Institute of Geologists of Ireland
Pyrite Course
4/12/13

EN 13242 & SR 21

WHATS IN THEM & THE ROLE OF THE GEOLOGIST

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AGGREGATE PRODUCT STANDARDS

- EN 12620 Aggs. for concrete
- EN 13139 Aggs. for mortar
- EN 13043 Aggs. for bituminous mixtures
- EN 13242 Aggs. for unbound & hydraulically bound materials
- EN 13450 Aggs. for railway ballast
- EN 13383-1 Armourstone

(EN 13285 Unbound mixtures)

CONTENTS OF AGGREGATE PRODUCT STANDARDS

- GEOMETRICAL PROPERTIES (Clause 4)
- PHYSICAL PROPERTIES (Clause 5)
- CHEMICAL PROPERTIES (Clause 6)
- DURABILITY PROPERTIES (Clause 7)

- EVALUATION OF CONFORMITY (Clause 8 or 9)

EXAMPLES OF SOME GEOMETRICAL PROPERTIES IN AGGREGATE PRODUCT STANDARDS

- SIZE (d/D)
- GRADING (G, etc.)
- FINES CONTENT (f)
- FINES QUALITY (f, MB, SE)
- SHAPE (FI, SI, C, E_{cs})

EXAMPLES OF SOME PHYSICAL PROPERTIES IN AGGREGATE PRODUCT STANDARDS

- RESISTANCE TO FRAGMENTATION (LA, SZ)
- RESISTANCE TO WEAR (M_{DE})
- RESISTANCE TO POLISHING (PSV)
- RESISTANCE TO SURFACE ABRASION (AAV)
- PARTICLE DENSITY (ρ)
- WATER ABSORPTION (WA_{24})

EXAMPLES OF SOME CHEMICAL PROPERTIES IN AGGREGATE PRODUCT STANDARDS

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- PETROGRAPHIC DESCRIPTION
- SULFUR CONTAINING COMPOUNDS (S & AS)
- CHLORIDES
- CARBONATE CONTENT
- CONSTITUENTS EFFECTING SETTING OF CONCRETE

EXAMPLES OF SOME DURABILITY PROPERTIES IN AGGREGATE PRODUCT STANDARDS

- MAGNESIUM SULFATE SOUNDNESS (MS)
- FREEZE-THAW RESISTANCE (WA_{24} , F , F_{EC})
- SONNENBRAND OF BASALT (SB_{LA}, SB_{SZ})
- DRYING SHRINKAGE
- ALKALI-SILICA REACTIVITY

EXAMPLE OF REQUIREMENTS FOR A PROPERTY IN AGGREGATE PRODUCT STANDARDS

- The necessity for testing and declaring all properties specified (in EN 13242) shall be limited according to the particular application at end use or origin of the aggregate
- When required, the tests specified (in EN 13242) shall be carried out to determine appropriate properties
- When a property is not required, a “No Requirement” category can be used

EXAMPLE OF REQUIREMENTS FOR A PROPERTY (LA Coeff. in EN 13242) IN AGGREGATE PRODUCT STANDARDS

- EN 13242 Table 13 – Categories for max. values of Los Angeles coefficient

LA Coefficient	Category
≤20	LA_{20}
≤25	LA_{25}
≤30	LA_{30}
≤35	LA_{35}
≤40	LA_{40}

LA Coefficient	Category
≤45	LA_{45}
≤50	LA_{50}
≤60	LA_{60}
> 60	$LA_{Declared}$
No Requirement	LA_{NR}

- When required, the resistance to fragmentation shall be determined in terms of the Los Angeles coefficient as specified in EN 1097-2
- The Los Angeles coefficient shall be declared in accordance with the relevant category specified in Table 13 according to the particular application or end use

SUMMARY OF REQUIREMENTS FOR PROPERTIES IN AGGREGATE PRODUCT STANDARDS

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- Not all properties listed in the ENs need to be specified
- Only those properties relevant to the end use of the agg. need to be specified
- But the ENs do not say what properties are relevant for any particular end use
- Neither do they say what value (category) should be specified for any property that is relevant
- They just outline a list (menu) of properties (geometrical, physical, chemical, durability) and a range of values (categories) for each of the listed properties
- These properties and their associated values (categories) must be taken into consideration when specifying requirements for a particular end use
- Therefore, simply specifying that an aggregate must meet the requirements of say EN 13242 is meaningless
- It is up to the specifier to decide (and specify) which properties are relevant for each end use and which values (categories) must be achieved by the properties which he/she has chosen

CONTENTS OF AGGREGATE PRODUCT STANDARDS

- GEOMETRICAL PROPERTIES (Clause 4)
- PHYSICAL PROPERTIES (Clause 5)
- CHEMICAL PROPERTIES (Clause 6)
- DURABILITY PROPERTIES (Clause 7)

- EVALUATION OF CONFORMITY (Clause 8 or 9)

