

Aggregate from Inert Waste: Resource Framework

Recycled Aggregate use in Concrete

Guidance & Testing Requirements

Specification for Highway Works (SHW) 2025

Clause CC 203

(formerly SHW Series 1000)

Applications

- Non-structural
- Structural, with strictly controlled limits

Focus

- Proving quality and strength





Recycled Aggregate use in Concrete

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Recycled Aggregate use in Concrete

CC 203 Explained

CC 203 is part of the 2025 Specification for Highway Works (SHW) that governs the properties and acceptance of aggregates in concrete used in highways pavements and structures. It covers natural, manufactured and recycled aggregates.

CC 203 replaces older Series 1000 requirements.

CC 203 aligns with much of the requirements of CC 201 in relation to pavement or foundation construction.

What CC 203 is responsible for

CC 203 is responsible for how you build and finish concrete pavements and structures:

- Concrete pavement materials
- Mix design and verification
- Construction of concrete layers
- Inspection, testing and acceptance.

CC 203 tells you how to design, produce, place and verify concrete, with focus on:

- Concrete (rigid) pavements
- Concrete bases and slabs
- Differing types of concrete pavements
- Materials (cement, aggregates, water, admixtures)
- Installation, curing, joints and finishes.

Summary:

CC 203 is the full specification for concrete pavements in highways, covering materials, construction and performance from start to finish. It tells you what concrete to use, what materials are allowed, how to place it and what quality and performance it must achieve.



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Aspects of CC 203 (Core content)

1. General requirements

- Surface levels and tolerances
- Alignment and geometry
- Surface regularity
- Preparation before overlays
- Rectification of defects

2. CRCP / CRCB (reinforced concrete pavements)

These are used where roads need to perform to high standards:

- Continuously Reinforced Concrete Pavement (CRCP)
- Continuously Reinforced Concrete Base (CRCB)

Covering the issues of:

- Reinforcement installation
- Joint details and terminations
- Concrete placement and finishing

3. Roller Compacted Concrete (RCC)

This is a major inclusion in SHW 2025, where concrete is used in heavily trafficked industrial or freight applications or where fast construction is required. Issues covered include:

- Constituent materials (aggregates and binder)
- Mix design and verification
- Placement using plant
- Induced cracking and curing
- Testing and inspection



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4. Jointed Unreinforced Concrete (JUC)

Commonly used in bypasses, slower-speed road and local authority works, this is mainly traditional 'slab' concrete covering:

- Joint layout and installation
- Concrete placement
- Surface finishes
- Crack control via joints

5. Materials and Constituents (Critical)

- Aggregates, including recycled
- Binder (cementitious)
- Water and admixtures

CC 203 and Recycled Aggregates

CC 203 explicitly allows recycled aggregates, but their use is subject to strict application-specific controls including quality and performance requirements. They can be used in concrete provided they meet:

- Product Standards (BS EN 12620)
- UK Concrete Standard (BS 8500)
- SHW 2025 Quality and Composition requirements
- Requirements of the Aggregates from Inert Waste Resource Framework

Types of Recycled Aggregate used in Concrete under CC 203

Under CC 203, recycled aggregates are typically from:

1. Crushed Concrete Aggregate (CCA)

- Derived almost exclusively from demolition material
- Preferred for structural applications
- Performs consistently if well processed



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2. General Recycled Aggregate (RA)

- Mixes of concrete, brick, masonry and asphalt
- More limited use (non-structural)

CCA is preferred for structural applications; mixed RA use is restricted to non-structural applications.

Where recycled aggregates are NOT normally used under CC203

Under CC 203, recycled aggregate concrete mixes are not normally acceptable where:

- Ground conditions are aggressive
- High chloride exposure exists (XS/XD classes)
- Severe freeze/thaw conditions exist (XF2–XF4)
- Critical structural performance or durability is required

What CC 203 expects from recycled aggregates to be used in concrete

Under CC 203, recycled aggregates are not treated any differently **in principle** from primary aggregates, but they **must perform exactly the same as natural materials**. CC 203 expects recycled aggregates to be clean, consistent, properly classified, and meet accepted industry standards. **There is no relaxation just because a material is recycled.**

1. Mandatory classification

Recycled aggregates must be tested to confirm proportions of:

- Concrete (preferred)
- Masonry (brick/block)
- Asphalt
- Unbound stone
- Contaminants/detritus

*SHW used defined component classes, and CC 203 expects tight control of what the recycled aggregate is composed of. **Class X contaminants comprising of wood, plastic, glass etc. are strictly limited to ≤ 1% by mass.***



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2. Performance requirements (same as natural aggregates)

Recycled aggregates must conform with all normal tests:

- Mechanical
- Physical
- Durability
- Absorption (extremely important)

If they don't meet the same performance standards as primary aggregates, recycled aggregates cannot be used in concrete.

