DEVELOPMENT OF QUALITY CONTROL AND CERTIFICATION OF CONCRETE ROAD PAVING BLOCKS IN THE NETHERLANDS

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SUMMARY

In this report the author describes the development of the standardisation of concrete paving blocks and of the quality assurance in the Netherlands. He illustrates the setting-up of the Council of Certification.

There is a close relationship between standardisation, quality system and certification. To the view of the author the best way for a buyer to make sure of the quality of the paving blocks is to buy them from a manufacturer who operates a quality system. Certification is then the most objective and effective and also cheapest method for ascertaining that manufacturers provide products which satisfy the requirements.

The certification of building products in the Netherlands is described and particularly the KOMO-certification of concrete road paving blocks. The procedures in certification are illustrated with a framework schedule for the internal quality control and some standard forms used in factories for this internal control.

The author notices that until now there is no work on an international standardisation of concrete paving blocks. He asks if this empty space can be paved with an international standard. Summarizing his report the author draws some short conclusions on standardisation, quality assurance, certification and their relationship.

1. THE STANDARDISATION OF CONCRETE ROAD PAVING BLOCKS IN THE NETHERLANDS [1] [10]

In our country where there is a longstanding tradition of making clay bricks for a wide range of applications, burnt clay bricks have been used for many centuries in road making. The centre of many Dutch towns and villages is paved with such materials, which has contributed to giving our country its very characteristic appearance.

After the second world war, when vast quantities of building materials were necessary for the reconstruction of the country, there was a great effort to produce new materials to help speed up the construction of houses, buildings and roads. Partly because of the scarcity of ceramic products at the time, concrete road paving blocks were introduced in the Netherlands at the beginning of the fifties.

In view of the development of motorized traffic it became rapidly necessary to set requirements for concrete road paving blocks as well. Such requirements would concern road safety and comfort of car passengers and also of course the possibility to lay and the mechanical strength of these concrete blocks.

The first Netherlands requirements were published by the "Rijkswaterstaat" in 1955. They were relative to constant shape, planeless of upper and lower faces, coefficient of friction and tensile bending strength. These requirements were largely based on previous requirements issued by the "Rijkswaterstaat" for white paving slabs.

Although these first requirements applied in principle only to deliveries to the "Rijkswaterstaat", they were also used by others and some local authorities, such as Amsterdam and Rotterdam, had in the meantime issued requirements that were not quite the same.

In 1963 Working Group D2 of the Centre for Roadstudies SCW (Studiecentrum Wegenbouw) recommended assessment requirements for concrete road paving blocks in the SCW bulletin 13 [2].
It contained recommendations for a standard length and width:

concrete road paving blocks with nominal dimensions of 105 mm x 213 mm. The recommended requirements are slightly different from those of the "Rijkswaterstaat" at the time to which they were in fact complementary. Up to 1966 these recommendations have been used as guidelines in many specifications.

In 1966 the Netherlands Standards Institute published the Standard NEN 7000 "Concrete road paving blocks [3]. The standard had been prepared by a Commission of KOMO (Stichting voor Onderzoek, Beoordeling en keuring van Materialen en Constructies KOMO). Further mention of the work of KOMO is made elsewhere in the paper.
The Standard gave requirements and methods for testing concrete road paving blocks.
The explanation mentions that the description of assessment procedures is aimed at a regular quality control on the total production of a factory.
Standard NEN 7000 describes the following requirements together with relevant methods: shape and appearance, dimensions, deviation form dimensions, composition, tensile bending strengtn and weightloss in the sand blast test.[11]
In the Netherlands Standard NEN 7000 was one of the first standards involving statistics in the assessment.
Both in determining the deviation in length, width and height and in determining the tensile bending strength and skid resistance it is necessary to determine the standard deviation for 15 blocks. For dimensional variations a limit is specified for this standard deviation. As regards the tensile bending strength and skid resistance, the minimum value is obtained by subtracting 1.65 times the standard deviation from the mathematical mean of the tensile bending strength and skid resistance of each of the 15 blocks in the sample.
The result must be compared to the requirements.

As with all standards it is necessary to examine from time to time whether the specifications contained in the Standard are still up to date. In consultation between NNI and KOMO a commission was set up which made a critical review of standard NEN 7000 of 1966. The commission proposed a number of amendments. These amendments were incorporated in a new draft which the NNI issued for critical approval in September 1982. Compared to the 1966 standard, the new version contains of few general changes such as the use of SI units as well as the following technical modifications:

a) apart from height, the length and width of "kei" and "waal" sizes are now also standardised. These sizes which developped historically, are as follows:
   standard "kei" size with nominal dimensions of 211 mm x 105 mm x h
   standard "thick" size with nominal dimensions of 211 mm x 69 mm x h
   standard "waal" size with nominal dimensions of 200 mm x 50 mm x h (h is the height in mm).
b) The Leroux number in the determination of skid resistance is lowered.
c) In order to get a better idea of the surface of the block the loss of mass in the sand blasting test is determined with less sand and the permissible mean loss of mass value adjusted accordingly.
d) A new element concerning statistical analyses has been included in the draft: in order to find out whether abnormally high or law results are due to chance or not, the standard includes a chapter "freak results" in which the Dixon criterion is applied.
e) Another innovation is an appendix giving a few articles about certification. It is stated that acceptance tests are generally not necessary if the manufacturer delivers his products with a certificate from an independent certification institute unless the buyer makes a special request to the factory.

2. QUALITY ASSURANCE, DEVELOPMENT AND CONSEQUENCES.

In order to reinforce the competitiveness of the Netherlands industries on the home and foreign markets, the Netherlands Ministry for Economic Affairs has adopted a policy aiming at improving the quality of manufacturing processes and, hence, of finished products. The "Quality Plan" of the Ministry has two parts [4] :

a) improving quality systems in the factories so that it is possible to talk of quality assurance
b) setting up and/or developing certification systems to extend quality control and creating a central body in the Netherlands for coordinating these efforts.