EVALUATION OF CONFORMITY

- The aggregate product standards state that “the conformity of the product with the requirements of this standard shall be demonstrated by initial type testing and factory production control by the manufacturer in accordance with EN 16236”

- INITIAL TYPE TESTS (EN 16236)

- FACTORY PRODUCTION CONTROL (EN 16236)

INITIAL TYPE TESTS

- Tests are carried out for those properties relevant to the end use of the aggregate
  - for each individual product manufactured by the producer from a particular source
  - whenever a new source is used or there is a major change in the nature of the raw material that may affect the properties of the product
  - whenever there is a major change in the processing conditions that may affect the properties of the aggregate

- The test results are documented in a Type Test Report for each individual product for the source in question

- These are the producer's declared values for his/her products and they define the particular product in question

- The Type Test Reports (i.e. the producer's declared values) are then used as the starting point for FPC

FACTORY PRODUCTION CONTROL (FPC)

- DOCUMENTED FPC MANUAL + DOCUMENTED SET OF PROCEDURES
  - quality plan, organisation & general administration
  - raw material
  - manufacture & delivery of finished product
  - testing & conformity of finished product

- QUALITY PLAN, ORGANISATION & GENERAL ADMINISTRATION
  - fpc documents
  - management representative for overseeing the FPC system
  - responsibility and authority of FPC personnel
  - control of FPC documents and records
  - training
  - internal audits
  - management review of the FPC System
  - sub-contracted services

FACTORY PRODUCTION CONTROL (FPC)

- RAW MATERIAL
  - knowledge of the raw material
- MANUFACTURE & DELIVERY OF FINISHED PRODUCT
  - the manufacturing plant
  - the manufacturing process
  - storing the product
  - delivering the product
  - traceability
- TESTING & CONFORMITY OF FINISHED PRODUCT
  - testing facilities and equipment
  - sampling and testing
  - assessing conformity
  - corrective / preventive action

IS THERE ANY GUIDANCE FOR THE SPECIFIER WHEN CHOOSING WHICH PROPERTIES & VALUES (CATEGORIES) TO SPECIFY FOR VARIOUS END USES?

- The aggregate product standards state that “guidance on selection of appropriate categories for specific applications can be found in national provisions in the place of use of the aggregate”

AGGREGATE PRODUCT STANDARDS		NSAI RECOMMENDATIONS
EN 12620	Aggs. for concrete	SR 16 (SR 60)
EN 13139	Aggs. for mortar	SR 18 (SR 60)
EN 13043	Aggs. for bituminous mixtures	SR 17 (SR 60)
EN 13242	Aggs. for unbound & hydraulically bound materials	SR 21
EN 13450	Aggs. for railway ballast	NONE
EN 13383-1	Armourstone	NONE

GUIDANCE FOR THE SPECIFIER – SR 21

- SR 21 — Guidance on the use of I.S. EN 13242 – Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction
- ANNEX A — Recommendations for specifying aggregates used as pipe bedding, haunching and surrounding
- ANNEX B — Recommendations for specifying aggregates used as backfilling for filter drains
- ANNEX C — Recommendations for specifying aggregates used as fill material
- ANNEX D — Recommendations for specifying aggregates used as unbound sub bases for road pavements
- ANNEX E — Recommendations for specifying unbound granular fill (hardcore) for use under concrete floors and footpaths
- ANNEX F — Recommendations for specifying aggregates used in cement bound bases and sub-bases for road pavements

SR 21 GUIDANCE FOR ANNEX A,B,C,D & F AGGREGATES

- SR 21 Annex A (pipe bedding), B (filter drain backfill), C (fill), D (unbound sub-bases) and F (cement bound bases and sub-bases) all recommend that the aggregate properties selected from EN 13242, and the values (categories) of the properties thus selected, should be as specified in the NRA Specification for Road Works (taking any relevant guidance in the associated NRA Notes for Guidance into consideration)

SR 21 GUIDANCE FOR ANNEX E AGGREGATES (Hardcore)

- GEOMETRICAL PROPERTIES

Size & Grading	cr. rock 0/31.5, DG_{80} gravel 0/40, DG_{80}
Fines Content	f_7
Percentage crushed /rounded (for gravel only)	$C_{50/100}$

(same as NRA Clause 804)
(same as NRA Clause 805)

- PHYSICAL PROPERTIES

Resistance to fragmentation	LA_{30}

- DURABILITY PROPERTIES

Magnesium sulfate soundness	MS_{25}
Water absorption	$WA_{24}2$

SR 21 GUIDANCE FOR ANNEX E AGGREGATES (Hardcore)

