European Standards on Concrete Blocks, Flags and Kerbs

By Jan J.M. van der Vring, the Netherlands
convener of CEN/TC 178/WG1

Summary

Under the Technical Committee TC 178 "Paving Units and Kerbs" three working groups are active on drafting specifications for products made of concrete, burnt clay and natural stone.
Workinggroup 1 is called WG1 "Precast Concrete Products". The group has drafted three standards: one for blocks, one for flags and one for kerbs. These drafts have been sent for enquiry to the European countries involved.
The standards give definitions and specifications for dimensions, strength, freeze/deicing salt resistance, resistance against abrasion and slip-/skid resistance. Also a proposed procedure is given for production control and attestation of conformity.
Although CEN-instructions demand that the requirements for physical and mechanical properties have to be performance-related and only can be specified by already existing testmethods, the tests proposed are "updated" and modified to meet the wishes and experiences of the expertmembers and their backing national advisors. So, after offering the drafts for enquiry the workinggroup has set up research programs to verify the proposed testmethods in the drafts. National testprograms are on their way to gain these data and the necessary experience to get the connection with the former situation. The results of these programs will be exchanged and discussed internationally. The results may be available on the moment the workshop will be held in Oslo.

1. INTRODUCTION.

In the history of the unification of Europe a unique process is taking place. Thousands of technicians are occupied with determining European Standards as another contribution to pulling down trade-barriers. This is supervised by the European Organization for Standardization (CEN).
Regarding building activities, within the CEN-organization a coordinating programme committee called "P.C. Building" has been created. Under this committee hundreds of technical committees are activated. One of them is the TC 178 "Pavement Units and Kerbs", established in november 1989 and with the United Kingdom holding the chairmanship and secretariat.
During the first meeting of this Technical Committee 178 it was decided to subdivide the scope in three different fields of interest based upon the three materials the elements can be made of. For each of these fields a workinggroup was established:

Workinggroup 1 (WG1): "Precast Concrete Products" (convenership by the Netherlands),
Workinggroup 2 (WG2): "Natural Stone Products" (convenership by the United Kingdom),
Workinggroup 3 (WG3): "Clay Products" (convenership by the United Kingdom).

In this contribution only the activities of WG1 are described.
WG1 was strongly supported by the international BIBM-organization which made the first proposal for the standards and did a lot of work after that.

They formed a very successful "Taskgroup" for WG1. These organizational facts are brought together in figure 1.