Background history

Quality assurance is a new concept in the Netherlands. It started in the USA during the second world war, when it became suddenly necessary to set up in a very short time an efficient military industrial production with a high degree of certainty that the industries concerned would deliver products of constant quality conforming to the requirements.
To this effect a system was established in which requirements were formulated not only for the products but also for the organisation which makes them (or gives a service).
After the second world war, Japan gratefully adopted the USA experience with quality assurance in developing its civilian industry and even extended the system. The results are obvious to all and amply demonstrated by the flood of Japanese quality products on the European and American markets to the delight of consumers and dismay of Western industry.

AQAP

Nato established a number of quality assurance standards which are part of the conditions imposed by Nato on the manufacturers of its member countries for the granting of defense contracts. These standards are known as "Allied Quality Assurance Publications", AQAPs for short.

The Ministry of defence asked a number of plants in the Netherlands to check whether their organisation was able to satisfy the requirements outlined in a given AQAP. If the answer was positive the plant was "AQAP certified" and could be given contracts for supplying its products for Defense.
Requirements are set in AQAP1 of AQAP4 according to whether the manufacturer designs, makes and supplies its own products of whether the production is based on a completely pre-established design.

Netherlands quality assurance standards

After a certain time it appeared that the Netherlands civil industry also needed standards of this kind, which would apply not only in contract situations but would aim in the first place to help in developing good quality systems and implement them c.q. to improve competitiveness. At the initiative of the Ministry for Economic Affairs a standards commission was set up in 1979 within the framework of the Netherlands Standards Institute in order to establish standards in this field.
In September 1980 the commission completed the following standards:

NEN 2646 - Quality assurance - General conditions for quality systems for the design, manufacture and supply of products and service and for the application of processes (more or less in parallel with AQAP1).

NEN 2647 - Quality assurance - General conditions for quality systems for the manufacture and supply of products and services according to pre-established design and for the application of processes (more or less in parallel with AQAP4).

NEN 2648 - Quality assurance - General conditions for quality systems for the assessment and supply of finished products or providing services (Comparable with AQAP9 - much extended).

At the same time a practical guide-line NPR 2645 gave information on the background basis, aims and application of these standards.
In 1981 the following publications were added to the series:
NEN 2649 - Conditions for measuring and calibration systems and NPR 2650 - Guide-lines for the introduction of a quality system conforming to the requirements of quality assurance: NEN 2646, NEN 2647 or NEN 2648.

Definitions of concepts.

What is really meant by quality assurance? According to the definition in the standards it means: "The maintaining of a quality system, including the demonstration that the system satisfies the requirements".
A quality system means: "A set of defined procedures and rules aiming at ensuring that a product, process or service satisfies the requirements".
A subsidiary part of the quality system is quality control, defined as:
operational techniques and activities necessary to maintain the required quality of a product, process or service".
Finally, the heart of the matter, the concept of quality itself, it is defined as "the extent to which the overall properties of a product, process or service satisfies the requirements deriving from the purpose".
Requirements for a product or service may be based e.g. on legal prescriptions, standards, client specifications or specifications devised by the supplier himself (for instance based on market research).

Aspects of quality assurance

According to these quality assurance standards the supplier must have a coherent, written survey of the quality system - including its aims, administration and procedures - for carrying out all activities involved in the field of quality assurance. The system must be integrated in the management of the manufacturing.

If it satisfies the requirements mentioned in one of the standards it is possible to talk of quality assurance.
Such a written survey is often called the "Quality assurance manual" for a given form.

The main aspects of a quality system are:
- staff organisation (qualification, allocation of tasks and responsibilities)
- instructions (labour and assessment instructions).
- records of data (e.g. buying, production- and assessment data)
- corrective measures
- control of assessment and measuring equipment
- quality control on delivered products and services
- production control
- random sampling procedures
- treatment of deviating products
- storage, delivery and after sales service.

Corresponding developments in other countries

Apart from the USA, Japan and Canada, there have been simular activities in a number of West European countries. The UK has issued standards that are very close to those in the Netherlands. Similar standards are being prepared in the Scandinavian countries. In France and the Federal Republic of Germany there are standard commissions in this field. The first meeting of the ISO Commission ISO/TC 176 "Quality Assurance" took place in 1980 (in Ottawa). The International Organisation for Standardisation ISO to which all national standards institutes are affiliated, has for aim to establish internationally accepted standards in various fields. The participant countries start off by presenting their own points of view, after which an effort is made to achieve general agreement.

Since the Netherlands standards are based on documents established by the European organisation for Quality Control after studying the AQAPs and relevant American, Canadian and English standards, there is already a certain international aspect to these standards. It is hoped that the points of view in the ISO Commission will not be too divergent since the importance of international harmonization of standards is quite obvious from the angle of international trade.

Quality policy

Total quality control is slowly becoming a key concept for industry. It is no longer only the quality of the end product that is examined, past-production control in fact, but more and more there is a policy of paying attention to quality over the entire process, from development and raw materials to production and sales. A policy of this kind, embracing all stages, offers many more advantages to manufacturers than the previous approach. The previous approach consisted mainly in quality checking (called quality control but quite different from a quality system).
Products were checked in the factory and data put on records to be analysed by graphical (and later statistical) methods. Quality was measured on products at the end of the production process and, if necessary also at the beginning or half way stage.
This approach has now been superseded by exercising quality care over the entire manufacturing process in a fully integrated manner. Management often shows concern for integrated quality care only in these aspects where it can see an important profit motive. Management often wishes to invest in quality improvement only if the market dictates it and where it can be shown that such measures will result in a definite lowering of costs. According to the Dutch quality expert Mulder [5], management is very reluctant to engage in "vague" or preventive quality care activities.

