	-
Group i	1	P''11	P''12	-	-	-
	2	'	'			'

where each P^{ik} is a percentage distribution chart of the different qualities k for group i taking into account all the products

P^{ik}

Type	%
1	
2	
⋮	
k	
⋮	
n	
Total	100

As stated in the foregoing paragraphs, these distribution curves must be traced with the aid of consumption data; however, there are two important aspects, i.e. :

- a) If the consumption is provided with imported material
- b) Which types of steel are exported.

When substitutes are analyzed it is important to know these aspects because in the first case the tendency shall be to recommend whenever technically feasible the substitution of the imported type by a locally produced type. In the second case it can happen that a steel that is being exported is a useful substitute of a low consumption steel (supposedly not recommendable as rationalized). This fact could lead to recommending the use of the steel that is exported also on the local market.

From this point of view the following complementary information is requested :

- (a) List of types of imported steel and percentages regarding consumption if the value is significant
- (b) Percentage distribution of types of exported steels

Another additional complementary information requested from the producers is related to the principal uses of each type of steel produced in the country.

The standard forms for requesting information as well as the consolidation charts follow at the end.

2.1. Information to be requested from users

Information shall be requested from users of Steels for Metal and Mechanical Constructions by Mechanical Characteristics regarding the intended use of each steel. From this point of view it is important to know the type of steel, the shape of the product they buy and the purpose for which this material is intended.

The users shall complete a little card for each type of steel.

In order to enable rationalization this information must be known with user's identification code.

Information required
for Rationalization

PILOT PROJECT FOR THE RATIONALIZATION OF METAL AND
MECHANICAL CONSTRUCTION STEELS BY MECHANICAL
CHARACTERISTICS

GROUP : Metal Constructions

LOCAL CONSUMPTION BRAZIL

Year

PRODUCTS	%
1. Hot-rolled sheets	
2. Cold-rolled sheets	
3. Rolled bars	
4. Structural sections	
TOTAL	100,-

PILOT PROJECT FOR THE RATIONALIZATION OF METAL AND
MECHANICAL CONSTRUCTION STEELS BY MECHANICAL
CHARACTERISTICS

GROUP : Metal Constructions
PRODUCT: Hot-rolled sheet

LOCAL CONSUMPTION BRAZIL

Year

TYPE (1)	%
TOTAL	100, -

(1) Indicate imported types and imported percentage if significant.

**PILOT PROJECT FOR THE RATIONALIZATION OF METAL AND
MECHANICAL CONSTRUCTION STEELS BY MECHANICAL
CHARACTERISTICS**

GROUP : Metal Constructions
PRODUCT: Cold-rolled sheet

LOCAL CONSUMPTION BRAZIL

Year

TYPE (1)	%
TOTAL	100,-

(1) Indicate imported types and imported percentage if significant.

PILOT PROJECT FOR THE RATIONALIZATION OF METAL AND
MECHANICAL CONSTRUCTION STEELS BY MECHANICAL
CHARACTERISTICS

GROUP : Metal Constructions
PRODUCT: Rolled bars

LOCAL CONSUMPTION BRAZIL

Year

TYPE (1)	%
TOTAL	100,-

(1) Indicate imported types and imported percentage if significant.

**PILOT PROJECT FOR THE RATIONALIZATION OF METAL AND
MECHANICAL CONSTRUCTION STEELS BY MECHANICAL
CHARACTERISTICS**

GROUP : Metal Constructions
PRODUCT: Structural sections

LOCAL CONSUMPTION BRAZIL

Year

TYPE (1)	%
TOTAL	100,-

(1) Indicate imported types and imported percentage if significant.

PILOT PROJECT FOR THE RATIONALIZATION OF METAL AND
MECHANICAL CONSTRUCTION STEELS BY MECHANICAL
CHARACTERISTICS

GROUP : Mechanical Constructions

LOCAL CONSUMPTION BRAZIL

Year

PRODUCTS	σ_0
1. Hot-rolled sheets	
2. Cold-rolled sheets	
3. Rolled bars	
4. Structural sections	
TOTAL	100,-

**PILOT PROJECT FOR THE RATIONALIZATION OF METAL AND
MECHANICAL CONSTRUCTION STEELS BY MECHANICAL
CHARACTERISTICS**

GROUP : Mechanical Constructions
PRODUCT: Hot-rolled sheets

LOCAL CONSUMPTION BRAZIL

Year

TYPE (1)	%
TOTAL	100,-

(1) Indicate imported types and imported percentage if significant.