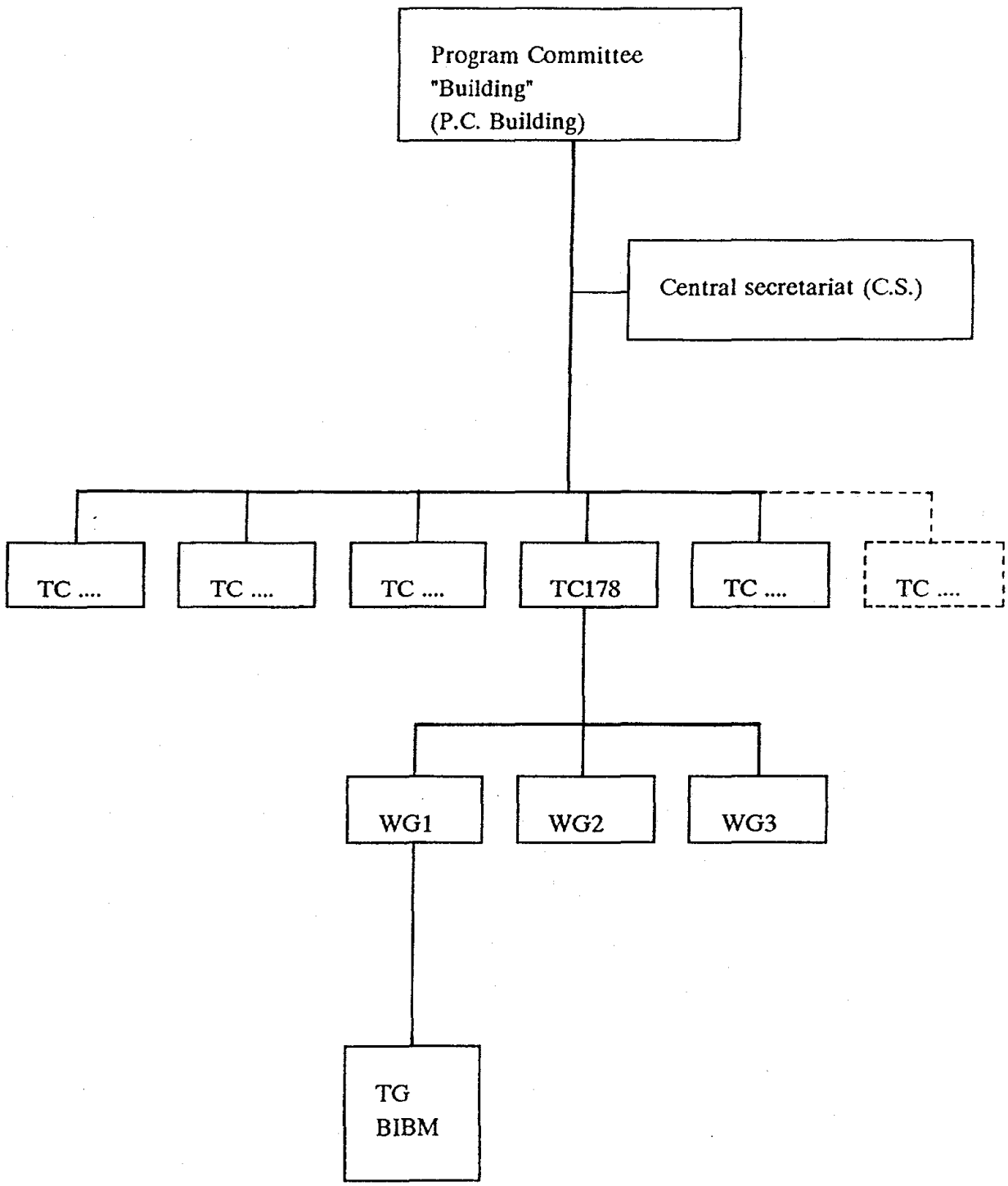


figure 1.

WG1 was set up on 19 february 1990 in Rijswijk, The Netherlands. They had to focus their attention on external paving elements of precast concrete. In this workinggroup, which needed 12 meetings to deliver the draft standards for inquiry, 14 countries are represented.
During the first meeting it was decided to have three standards concerning with concrete blocks, concrete flags and concrete kerbs. The reason for this subdivision was the different shape of these elements (compact, flat and thin or stretched longitudinally), the different way of casting and in a number of cases the composing materials.
It will be obvious, that these standards are to be "product-standards"

2. STARTINGPOINTS.

By setting up such a big operation on standardization, it will be clear, that there is a strong need for a uniform lay out and format for the standards and also standardized procedures and terminology. Therefore a lot of rules and formalities have been constituted.

More in principle the starting points for this European standards are:

1. They must be performance related.

2. Only existing methods are to be used. The development of new tests is not allowed.

3. The products must fulfil the six essential requirements, set up by the European Committee (EC). These are:

   - Mechanical strength and stability
   - Safety in case of fire
   - Hygiene, health and the environment
   - Safety in use
   - Protection against noise
   - Energy, economy and heat retention

ad1) This means, that they must be related as much as possible with the use and circumstances in practice. So, testmethods that are used to qualify the products must be closely related to properties that are essential for the practical use.
It is very difficult to measure "reality". For instance, almost every testmethod uses specimen that differ from practice due to their form, the way of production, the conditions of storage, inhomogeneities, their sampling, etc. Another, more specific, difference will occur if the testmethod measures a property in an indirect way. It is also current practice, to accelerate the process tested when it is taking too much time in a normal performance related way. There are many reasons possible that make a testmethod measuring something different from reality.
In combination with the fact, that only existing methods are allowed to be used, this is a very difficult point to maintain.

ad2) This preliminary principle is set up to prevent endless experimenting and to obviate the use of this as an excuse for extending the development and introduction of European common standards.
In practice it also has been very difficult to maintain this rule.
Loose thinking might lead to the thought that it would be a good solution to take for each property the best specification available from the national standards involved and put them in a new "super standard" with nothing than highclass requirements.
In practice this is not possible and not wise.