This links up with the statement of an American expert Juran [5] that quality improvement is to be obtained for 85% at management level and only for 15% on the shopfloor.

The series of articles [5] in the journal "Financiële Dagblad" ends with the listing of a number of weak points to be observed in quality care in Europe.

- lock of involvement of top management
- quality care is left to the specialists and remains too much in isolation
- line management is not sufficiently involved.
- there is too much stress on the technical quality of the product.
- too little attention is paid to the marketing quality
- too little attention to a policy of prevention to ensure quality
- there may be good quality of the finished product but at unnecessarily high costs
- not enough influence at shopfloor level

Activities in the field of quality care do not generally produce spectacular results in the short term. It is all a question of attitude, of a fruitful industrial cultural environment or one that can be made fruitful, and also of training and development. And this could carry on for year after year, depending on the present day climate in the field of quality.

3. THE COUNCIL FOR CERTIFICATION IN THE NETHERLANDS.

Preparation

A Commission for quality assurance set up in 1972 within the framework of the Netherlands Standards Institute at the request of the Ministry of Economic Affairs, carried out a study on the situation in the Netherlands in the field of certification.

The conclusion of this study was that the situation in the Netherlands was particularly unwieldy because of the great differences in form, content, background and value of the certification systems operating is our country. It was recommended therefore to set up a regulating national body that would:

- provide a forum for concertation and cooperation in the field of certification between all interested parties.
- check and control whether certification schemes function according to criteria formulated and accepted by the interested parties as regards impartiality, competence, reliability and efficiency.
- adapt the criteria as needed to deal with new developments.

Commission for certification Affairs

In 1975 a Commission for certification affairs was set up, composed of representatives of the interested groups and with the task of formulating recommendations on the basis of the study mentioned above.
In 1980 the Commission put forward a proposal to set up a foundation "Council for Certification". The proposal was approved and the Council was set up on 9 February 1982 by the Minister for Economic Affairs.

Aims and implementation

According to its Statutes, the aim of the Council is to be "the central body in the Netherlands for regulating certification systems taking account of national and international agreements existing in this field".
The Statutes of the foundation may be summarised as follows:

a. The Council tries to achieve its objectives in many ways, e.g. the assessment of certification systems on request as regards the criteria; the granting of accreditation to systems which satisfy the criteria; the checking of accredited bodies, the encouraging of coordination between these bodies and of harmonisation of their certification systems; advising the authorities on certification problems; making recommendations for participation of the Netherlands in international certification organisations; publicising certification markings of accredited bodies and providing information about the usefulness of certification.
b. Policy making and its implementation is allocated to a board and a executive committee, coordination commissions, director and bureau.
c. The board is wide-ranging in its composition:
   representatives of the ministries, of various sectors of industry, service industries, retailing, consumer organisations, accredited certification bodies, the Standards institute, scientific bodies, research organisations ans possibly some independent experts will participate in this board.
d. The executive committee is restricted in its composition and consists of half a dozen members of the board. Its main task is to grant accreditation to certification bodies which satisfy the criteria or cancel it if criteria are no longer satisfied.

Accreditation criteria

It would exceed the scope of the present paper to go into details of the criteria applied for granting accreditation to certification systems. Important features are:

- cooperation of interested parties in formulating requirements and methods of investigation which form the basis of the certification system as also in the choice of the type of certification (certification of product, service-process and/or quality system) the combination required and the frequency of assessment.

- definition in writing of the certification system
- qualification of staff, possibly of any research laboratories involved.
- recording of data concerning certification
- control of testing and measuring apparatus also in any research laboratories involved (e.g. by calibration according to specific requirements).
- confidentiality of any information about plant, firms, processes, products etc. acquired in the course of certification work.
- possibility of appeal against a decision of a certification body
- type of presentation of the certification system
- handling of claims and complaints about certificated products, i.e. quality systems
- sanctions against abuse of certificates and/ of certification marks.
- equal treatment of requests for certification from national and foreign manufacturers.

Definitions of concepts

The following definitions apply:

Certification

The operation of a certification system by a certification body.

Certification system

A documented system intended to determine whether products, processes, services and/or quality systems conform to the requirements which are the conditions for granting a supplier the use of a certification mark or certificate and also to carry out supervision to ensure that the above requirements are still satisfied after certification has been granted.

Certification body

A legal entity fully entitled to operate one or more certification systems.

Certificate

A written declaration the use of which is granted by a certification body to any one who whishes to make known

a) that the certificated products or services conform to the properties and requirements specified in the certificate, and/or
b) that, as regards the process or quality system described in the certificate, the plant operates as described in the certificate and in conformity to the requirements for the certification.

Accreditation

The Council for Certification has issued its first certificate of accreditation on 26 september 1983 to KEMA of Arnhem for the assessment of electrotechnical materials. At the time there were another 14 requests in the pipeline. It is expected that the other requests will be dealt with in the course of 1984 and 1985.

Quality assurance and certification

Chapter 2 gives a few details about quality assurance. Is certification a logical consequence of quality assurance? This may often be the case.

There are various types of certification. There is certification of products, of services, of processes and of quality systems for both manufacturing and service industries.

Certification of products can also be based on a combination of different activities.