- CHEMICAL PROPERTIES

Mudrock content	≤ 10%
Acid-soluble sulfate	$AS_{0,2}$
Total sulfur	If S >1%, then the agg. is unsuitable
	If S ≤ 0,3%, then the agg. is suitable (with respect to total sulfur) without further testing
	If S > 0,3% and ≤ 1%, then a more detailed petrographic examination must be carried out by a Professional Geologist If this indicates, in the opinion of the Geologist, that any pyrite present is predominately in a reactive form, then the agg. is unsuitable If it indicates, in the opinion of the Geologist, that any pyrite present is predominately in a non-reactive form, and if the Geologist has no other concerns regarding the agg., then the agg. is suitable (with respect to total sulfur) If it indicates, in the opinion of the Geologist, that pyrrhotite is present, then the agg. is suitable (with respect to total sulfur) only if S ≤ 0,4%

THE GEOLOGIST

- EN 13236 (FPC) Clause 6.3.4- Knowledge of the raw material
  - " there shall be documentation detailing the nature of the raw material..."
  - guidance given in SR 21 Clause 3.4.3
- SR 21 Clause 3.3.1.3
  - aggressive chemical attack on concrete
- SR 21 Annex C (fill)
  SR 21 Annex D (aggregates for unbound sub-bases)
  SR 21 Annex F (aggregates for cement bound bases and sub-bases)
  - via NRA Spec. For Road Works
  - near cementitious or metallic elements
  - requirements re. sulfur containing compounds may be conservative
  - geological/petrographic assessment may relax the specified limits
- SR 21 Annex E (hardcore)
  - mudrock content and problematic lithologies – simplified petrography
  - interpretation of content of sulfur containing compounds
  - if S > 0.3% and ≤ 1% - more detailed petrography

THE CONSTRUCTION PRODUCTS REGULATION (CPR)

- EU LEGISLATION
- FOSTER FREE MOVEMENT OF PRODUCTS THROUGHOUT EU
  - eliminate technical barriers to trade
  - but still ensure that basic requirements for construction works are not compromised (stability, safety in case of fire, health, safety in use, energy economy, sustainability)
- COVERS CONSTRUCTION PRODUCTS
  - for permanent incorporation in construction works (buildings and civil eng. works)
  - and for which a harmonised European standard (hEN) exists
- HARMONISED EUROPEAN STANDARDS
  - they look like all other ENs
  - but they include an Annex ZA
- PRODUCTS MUST BE “CE” MARKED

THE CONSTRUCTION PRODUCTS REGULATION (CPR)

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- Harmonised standards (✓)

• EN 12620	Aggs for concrete ✓
• EN 13139	Aggs for mortar ✓
• EN13043	Aggs for bituminous mixtures ✓
• EN 13242	Aggs for unbound & hydraulically bound materials ✓
• EN 13450	Aggs for railway ballast ✓
• EN 13383-1	Armourstone ✓
• EN 197-1	Cement ✓
• EN 206-1	Concrete X
• EN 771-3	Concrete blocks ✓
• EN 998- 1 & 2	Mortar ✓
• EN 13108- 1 to 7	Bituminous mixtures ✓
• EN 13285	Unbound mixtures X
• EN 14227-1	Hydraulically bound mixtures (cement bound) X

THE CONSTRUCTION PRODUCTS REGULATION (CPR)

- INITIAL TYPE TESTING (ITT)
- FACTORY PRODUCTON CONTROL (FPC)
- ASSESSMENT & VERIFICATION OF CONSTANCY OF PERFORMANCE (AVoCP)
  - initial and annual assessments of FPC documents and FPC implementation
  - most aggregate products - AVoCP System 4 (self certification)
  - high PSV aggs. and hardcore - AVoCP System 2^+ (3^{rd} party certification by Notified Body)
- DECLARATION OF PERFORMANCE (DoP)
  - legal declaration by the producer that the product conforms with the performance declared by him/her in the DoP and that he/she complies with all other CPR requirements
- CE MARKING
  - visible proof of compliance with the CPR

BEWARE – CPR/CE MARKING MISCONCEPTIONS

- A product of “poor” quality can be CE marked
- Performance need be declared for only those properties listed in Annex ZA for which “regulations” exist in the country of use
- If no “regulations” for the end use, then performance of only one property needs to be declared
- What are “regulations” in Ireland?
- Producer simply declares performance of his/her product but does not declare that it meets the specifier’s requirements
- CE marking just uses a common language to declare the product’s performance (test methods, calculations etc.) and common systems for ITT, FPC, AVoCP, CoP etc. so that performance can be understood and assessed by all

BEWARE – CPR/CE MARKING MISCONCEPTIONS

- Therefore NOT a Quality Mark
- Simply a passport that allows product to be legally placed on the market
- Specifier must always decide if declared performance is what he/she requires
- Distinguish between CE marking info. & Project Spec (i.e. specifier's contractual requirements)

Go raibh maith agaibh

Thank you for your time & attention

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Technical Advisors
Aggregates, Asphalt, Concrete

Including Factory Production Control Manual and Procedures
and CE Marking
for
Aggregate Producers

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