First of all, each specification or requirement does not stand at its own and cannot be isolated. It must be regarded in cohesion with the other specifications. Together they form a coherent system for establishing the quality of a product.

Second, each country has a different system which performs more or less satisfactory for the user and most of them are in service for a long time. The parties involved are used to the system and know rather well what to expect from the tests connected with the requirements or specifications in each system. New specifications generate uncertainties, differences in interpretation of the results and differences in carrying out the tests.

Third, it will be very difficult to estimate the value of a specific requirement and the testmethod to verify it. This is a result of the fact that this value is coherent with the other specifications. Besides this, a lot of requirements are not performance-related and the corresponding testmethod gives indirect data for the property to be regarded.

A new standard has to be a comprehensive system of properties and testmethods related to this, characterising the product.
The number of tests has to be limited as much as possible and the testmethods have to deal with properties that are not or less dependent from each other.
The testmethods have to be as simple as possible. They must show a good reproducibility and less scatter and must be carried out against the lowest costs.
Experience has learned, that in many cases these criteria are difficult to quantify and so a choice based on rational considerations is hard to make. This caused, and still causes, a lot of discussions.
Another point is that by making a choice for one existing method, there are always countries that have no experience with that specific method due to the fact that in the existing national system they do not measure this property or that they use a different method. So, research to gain experience, to get acquainted with the new method or to establish correlations with the former method used is essential and reasonable.
When a specific method has been chosen for one reason or the other, it may become clear, that this method has certain imperfections that have to be cleared or solved and this sometimes causes also the need for investigations to determine the right materials used and to set up adequate uniform specifications. After that, a modified testmethod may be the result with nobody having comparable figures or data to verify it. This is almost the same situation as in case of a new method.

ad3) The essential requirements are not typical for CEN, but given by the EC. This has to do with the fact that a European standard has legislative force. CEN is not a legislative institute. Adopting a CEN regulation is a voluntary act of a country or manufacturer. EC-intervention is needed to make it European law.
If a product fulfils the six essential requirements the way is free to ask for a "CE-mark". Products bearing an EC-mark have no trading limitations in the Common European Market.
The essential requirements are related to constructions made with the product(s) specified in the standard. Not all the requirements are always relevant for a specific product. In the case of small concrete paving elements "Mechanical strength" and "Safety in use" may be relevant.

3. CONTENT OF THE STANDARDS.

The content of the standards has been set up according to a specific order which differs very slightly for the three different products. It starts with a preface preceding the different chapters.

Preface.
In the preface data can be found about the committees that have been busy to create the standards, the mandate given by the EC, the essential requirements that are relevant and, if necessary, guidelines concerning the content of the standards.

1. Scope.

   The scope contains data about where the product in the standard is meant for and indications for the use and application of the product.

2. Definitions.

   A uniform description of the terms used in the standard is an essential part of the text.

3. Requirements for materials.

   In this chapter a specification is given about the composing materials of the product and the relevant requirements (levels).

4. Requirements for products.

   In this chapter the requirements (levels) can be found for the properties that are related to the use of the product (performance).

5. Test methods.

   Every requirement and its specific level mentioned in 3) and 4) must be verified according the test method or procedure specified in this chapter.

6. Marking.

In this chapter the identification of a product is specified. It contains information about its place of manufacturing, producer, EN-number, moment of production, kind of product and eventually its certification.

7. Assessment of conformity.

This chapter may contain matters about procedures for production-control in which are indicated the commitments for the producer, the certifying body and the procedures for delivery control.

- Annex A (normative); Quality assurance and switching rules.

Rules for quality assurance and diverging situations are given in this annex. They have been placed apart to keep the essentials of the standard clear.

- Annex B (informative); Test methods and examples of measurement equipment.

In this annex testmethods are given that are not obligatory in the standard. Besides that, examples are given of measuring devices.

The chapters 1 and 2 need no further explanation. About the rest of the content the following remarks can be made:

Ad3) "Material Requirements"

The materials used to manufacture these small concrete paving elements are cement, aggregates, water, additions, admixtures and pigments.
In the specifications an opening has been made for the application of materials not covered in the standard. However, they must lead to a product with properties that are comparable to a product made with conventional materials.
The specifications in this chapter are based upon national or local existing regulations, so no further specifications are given.
For pigments it is specified that they can be organic or inorganic, provided that they are stable.
No testmethod is known to specify this stability. The members of WG1 have considered this property important enough to say something about it in the standard. So, this is the only requirement for which no testmethod is described.