Applying all this to the certification of concrete paving blocks, it may be stated that it is based on a combination of:

- assessment of the manufacturer's quality system to check whether the plant can produce products of constant quality.
- examination of samples taken from the production run or from stocks

If the certification concerns only the manufacturer's quality system, the manufacturer will still have to convince the buyer that his products satisfy the buyer's requirements. The way in which this is to be done - in conformity with the relevant standards - is laid down in the sales contract between manufacturer and buyer. This could lead to a tendency for buyers to make their own inspections at the factory, which would offset the initial advantages of certification.
By including the end product - in this case the concrete roadpaving blocks - in the certificate the buyer will no longer have to control the product himself since the certification body states that the product is deemed to satisfy NEN 7000.
Certification of a quality system "by itself" does not seem to be very acceptable for buyers. They also whish a check on the end product as well.

Combined assessment of a) the quality system and b) the end product seems therefore to be the most attractive solution both for the buyer - who gets the best certainty that the product conforms to his requirements - and for the manufacturer - efficient quality management and few external inspections.

4. THE THREE STAGES: STANDARDISATION, QUALITY SYSTEM, CERTIFICATION

The previous pages give an outline of the development of standardisation, quality systems and certification in the Netherlands. The development towards standardisation, quality systems and certification is stimulated by two important groups in the market situation, namely:

1. The users. They are getting more critical. Not only the professional users, such as those who use concrete road paving blocks but also individual users, the consumers. In the view of the user a product made in conformity to a standard, in a plant with a quality system in operation and checked by an independent certification body carries an aura of objective respectability.
2. The manufacturers are also becoming more critical. They are aware that systematic quality care has advantages. A note to the Minister of Economic Affairs states: "Systematic quality care requires constant supervision and better control of the production process. At the initial stage this generally means an increase in cost. In the second stage, however, it may result not only in greater mastery of the quality of the goods produced or services provided, but in a structural lowering of cost levels, since losses of manhours and equipment can be reduced to a minimum. Greater mastery of quality will also lead to possibilities of economy on servicing and maintenance".

In our country, there is a stimulus for the application of quality assurance standards. This means that manufacturers should have a quality system in operation in their factories. If a manufacturer want to show his customers that he keeps his quality system at the right level through quality assurance and that this quality system satisfies the requirements, it becomes rapidly obvious that certification is a very suitable means to achieve this objective.
The two critical groups mentioned above, users and manufacturers, are in fact, in total agreement; they want a quality product at a fair price and with a reasonable durability. What are the criteria by which it is possible to decide whether a product belongs in this category? First of all, it is necessary to set requirements, not too high, not too low. On no account should the requirements be any higher than the requirements necessary for fitness for purpose. For concrete road paving blocks it is standard NEN 7000 with a single quality class which applies in our country.

In the opinion of the standards-commission any quality below that of NEN 7000 would be irresponsible and any higher quality unnecessary. The standard does not specify any "gilt edge quality" anyway; it would be much too expensive for the field of application. The standard gives an optimum quality for concrete road paving blocks; less is not permissible and more is quite unnecessary.

Secondly : the manufacturers of building materials must ensure that they provide the required quality. To this effect it is necessary that they should have a quality system capable of making sure that the products satisfy the specified requirements

Thirdly : the best way for a buyer to make sure that he is buying a good product is to buy it from a manufacturer operating a quality system. Certification is then the most objective and efficient and also cheapest method to check that manufacturers provide products which satisfy the requirements. Otherwise, each buyer would have to make sure himself that such is the case. Consequently there is a clear link between certification and a) standardisation - quality requirements for the products and b) the quality system of the manufacturer.

At the setting up of the Council for Certification in 1982 the Minister of Economic Affairs said that making good quality products would turn out cheaper in the end than making poor quality products. Quality care and its demonstration through certification pays for itself in the end. "Quality pays" is the motto of the three stage procedure: standardisation, quality system, certification. Certification always implies systematic quality care on the part of the manufacturer as a condition for granting a certificate.

5. CERTIFICATION OF BUILDING PRODUCTS IN THE NETHERLANDS

The history of the certification of building products in our country is closely linked with the history of Foundation KOMO. This foundation was set up in 1961 at the initiative of the directors of municipal public works services because it seemed more efficient to carry out joint assessments for the various municipal authorities. So far each buyer had carried out its own assessment. However, this centralised assessment is far more than the sum of a number of individual assessments since the centralisation and combination of assessments meant that the assessment institute carried out far more frequent and even daily inspections of a manufacturing plant.

This meant: more direct contact with management, better understanding of the quality control, availability of long term data, better knowledge concerning specific defects, more information about disturbances etc. Because of its continuity, central assessment came close to production control.

And this continuous production control by KOMO led rapidly to the introduction of the KOMO guarantee mark system. This entailed a commitment of the manufacturer in relation to KOMO to ensure and to guarantee to his customers that his product conformed to the quality requirements specified by KOMO.

KOMO gave the manufacturer the right to use the name of KOMO together with its trade name and undertook to make sure that the manufacturers fulfilled his obligations. It meant that KOMO made random inspections to control production. This no longer concerned a given batch for a given customer but the total production for which all customers have the same requirements.

To return to the history of KOMO: it started with a number of commissions for plastics, cast iron and concrete products. In 1967 - after the completion of NEN 7000 - the first KOMO guarantee marks for concrete road paving blocks were granted.

Towards the end of 1967, there were 14 factories that could provide concrete road paving blocks under KOMO guarantee marking. The number has now risen to 36, all located in the Netherlands. In that time KOMO has also grown and there are now 1850 valid quality declarations available covering over a wide range of building materials. In the meantime foundation KOMO has changed from its initial role as a customers organisation to that of a general quality declaration organisation as from 1983 [8] .
The Board of KOMO which has about 35 members includes representatives of many bodies concerned with building such as national, provincial and municipal authorities, the manufacturers, contractors, architects, the trade investors, consumers and science. The reorganisation of KOMO in 1983 and 1984 is aimed at establishing a structure which should enable it to function in practice as the centralising umbrella organisation for issueing quality declarations. This central umbrella role of KOMO promotes clarity and prevents undue complication and frittering away of forces. Cooperation with inspection institutes and consultation with manufacturers and buyers results in a participation in the central function of KOMO by all these concerned in the building process.
The majority of KOMO's quality declarations concern Netherlands firms but the number granted to foreign firms increases every year. At the moment it is about 300 in 15 European countries [9] .