PILOT PROJECT FOR THE RATIONALIZATION OF METAL AND
MECHANICAL CONSTRUCTION STEELS BY MECHANICAL
CHARACTERISTICS

GROUP : Mechanical Constructions
PRODUCT: Col-rolled sheets

LOCAL CONSUMPTION BRAZIL

Year

TYPE (1)	%
TOTAL	100,-

(1) Indicate imported types and imported percentage if significant.

PILOT PROJECT FOR THE RATIONALIZATION OF METAL AND
MECHANICAL CONSTRUCTION STEELS BY MECHANICAL
CHARACTERISTICS

GROUP : Mechanical Constructions
PRODUCT: Rolled bars

LOCAL CONSUMPTION BRAZIL

Year

TYPE (1)	σ_0
TOTAL	100,-

(1) Indicate imported types and imported percentage if significant.

PILOT PROJECT FOR THE RATIONALIZATION OF METAL AND
MECHANICAL CONSTRUCTION STEELS BY MECHANICAL
CHARACTERISTICS

GROUP : Mechanical Constructions
PRODUCT: Structural sections

LOCAL CONSUMPTION BRAZIL

Year

TYPE (1)	%
TOTAL	100,-

(1) Indicate imported types and imported percentage if significant.

PILOT PROJECT FOR THE RATIONALIZATION OF METAL AND MECHANICAL CONSTRUCTION STEELS BY MECHANICAL CHARACTERISTICS

GROUP : Metal Constructions
PRODUCT:

EXPORT BRAZIL

Year

PRODUCT (1)	%
1. Hot-rolled sheets 2. Cold-rolled sheets 3. Rolled bars 4. Structural sections	
TOTAL	100,-

(1) Percentages must refer to local consumption.

PILOT PROJECT FOR THE RATIONALIZATION OF METAL AND
MECHANICAL CONSTRUCTION STEELS BY MECHANICAL
CHARACTERISTICS

GROUP : Metal Constructions
PRODUCT: Hot-rolled sheets

EXPORT BRAZIL

Year

TYPE	σ_0
TOTAL	100,-

PILOT PROJECT FOR THE RATIONALIZATION OF METAL AND
MECHANICAL CONSTRUCTION STEELS BY MECHANICAL
CHARACTERISTICS

GROUP : Metal Constructions
PRODUCT: Cold-rolled sheets

EXPORT BRAZIL

Year

TYPE	%
TOTAL	100,-

PILOT PROJECT FOR THE RATIONALIZATION OF METAL AND
MECHANICAL CONSTRUCTION STEELS BY MECHANICAL
CHARACTERISTICS

GROUP : Metal Constructions
PRODUCT: Rolled bars

EXPORT BRAZIL

Year

TYPE	%
TOTAL	100,-

PILOT PROJECT FOR THE RATIONALIZATION OF METAL AND
MECHANICAL CONSTRUCTION STEELS BY MECHANICAL
CHARACTERISTICS

GROUP : Metal Constructions
PRODUCT: Structural sections

EXPORT BRAZIL

Year

TYPE	%
TOTAL	100,-

PILOT PROJECT FOR THE RATIONALIZATION OF METAL AND
MECHANICAL CONSTRUCTION STEELS BY MECHANICAL
CHARACTERISTICS

GROUP : Mechanical Constructions

EXPORT BRAZIL

Year

PRODUCT (1)	%
1. Hot-rolled sheets	
2. Cold-rolled sheets	
3. Rolled bars	
4. Structural sections	
TOTAL	100,-

(1) Percentages must refer to local consumption.

PILOT PROJECT FOR THE RATIONALIZATION OF METAL AND
MECHANICAL CONSTRUCTION STEELS BY MECHANICAL
CHARACTERISTICS

GROUP : Mechanical Constructions
PRODUCT: Hot-rolled sheets

EXPORT BRAZIL

Year

TYPE	%
TOTAL	100,-

PILOT PROJECT FOR THE RATIONALIZATION OF METAL AND
MECHANICAL CONSTRUCTION STEELS BY MECHANICAL
CHARACTERISTICS

GROUP : Mechanical Constructions
PRODUCT: Cold-rolled sheets

EXPORT BRAZIL

Year

TYPE	σ_0
TOTAL	100,-

PILOT PROJECT FOR THE RATIONALIZATION OF METAL AND
MECHANICAL CONSTRUCTION STEELS BY MECHANICAL
CHARACTERISTICS

GROUP : Mechanical Constructions
PRODUCT: Rolled bars

EXPORT BRAZIL

Year

TYPE	%
TOTAL	100,-

PILOT PROJECT FOR THE RATIONALIZATION OF METAL AND
MECHANICAL CONSTRUCTION STEELS BY MECHANICAL
CHARACTERISTICS

GROUP : Mechanical Constructions
PRODUCT: Structural Sections

EXPORT BRAZIL

Year

TYPE	%
TOTAL	100, -

3. Standard Forms and Calculation Sheets

3.1. Forms for Producers

The attached form is an example of the one to be submitted to the producers of Metal and Mechanical Construction Steels by Mechanical Characteristics.