Ad4) "Product Requirements" and
ad5) "Testmethods"

The two chapters are taken together while they are so closely related to each other, that it is more sensible for these two to make a division based on the properties specified.

Dimensions.

For measuring the dimensions of concrete paving blocks, flags and kerbs no specific method is given. In annex B some devices are described.
Essential is, that values for tolerances are given. They have been brought in connection with different ways of use and this has resulted in the use of a number of classes.

Strength.

For paving blocks a splitting value is given. The blocks are tested over the length in order to test as much material of the block as possible. This results also in a large breakingsurface that can be inspected visually.
The splittingtest is an easy and rather cheap test. It measures the tensile strength which is the tension for instance generated in case of spalling.
The splitting test has also its limitations:

- The splitting test is very sensitive for the size of the aggregate, although it is said that this can also be seen as an advantage. It makes the splittingtest a better performance-related test
- The splitting test is more thickness-dependent than the test for the compressive strength. It looks like this can be overcome by using correctionfactors as has been shown in calculations with comparable testresults.
- The variation coefficient of the splitting test is approximately 10% while this coefficient for the compressive strength is below 5%. It is indicated, that the 10% is too high.

This splitting test has been developed in France and many other countries like Germany (Compressiontest) and The Netherlands (Tensile strength) that are not used to this will set up a test program, in order to gain experience.
This test is a very good example of how adoption of the method took place after a lot of modifications were made. For example the diameter of the bearers was enlarged and this caused a wider range of scatter which was diminished by using smaller packing pieces with a limited thickness which also had to be specified according existing rules for hardboard.
The principle of the test is given in figure 2.

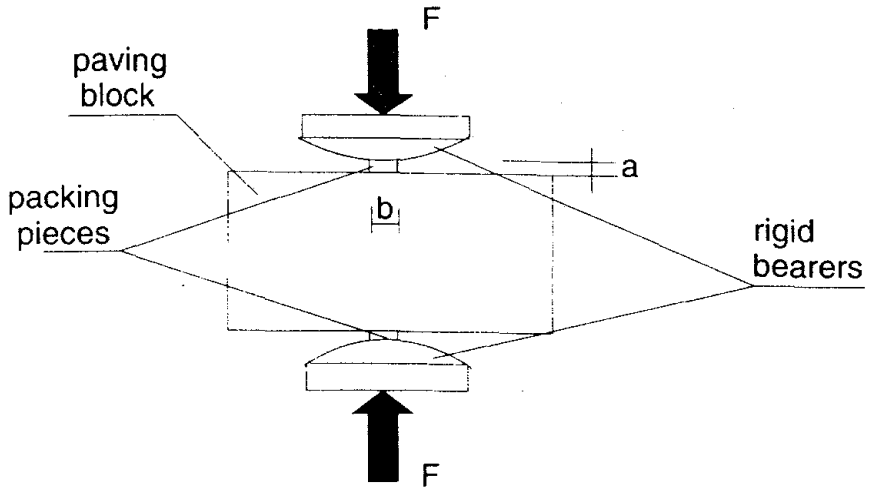


figure 2.

For concrete flags and kerbs the strength is measured by bending them. This differs hardly from existing practice in most countries. The principle of the testmethods are given in figure 3 for the flags and in figure 4 for the kerbs.