6. THE DEVELOPMENT OF CERTIFICATION OF CONCRETE ROAD PAVING BLOCKS.

Standard NEN 7000, issued in 1967, gave the requirements for concrete road paving blocks. It was then up to the manufacturers to provide blocks conforming to the standard. Quality systems and quality assurance as described above were still relatively unknown concepts at the early stages of certification then still called guarantee mark.
However, both the manufacturers and KOMO were keen not to restrict assessment to the end product but also the question of how the independent internal works control functions.
A publication [7] dating from this initial stage says the following: "The granting of the right to a guarantee mark is a very important question which can not be decided lightheartedly or with insufficient motivation. It is the formal expression of a relation of trust between KOMO and the manufacturer in which both parties accept a great deal of responsibility in relation to the customer. This is why it would not be sufficient to decide on the basis of a few random tests whether the finished product satisfies the requirements at a given moment.
To achieve true insight into the pattern of the quality level it is necessary to have detailed knowledge of the entire production and control arrangements in the factory. Particularly the question of how the internal independent works quality control functions and how it relates to management is of great importance. And finally, there is a factor that is difficult to express in words or figures that plays a very important part as well: what is the attitude in the factory. Are not only the management but also all the other parties involved fully aware that nothing can be overlooked or hidden etc....".
Even at the early stages in 1967 the quarantee mark control affected all parts of the production, internal control in the factory, control tests by the works laboratory and regular calibration of the apparatus, analysis of test results, internal communications, internal transport, storage, transport to the customer etc.
KOMO inspectors visited all concrete road paving block factories every week in 1967. They tested samples taken 28 days before. At regular intervals they took samples of 15 blocks for control testing by an independent laboratory.

In the very first years of the quarantee marking of concrete road paving blocks these external laboratory tests were very important. The results were the decisive factor in maintaining the quarantee mark agreement. Although, in theory, it was the independent internal manufacturer's control which formed the main element in the granting of a quarantee mark, the fact is that the results of external laboratory tests were really decisive because they brought real evidence. Rumour has it that in those prehistoric days some manufacturers awaited the results of the external laboratory tests in fear and trembling because - it seemed - they themselves had no real awareness of the quality of their products.
It is obvious that such conditions belong totally to the past. The number of checks through tests in an external laboratory has now been reduced to only a few per year and, anyway, always involves a double sample where one half is tested in the works laboratory and the other half by the external laboratory. This is to check whether the methodology used by the works laboratory is satisfactory.
In the 17 years since 1967 any amendments required in the approach of both manufacturers and KOMO have found their way into the procedure, but the principles of the granting of a quarantee mark still remain the same.

7. PROCEDURES IN CERTIFICATION, PARTICULARLY FOR CONCRETE ROADPAVING BLOCKS

The certificate is a quarantee document in which the certification body declares that the products of a given factory and ca rying the conformity mark can be deemed to satisfy the specifications quoted in the certificate.
The quality system operated by the manufacturer must be such that it is possible to guarantee that the end products will satisfy the specifications. It has already been mentioned what is meant by such a quality system. Part of this quality system is the internal quality control at the factory.

In the Netherlands, KOMO, in consultation with the manufacturer's organisation FABES has established a framework schedule for internal quality control on concrete roadpaving blocks according to NEN 7000 (see fig. 1) which is in force in all the factories that hold a certificate.
All these factories use standard forms for sieve tests on aggregate and mix composition, for batching and mixing equipment, for laboratory measuring instruments, for test reports on the 15 block samples, (fig. 2) for the weekly report and for periodic surveys of the internal quality control on concrete road paving blocks. Figure 2 has not been translated and it is to be hoped that it is sufficiently clear, even in a foreign language. All the forms are available at the KOMO-stand in the exposition. In this connection it is interesting to reproduce the text of Appendix A to the revised draft of NEN 7000 which is entirely devoted to certification. This is something completely new for the Netherlands. The text is as follows:

"Certification

A1. General

If a manufacturer provides blocks carrying a certificate[1] granted by an independent certification body, it is generally unnecessary to carry out acceptance tests unless the buyer has requested it specifically.

A2. Internal quality control

If a manufacturer delivers his products under a certificate as mentioned in A1, he is obliged to operate an internal quality control which is part of the base of the certification regulations.

1) Such a certificate may be issued by the Organisation for Quality Declarations for Materials and elements for building KOMO at Rijswijk (ZH).

The internal quality control includes e.g. requirements for the production management (process control; the operation of an internal quality control; measuring and test facilities; judicious use of these facilities and records of results; feedback to management, internal transport and storage of raw materials and finished products). Within the framework of this internal quality control it is possible to include a control test in which a sample is taken two days after production and placed within two days in water in the laboratory or in a wet room with a temperature of 20 ± 2°C. If placed in a wet room there must be a film of water on all faces or the blocks. After 28 days the blocks are tested according to 7.5.2. The certification body checks the results on the internal quality control at regular intervals and takes or orders samples to be taken which are then tested partly in the works laboratory and partly in an external laboratory".

How is a certificate established?