One sheet shall be completed for each Product-Group manufactured. The same shall show the Product (for instance, Bars) and the Group (for instance, Metal Constructions).

In the box the type and tonnage shipped in the base year shall be specified, indicating Internal Market and Exports. At the same time, the principal uses assigned to each type shall be stated.

The answers of the various producers shall be transferred to the calculation sheet to be added at country level.

Endeavours should be made to poll all the producers. Should this be impossible the sampling survey should be made sufficiently representative.

3.2. Form for Imports

In a sheet similar to the foregoing, data should be requested from whoever is competent regarding imports of Metal and Mechanical Construction Steels by Mechanical Characteristics, indicating tonnage shipped to the market by type of steel within each Product/Group. This information is transferred to the calculation sheet, and each imported type is ticked off. This tick is transferred to the summary of percentage consumption, and if the imported percentage

is significant, then this too is shown.

3.3. Forms for users

Each user of these products shall complete a card similar to the one attached, with indication of Product/Group and Type of Steel used. Subsequently, the intended use shall be shown.

PILOT PROJECT FOR THE RATIONALIZATION OF METAL AND
MECHANICAL CONSTRUCTION STEELS BY MECHANICAL
CHARACTERISTICS

Survey of Producers

GROUP :
PRODUCT :

SHIPMENTS Year
in tons

TYPE	TO LOCAL MARKET	FOR EXPORT	TOTAL
TOTAL			

Metal and mechanical construction steels specified by their mechanical characteristics can be marketed under various shapes. These are :

1. Hot-rolled sheets
2. Cold-rolled sheets
3. Rolled bars
4. Structural sections

The rationalization analysis requires detailed information about each one of these shapes.

Such information can be broken down by mechanical construction steel group as follows :

1. Steels for Metal Constructions
2. Steels for Mechanical Constructions

A separate specification of these groups is necessary for the rationalization.

The purpose being to rationalize the local consumption in Brazil, it is necessary to have a distribution of the different types of steel used (in a base period).

This is accomplished with the total of shipments to the local market made by Brazilian producers plus imports during the same period. By way of marginal information, export data is required as a useful aid in the analysis of substitutes.

PILOT PROJECT FOR THE RATIONALIZATION OF METAL AND
MECHANICAL CONSTRUCTION STEELS BY MECHANICAL
CHARACTERISTICS

Survey of Foreign Trade Entity

GROUP :
PRODUCT :

IMPORTS Year
in tons

TYPE	t
TOTAL	

PILOT PROJECT FOR THE RATIONALIZATION OF METAL AND
MECHANICAL CONSTRUCTION STEELS BY MECHANICAL
CHARACTERISTICS

Survey of Users

Firm :

Type of steel (1) :

Shape of product (2) :

Destination (3) :

Remarks (4) :

Notes :

- (1) If the steel complies with an internationally known standard (ABNT, ASTM, etc.) specify which as well as corresponding type (for instance : ABNT E B-255-CG-24). Otherwise, kindly specify the required mechanical characteristics.
- (2) Thick plate, T section, etc.
- (3) Welded metal structures, mechanical constructions, etc.
- (4) As deemed fit.



Definition and Controls

4. Definitions and Controls

4.1. Definitions

a) The Metal and Mechanical Construction Steels by Mechanical Characteristics are those that are being commercialized principally in accordance with this requirement, with the exclusion of steels for boilers, shipbuilding, pressure containers, API piping for oil, deep-drawing steels and structural steels with special forming requirements.

Steels commercialized as commercial quality are not to be included even if they have an approximately constant mechanical characteristic. Neither should equivalences be made of steels by chemical composition with a mechanical characteristic.

b) The definition of the products of this work shall be made in accordance with the practice and customs of the Brazilian market, however, in general, it should be compatible with each other and permit that the tonnages of various products be added together.

4.2. Controls

In order to check the results of the surveys, the verified tonnages shall be contrasted with statistical data which may be more general but can give an idea of the representativity.

The tonnages are not necessary for the rationalization; none the less it ought to be possible to suppose that the distribution curve of types represents the universe.

Another control that must be effected consists in comparing the lists of types of steels derived from surveys among users and producers and imports. Any difference shall be cleared up (for instance, a type of steel X Y Z has been declared by a user but not by producers or imports).

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