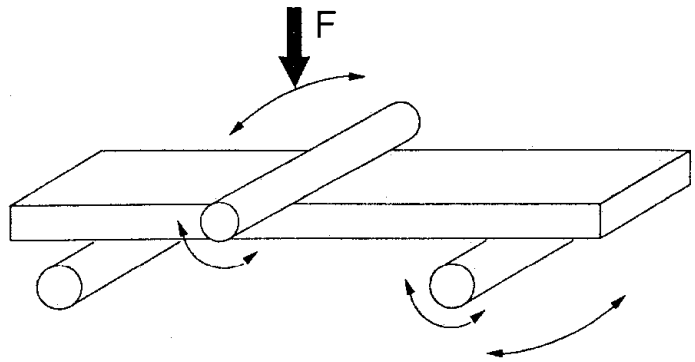


Figure 3

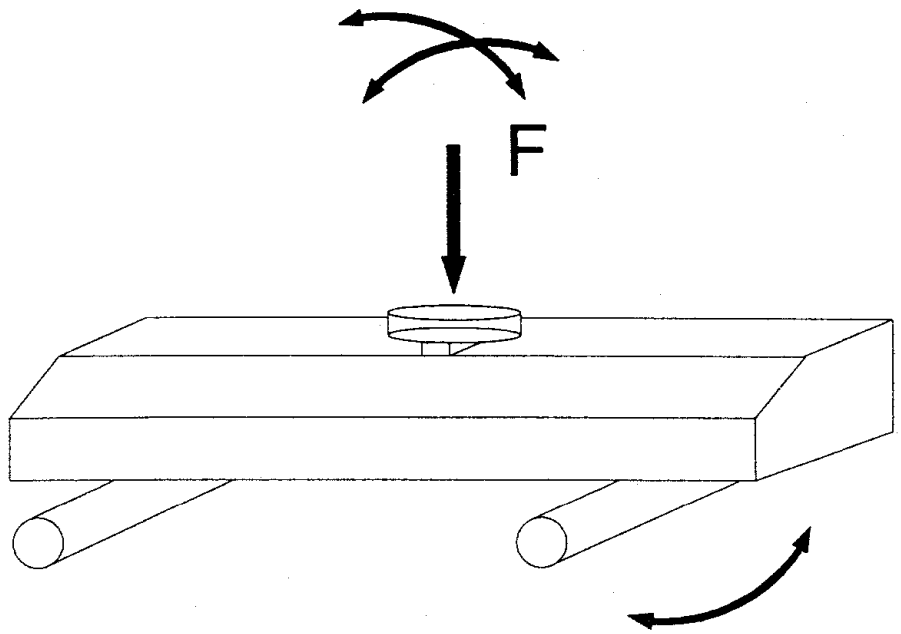


Figure 4

Abrasion.

The abrasion value will be measured by the so called "Wide Wheel Abrasiontest" of which a sketch is given in figure 5

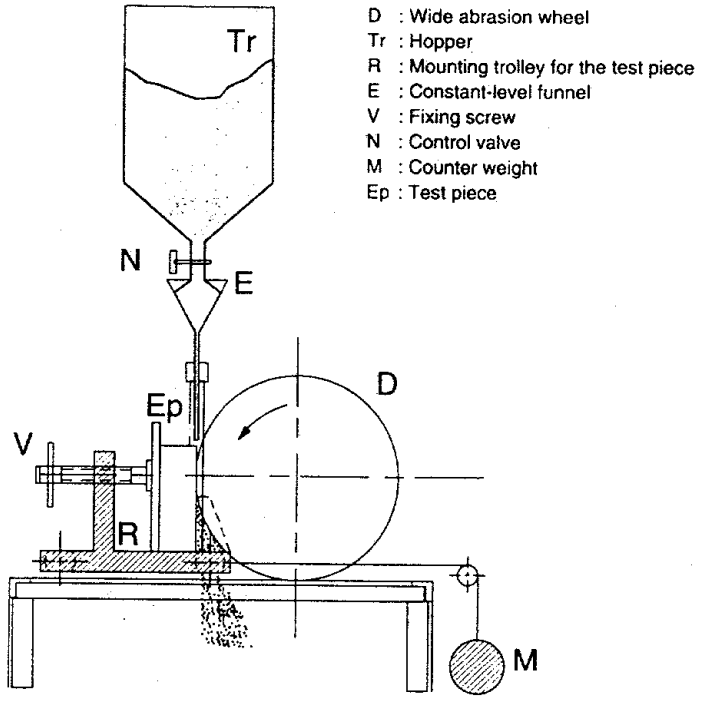


figure 5

What exactly has to be measured is indicated in figure 6.