When a manufacturer makes a request for certification, KOMO will inform him of the main points the application procedure.
This procedure is described in the Regulations for Quality Declarations [6] (which have been translated into English, French and German and are available from KOMO on request). The basis for the certification of concrete road paving blocks is: a) the above mentioned "Regulations for Quality Declarations b) the Regulation of the Appeal Council c) NEN 7000 d) the framework schedule for internal quality control. Once the manufacturer has filled in the application form and returned it duly signed, one of the inspection institutes of KOMO (in the case of concrete road paving blocks this will be KIWA) starts the preliminary investigation. This includes an judgement of the factory; including e.g. equipment, internal quality control, measuring and testing facilities, recording of measurement and research results, qualification of the staff, internal transport and storage of raw materials, half-products and end-products.

There is also a testing of samples both in the works laboratory and in an external laboratory (in this case mostly the IBBC-TNO at Delft).
If the inspection institute gives a positive answer to the application it notifies KOMO and produces a final report and a draft certificate recommending the granting of a certificate.
KOMO checks whether the content of the certificate complies with the statutes, regulations and other guidelines issued by KOMO and presents to the manufacturer a written agreement together with the final certificate. When the agreement is signed the inspection institute will make random inspection visits to the factory to find out whether the manufacturer operates his quality system in the agreed manner and continuously supplies concrete road paving blocks that satisfy standard NEN 7000. For each inspection the inspector fills in a form in which he records his findings. One copy of the report is kept in the factory (fig. 3). If the manufacturer fails to comply with the agreement KOMO can apply sanctions: reprimand, suspension or cancellation of the certificate. Once every quarter KOMO publishes a list of certificate holders. The manufacturer must make sure that any customer to whom he presents his products has a valid certificate available. This is why all certificates are printed. For concrete road paving blocks it is also agreed that bills of lading shall carry a yellow seal with the KOMO mark and that each packet of blocks is clearly stamped with at least a black ink 150 x 66 mm stamp. It is extremely important for the user to know that the products carry a KOMO certificate. He then knows that an independent institute inspects the manufacturer at regular intervals so that the risk of getting a defective product is minimal. If by any chance he still found a product that does not comply with the requirements, the manufacturer who had guaranteed that his products did conform to these requirements, will certainly want to put matters right.

And KOMO guarantees in turn that the manufacturer will honor his guarantee. If there is a complaint, KOMO examines whether the materials delivered really do not conform to requirements, acts as mediator for setting the claim and may impose a sanction on the manufacturer if he does not fulfill his guarantee commitments.

8. INTERNATIONAL CERTIFICATION - HAS IT ANY REAL ADVANTAGES?

A few years ago the Commission of the EEC put forward a proposal for a framework directive "concerning mutual adaption of legal and administrative procedures relative to building products" and presented it to the Council of European Communities. In EEC circles it had been observed that quality certification in the various countries may act as an obstacle to trade in practice. The draft framework directive was the object of much criticism. We, for instance, have wondered what the effect of implementation of the framework directive would be and what it was expected to achieve. There are still many things that should be harmonised in Europe before there can really be question of a common market for building materials. It is not only the rules for certification that need to be harmonised. It is far more the multiplicity of laws and national regulations which present obstacles to trade. In all European countries there are complicated systems of laws and regulations which, to put it mildly, do not exactly encourage trade with other countries. In spite of the trend towards release from regulations it can not be expected that the situation will improve rapidly. In any case, industry and users do not just await events. The International Standards Organisation (ISO) does excellent work trough:

a) harmonising the requirements for products on an international level.
   Unfortunately, there are still large empty areas in the field of building materials. Could this empty space be paved over with an ISO standard for concrete road paving blocks?
b) the requirements for quality assurance are approached in Technical Committee 176. The Commission is only a few years old however and has not yet produced many documents.
c) the special ISO certification branch CERTICO which has already done important preliminary work for the setting up of international or national certification rules, for instance by establishing guide lines for the acceptance of testing and inspection agencies. At the moment, guide lines are being prepared for certification bodies.

A part from all this, there is also the CEN, the European standardisation committee which is active in this field. CEN works in close cooperation with ISO to prevent any overlap. That does not mean that it might not be useful to envisage a European standard for concrete road paving blocks if a world wide approach seems a little over ambitious. Harmonisation of the "technical" basis (product standards and standards for quality systems), as well as harmonisation of rules for certification institutes are all necessary to achieve European certification. Such European certification does not yet exist in the field of building materials and it will be quite some time before reaching that stage. This does not mean that we could not make a start by outlining a few essential conditions. Your congress could take the initiative for instance to approach ISO or CEN with a view to establishing an international standard for concrete road paving blocks. Whether international certification in due course might offer opportunities for wider use of the product concrete road paving blocks can not be estimated.

As far as we know there is relatively little foreign trade in this product. It could well mean that so far the problem remains rather theoretical.

9. CONCLUSIONS

9.1 Standardisation of concrete road paving blocks gives an optimum quality in relation to the field of application. In the Netherlands it appeared that one class of product is sufficient, less is not acceptable, more is unnecessary. Every standard must be examined regularly in the light of new experience and insight.

9.2 To enable them to maintain their position in the market, manufacturers should be able to rely on a quality system. True quality policy is unevitable and this applies particularly to quality of management. If that quality is good, the quality of the concrete road paving blocks will necessarily be good also.

9.3 The best way for a buyer to make sure of the quality of the blocks is to buy them from a manufacturer who operates a quality system.
Certification is the most objective and effective and also cheapest method for ascertaining that manufacturers provide products which statisfy the requirements.

9.4 Since there are wide variations in form, content, backgrounds and value of existing certification bodies it is useful to be able to assess them against objective criteria. In the Netherlands, this is done by a Council for Certification and harmonisation in the building field is achieved by the umbrella certification institute KOMO.

9.5 The harmonising procedure in quality assurance and KOMO certification of concrete road paving blocks, with a framework schedule for internal quality control and standard forms works well in practice.