Additional requirements specific to recycled aggregates

1. Water absorption control

This is important due to old cement paste/dust in the recycled aggregate from crushed concrete:

- It must be measured and included in the design mix

If not taken into account, this can affect:

- Workability
- Strength
- Durability

2. Consistency of supply

Ongoing compliance testing is required to ensure that quality is not the result of a single test.

- Material source must be controlled
- Material must be consistent batch to batch



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3. Proportion limits (from BS 8500)

While some requirements for coarse RA are specified in BS 8500-2:2023, they are insufficient to form adequate specifications. As the potential composition of RA is so wide, the additional specification requirements should be assessed on a case-by-case basis taking into account the specific composition of the RA. In particular, the project specification for RA should include:

- a) maximum acid-soluble sulphate;
- b) method for determination of the chloride content;
- c) classification with respect to alkali-aggregate reactivity;
- d) method for determination of the alkali content; and
- e) any limitations on use in concrete.

Roller compacted concrete does not allow the use of recycled aggregates.

4. Resource Framework Compliance

To be accepted under SHW CC 203, recycled aggregates must comply fully with the Aggregates from Inert Waste Resource Framework, and have:

- Traceability
- Factory Production Control procedures in place
- Meet End of Waste criteria through product testing
- Independent third-party UKAS accreditation of the production process

This guarantees that the material is a tested and certified 'product' and not a waste which, if untested and unverified, could have critical implications for the performance of the designed concrete mix and its application.

Common non-compliance issues include:

- No composition data (very common)
- Missing certification/testing/verification (Resource Framework)
- Ignoring higher absorption values in the mix design
- Not being able to prove that CCA aggregate was used in the mix instead of RA

Know what's in it, where it came from, how it performs and control its variability.



Recycled Aggregate use in Concrete

Summary:

CC 203 allows recycled aggregate use in concrete, but only where they are fully characterised, controlled, tested and proven to deliver the same performance as primary materials. Material production and quality should be fully traceable, documented, certified and fully auditable.

Mandatory Standard Aggregates Tests for Recycled Aggregates to be used in concrete (CC 203)

For SHW 2025 CC 203, recycled aggregates must comply with a core set of mandatory laboratory and site tests to fully demonstrate material suitability and consistency.

Test	Standard
Grading (PSD inc fines content)	BS EN 933-1
Flakiness	BS EN 933-3
LA Abrasion	BS EN 1097-2
Particle Density & Absorption	BS EN 1097-6
Acid Soluble Sulphate Content	BS EN 1744-1
Total Sulphur Content	BS EN 1744-1
Magnesium Sulphate Soundness	BS EN 1367-2
Carbonate Content*	BS EN 196-2

*Only required for fine aggregates used in concrete surface courses

CCA (Crushed concrete aggregate) will also require an Alkali Content test

For Continuously Reinforced Concrete Base (CRCB) and Continuously Reinforced Concrete Pavement (CRCP) applications, where the pavement quality concrete for CRCB and CRCP has a minimum mean flexural strength (MPa) of 5.5 MPa or greater at 28 days, the aggregate in the pavement quality concrete shall have a **coefficient of thermal expansion** of 10×10^{-6} per °C or less.

Other testing that **may** be requested:

Particle shape	BS EN 933-4
Shell content	BS EN 933-7
Sand equivalent value	BS EN 933-8
Methylene blue test	BS EN 933-9
Aggregate impact value	BS EN 1097-2
Micro Deval	BS EN 1097-1



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Polished Stone Value	BS EN 1097-8
Aggregate Abrasion Value	BS EN 1097-8
Resistance to abrasion from studded tyres	BS EN 1097-9
Bulk density	BS EN 1097-3
Freeze/thaw resistance	BS EN 1367-1
Aggregate Drying Shrinkage	BS EN 1367-4
Water soluble chloride	BS EN 1744-1
Acid-soluble chloride ion content	BS EN 1744-5
Water soluble sulphate content	BS EN 1744-1
Volume stability of air-cooled blast furnace slag	BS EN 1744-1
Iron disintegration of air-cooled blast furnace slag	BS EN 1744-1

Purpose:

- These control the key design mix performance and durability. Recycled aggregates **must** perform to the same standards as natural aggregates.

Additional Tests for Recycled Aggregates to be used in concrete (CC 203)

1. Composition Classification

Quantifies individual components within the recycled aggregate.

Test	Standard
Composition classification	BS EN 933-11

Purpose:

- One of the most critical tests for recycled aggregate, designed to mitigate variability and durability risk.



Recycled Aggregate use in Concrete

Key differences in testing versus natural aggregate

Aspect	Natural	Recycled
Composition	Not required	Mandatory
Contamination	Low concern	Critical
Water absorption	Moderate importance	High importance
Variability checks	Standards	Increased frequency
Durability scrutiny	Standard	Higher scrutiny



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