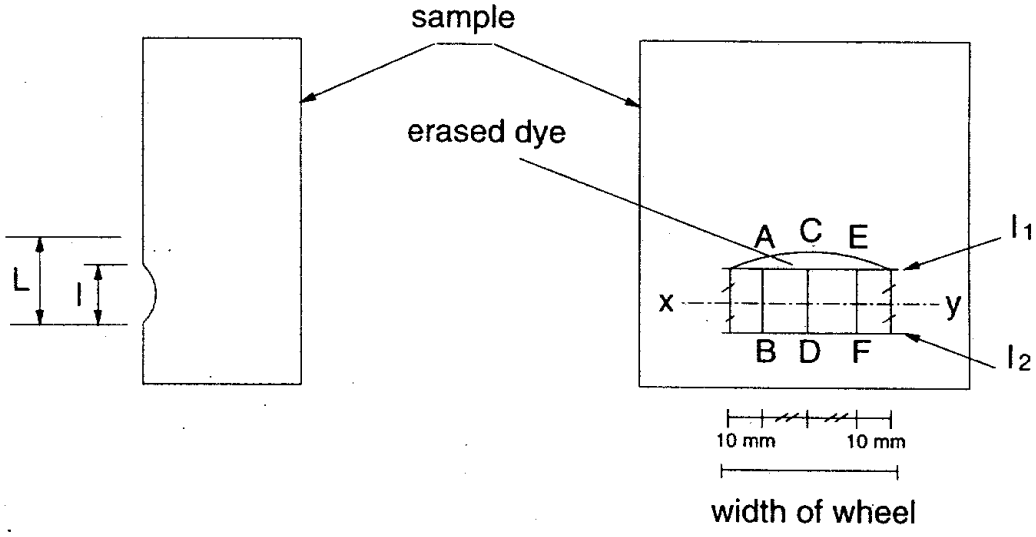


figure 6.

Besides in France, this test was known in a very few countries. For the same kind of value the German "Böhme-test" can be used. In Germany this test is very seldom used nowadays, while the other German specifications result in a product, that automatically meets the requirements for the Böhme-test. Both methods have a good correlationship.
Like the test for strength, the initial method for testing the abrasion (Capon test) has been modified on many points. For example the original abrasive "Fontaine Bleau sand" has been replaced by the more worldwide known and better specified korund. The abrading wheel has been widened from 10 mm to 70 mm to neutralise the influence of the individual particles of the aggregate and the number of circulations and the force to press the specimen have been adjusted.
This and the fact that almost no country is familiar with this testmethod has raised the need for a prenormative testprogram on this subject. Within the European Common Market special funds are available for this aim and a request of WG1 for financial support has been successful and enabled the start of a testprogram. This program is coordinated by France and is aiming at verifying and improving the repeatability and accuracy of the testmethod by internationally agreed series of tests and exchange of data.

This test is applied for all three products: blocks, flags and kerbs.
To meet the possibility for several kinds of application in the various countries, several classes have been established. Also a class for the use of studded tires has been installed, although the use of them is restricted to a very few countries. The testmethod for this is adopted from Finland, but most of the Scandinavian countries will reject this test nowadays and in case they will change to a intensified abrasion test. It will be clear that Mediterranean countries have no need for this.

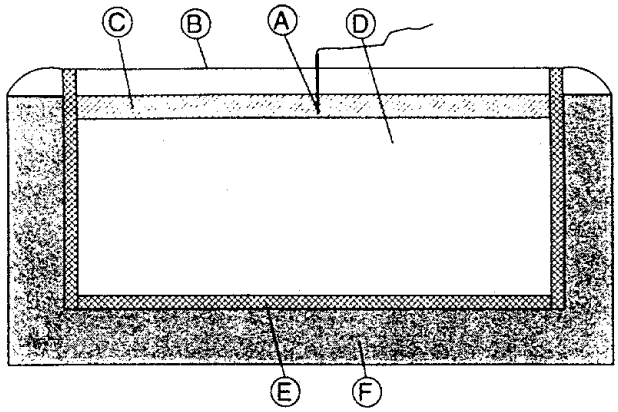
Slip-/skidresistance.

Normally spoken, a surface made of concrete is slip-/skidresistant enough. Consequently it is presumed, that the surface of an element-pavement is not worse. This was agreed by most of the members of WG1. So, although there is an essential requirement "Safety in use", affecting this property of the pavement, no requirement is given in the standard. To show that this is on purpose, it is mentioned in the standard, that if the purchaser wants a specification for this property, the testmethod of the clay-products has to be used. In the annex B a description of this testmethod (S.R.T.) is given.

Frost/deicingsalt resistance.