9.6 It is extremely useful to strive for harmonisation on an international level, for instance of:
a) Standards for concrete road paving blocks
b) Requirements for quality assurance
c) Criteria for certification systems

A solution to these questions could eliminate obstacles to trade.

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Figure 1. Framework schedule for internal quality control on concrete roadpaving blocks according to NEN 7000

What has to be tested		Which item has to be tested	How to be tested	Frequency of testing	Notation
CONCRETE	mixing time	adjusted time, dry mixture	through timing	once a day, each mixture apparatus	yes
		adjusted time, wet mixture	through timing	once a day, each mixture apparatus	yes
	mixture composition	compaxe ideal mixture with practical mixture	through sieving and specie analysis	when changing and when doubtful	yes
PRODUCTION	filling of the mould	exact filling	visually	3 times a day, each machine	yes
	consolidation	exact consolidation time	by timing	3 times a day, each machine	yes
	brushes	position and quality	visually	3 times a day, each machine	yes
	pallets, boards	wastage	visually	once a day, each machine	yes
	stamps, moulds	position and quality	visually	once a day, each machine	yes
	height of new product	aimed value	by measuring	when starting and during production twice a day, each machine	yes
	hardening[6])	aimed hardening time	by timing	once a day	yes
	relative humidity in hardening room[6])	aimed value	by measuring	once a day	yes
	assort	external defects	visually	3 times a day, each machine	yes
	after-treatment[6])	exact way of sprinkling,	visually	once a day	yes
		exact way of dipping	visually	once a day	yes
	voluminous mass of the fresh product	aimed value	by underwater weighing method by weighing and measuring	5 blocks a day, each machine	yes
FINISHED PRODUCT AFTER 7 DAYS	dimensions	aimed value	according to NEN 7000	once a day, 5 blocks each machine	yes
	skid resistance apparatus[7])	aimed value	according to NEN 7000	once a day, 5 blocks each machine	yes
	bending strength	aimed value	according to NEN 7000	once a day, 5 blocks each machine	yes
FINISHED PRODUCT AFTER 28 DAYS	dimensions	according to requirements	according to NEN 7000	once a week each machine	
	skid resistance apparatus	according to requirements	according to NEN 7000	15 blocks out of day-production	yes
	bending strength	according to requirements	according to NEN 7000		
	mass loss	according to requirements	according to NEN 7000	once a month 5 blocks out of above mentioned sample	yes

continued next page.

DRYING PLACE	weather conditions	minimum temperature	by reading thermometer	once a day	yes
		maximum temperature	by reading thermometer	once a day	yes
	finished product	external defects	visually	once a day	yes
	production date	legibility and exactly recorded	visually	once a day	yes
	marking	presence and legibility of the KOMO-mark	visually	once a day	yes
	storage	separate storage KOMO-production	visually	once a day	yes
LABORATORY/ MEASURING EQUIPMENT	bending machine	according to requirements	through external gauging by competent body	once every 2 year	yes[1])
	scales	reliability	through internal gauging by means of gauged weights	once a year	yes
	sieves	NEN 2560	visually	before use	yes, once every quarter
	marking gauges	reliability	through internal gauging	once every quarter	yes
	moulder gauge	reliability	through internal gauging	once every quarter	yes
	sand-blast apparatus (optional)	according to requirements[2])	through internal gauging by means of plate-glass	before every sample series and when testing continuously after every 25 specimen	yes
	skid resistance apparatus (Leroux)	according to requirements[3])	through internal gauging[3]) by means of a gauge-file	before every sample series	yes, once every quarter
	temperature gauge	reliability	through internal gauging	once every quarter	yes
DOSAGING/ WEIGH OUT AND MIXING EQUIPMENT	for:				
	-cement	reliability	through external gauging	once only, by supplier of the equipment issued gauge certificate	yes[4])
			through internal gauging	once every quarter	yes
	-aggregates	reliability	through external gauging	once only, by supplier of the equipment issued gauge certificate	yes[4])
			through internal gauging	once every quarter	yes
	for:				
	-additives[5])	reliability	through internal gauging	once every quarter	yes
	-colouring matter	reliability	through internal gauging	once every quarter	yes
	-mixing equipment	defects and fouling	visually	once a day	yes
RAW MATERIAL AND STORAGE	cement[5])	type nomination and class	stamp or signature on receipt	each delivery	yes
		required properties according to NEN 3550	inspection report or valid certificate	once every quarter	yes
		storage	visually	each delivery	no
	aggregates	type nomination	stamp or signature on receipt	each delivery	yes
		required properties	visually	each delivery	no
			sieving analysis	minimum once every 2 weeks	yes
		fouling	visually	each delivery	yes
			test according to NEN 3542	when doubtful	yes
		storage	visually	each delivery	yes
	additives[5])	required properties	stamp or signature on receipt	each delivery	yes
	colouring-matter	required properties	stamp or signature on receipt	each delivery	yes
		storage	visually	each delivery	yes
	mixing water, with the exception of potable water	noxious substances	by a fitness test (for instance British Standard 3148)	when applying well-water: at least once a year and when changing well using surface water: minimum 6 times a year	yes yes

continued next page.

What has to be tested	Which item has to be tested	How to be tested	Frequency of testing	Notation
TRANSPORT bill of lading	presence of KOMO-stamp NEN 7000	visually	once a day, all bills of lading	yes
	production date if the stones are not older than 28 days, this in accordance with KOMO-certificate	visually	once a day, all bills of lading	yes

Rijswijk, January 1984

[1]) certificate of gauging
[2]) draft NEN 2875
[3]) draft NEN 2873
[4]) only with new delivered equipment
[5]) statement of sort and class, report changes in sort and/or class to the inspection institute
[6]) dependent on system
[7]) only when - results after 28 days testing are insufficient
- reference investigation, executed by external laboratory, in connection with skid resistance are insufficient
- findings of inspection institute concerning the skid resistance are insufficient

Radical changes in as well the production process as the mixture composition, should be reported to the inspection institute.

Figure 2. Weekly report.

Weekrapport Betonstraatstenen

nr.	schuifm. b	schuifm. h	p	h (schuifmaat) hL1	hL2	hL3	hL4	hm	hgem	vormbak L	vormbak B	σ bt	str. heid	vol. massa
1														
2														
3														
4														
5														
mach. :					totaal									
afm. :		x	x	mm	gemiddeld									
type :					W									
kleur :					0,43.W = SW									
prod. d. :					1,65.SW = 0,7W									
bepr. d. :					minimum									

nr.	schuifm. b	schuifm. h	p	h (schuifmaat) hL1	hL2	hL3	hL4	hm	hgem	vormbak L	vormbak B	σ bt	str. heid	vol. massa
1														
2														
3														
4														
5														
mach. :					totaal									
afm. :		x	x	mm	gemiddeld									
type :					W									
kleur :					0,43.W = SW									
prod. d. :					1,65.SW = 0,7W									
bepr. d. :					minimum									

nr.	schuifm. b	schuifm. h	p	h (schuifmaat) hL1	hL2	hL3	hL4	hm	hgem	vormbak L	vormbak B	σ bt	str. heid	vol. massa
1														
2														
3														
4														
5														
mach. :					totaal									
afm. :		x	x	mm	gemiddeld									
type :					W									
kleur :					0,43.W = SW									
prod. d. :					1,65.SW = 0,7W									
bepr. d. :					minimum									

nr.	schuifm. b	schuifm. h	p	h (schuifmaat) hL1	hL2	hL3	hL4	hm	hgem	vormbak L	vormbak B	σ bt	str. heid	vol. massa
1														
2														
3														
4														
5														
mach. :					totaal									
afm. :		x	x	mm	gemiddeld									
type :					W									
kleur :					0,43.W = SW									
prod. d. :					1,65.SW = 0,7W									
bepr. d. :					minimum									

beproeving 7 dagen (dagelijks)

nr.	schuifm. b	schuifm. h	p	h (schuifmaat) hL1	hL2	hL3	hL4	hm	hgem	vormbak L	vormbak B	σ bt	str. heid	vol. massa
1														
2														
3														
4														
5														
mach. :					totaal									
afm. :		x	x	mm	gemiddeld									
type :					W									
kleur :					0,43.W = SW									
prod. d. :					1,65.SW = 0,7W									
bepr. d. :					minimum									

	maandag		dinsdag		woensdag		donderdag		vrijdag	
Afweeg, doseer en meng- apparatuur mengapparatuur										
Grondstoffen en opslag										
cement										
toeslag materialen										
hulpstoffen										
kleurstoffen										
aanmaakwater										
Beton	droog	nat	droog	nat	droog	nat	droog	nat'	droog	nat
mengtijd in sec.										
mengselsamenstelling										
Produktie										
vulling mal										
verdichting										
borstels										
pallets, onderleg planken										
stempels										
mallen										
hoogte vers produkt in mm.										
verhardingstijd in uren										
r.v. in verhardingsruimte (%)										
tempt. in verh. ruimte in °C										
uitsorteren										
nabehandeling										
Tasveld	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
temperatuur in °C										
gereed produkt										
produktie datum										
merken										
gescheiden opslag										
Transport vrachtbrief										

Fabrikant:

Opmerkingen:

Nr. 202-'82

Fabrikant: te:
Certificaat nr.:

Datum van de kontrole: 19
Keurmeester:
Nr.: Nr.:0002 *

	Bedrijfskontrole				Door KIWA uitgevoerde kontrole			
Lab./meetapparatuur	o	m	g	opmerkingen	o	m	g	opmerkingen
buigbank								
weegsch./contr. zeven								
schuifm./vormbakm.								
zandbl.app./stroefh.m.								
temperatuurmeter								
Doseer/afweeg- en mengapp.								
cement/toeslagm.								
hulp-/kleurstoff.								
mengapparatuur								
Grondstoffen en opslag								
cement/toeslagmat.								
hulp-/kleurstoff.								
aanmaakwater								
Beton								
mengtijd								
mengsel samenstell.								
Transport								
vrachtbrief								

	Bedrijfskontrole				Door KIWA uitgevoerde kontrole			
Produktie	o	m	g	opmerkingen	o	m	g	opmerkingen
vulling mal/verdichting								
borstels								
pallets/onderlegplanken								
stempels/mallen								
h. vers prod./verharding								
R.V.-/temp. verh. ruimte								
uitsorteren/nabehandl.								
volumiekemassa vers prod.								
Gereed produkt na 7 dagen								
afmetingen/stroefheid								
buigtreksterkte								
Gereed produkt na 28 dagen								
afmetingen/stroefheid								
buigtreksterkte								
massaverlies								
Tasveld								
weersomstandigheden								
ger. produkt/prod. datum								
merken/opslag								

Datum monsterneming: Produktie datum: Machine nr.: Opgegeven afmetingen: x x mm.

Steennummer		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	$\bar{X}$	s	X_{min}	afw.	1	2	3	4	5	$\bar{X}$	s	afw.
Lengte	mm																											
Breedte	mm																											
Hoogte	mm																											
Δh	mm																											
σ_{bt}	N/mm^2																											
Stroefheid																												
Massaverlies	gr.																											
Vellingk.	mm																											
Deklaag	mm																											

Opmerkingen:

	ontvangst	fabrikant	keurmeester	KIWA
paraaf				

KEURINGSINSTITUUT VOOR
WATERLEIDINGARTIKELEN N.V.

Nr. 212-'82

Figure 3 Report KOMO-inspection.