Although very few countries had a test for this property in their national standards, it was almost unanimous agreed to have a specification about this in the European standard
To measure this property a vast series of methods is available and it is very hard to establish which one is the best.
All of them have in common that they are very complicated, need a long time to be executed and have to be performed with very special expensive equipment. They are accelerated tests.
After long discussions it was decided to choose an existing Scandinavian testmethod

experienced for some time by Denmark and Sweden. Provisional tests carried out in other countries, to get an idea about the testresults from tests done with national products were in a number of cases alarming. This was reported in the WG1-meeting held in The Netherlands on 26 and 27 august 1993. Now new specifications are available and unofficial prenormative research is carried out to bring down the scatter and to improve the repeatability of the method.
How the specimen is instrumented and packed in isolationlayers is shown in figure 7.



A : Thermo-couple
B : Evaporation protection
C : Salt solution
D : Specimen
E : Moisture barrier
F : Thermal insulation

figure 7.

In figure 8 the diagram is shown according to which the specimen is frozen en thawed.

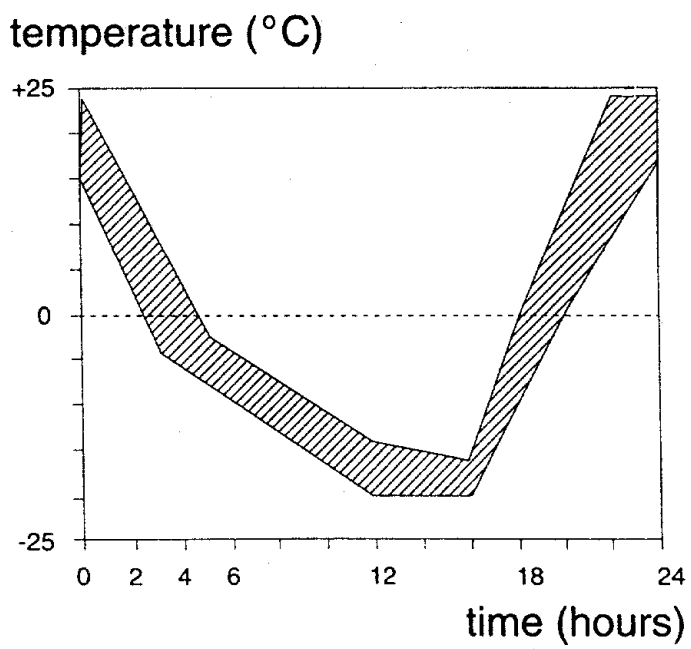


figure 8

Ad7) "Production Control"

Up till now it is rather uncertain what is going to happen on behalf of this subject. It is very clear, that there are big differences in Europe in the way manufacturers and purchasers are dealing with each other.
Nevertheless, WG1 has taken the opportunity to make a proposal that makes sense. It was initially set up and re-drafted by the BIBM-committee, acting as a taskgroup for WG1. In this group the manufacturers are represented and therefore the proposal can be regarded as a very serious attempt of the manufacturers to bring more uniformity in the situation and to push back the free remaining situation in several countries.
Some of the regulations are put in the standard. The rather extensive procedures are put in Annex A.
The inquiry-period will show what it is worth.

4. HOW TO PROCEED ?

Very recently (december 1993) the standards have gone for enquiry and the national comments and suggestions are being formulated.
The enquiry-period will end at the 15th of may.
In the mean time, after delivering the draft-standards to the TC 178, WG1 has continued its activities. They were mainly aimed at the results of prenormative research and the experiences with the various testmethods.

After the period of enquiry is over, the comments will be gathered and brought in a special "Comments Resolution Meeting". This meeting is a limited version of TC 178 and will order the comments systematically.
The comments will be dealt with in the workinggroup WG1. After this the TC 178 has to formalize the standards, if necessary by voting.

The future acivities are scheduled as follows:

- Enquiry : december 1993 - may 1994
- Treatment of comments : august 1994 - august 1995
- Comments Resolution meeting : oktober 1994
- Meeting TC 178 : december 1995

It is obvious, that the European standards for precast concrete paving elements will need some extra time to go into practice.

Mailing adress: C.R.O.W, P.O. 37, 6710 BA EDE, The Netherlands
Phone: +31 8380 20410, Fax: +31 8380 21112