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Use of construction waste in non-structural mortars and concretes.

Use of construction and demolition waste in mortars and non-structural concretes

Use of civil construction waste in structural mortars and hormigones

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Abstract: The growth of the construction industry has intensified the extraction of natural aggregates and the generation of construction and demolition waste, making it necessary to technically reintegrate these materials into production chains with less environmental impact. This article aims to analyze the use of construction waste in non-structural mortars and concretes, emphasizing regulatory requirements, the properties of recycled aggregates, performance in fresh and hardened states, substitution limits, and recommended applications. The research was conducted through a narrative literature review, selecting recent national and international publications between 2020 and 2026, as well as technical standards relevant to the topic. The results indicate that class A recycled aggregates have potential for use in coating mortars, bedding, screeds, blocks, pavers, curbs, gutters, sidewalks, and non-structural concretes, provided they are previously processed, segregated, characterized, and dosed with water absorption control. It was observed that partial replacements tend to exhibit greater technical stability, while high levels require granulometric corrections, impurity control, pre-humidification, or adjustments to the water/cement ratio. It is concluded that the reuse of recycled construction and demolition waste (RCC) is technically feasible and environmentally relevant, but its adoption depends on quality management, traceability, characterization tests, and compatibility between the required performance and the final application.
Keywords: Construction waste. Recycled aggregates. Mortar. Non-structural concrete. Sustainability.

Abstract: The growth of the construction sector has intensified the extraction of natural aggregates and the generation of construction and demolition waste, making the technical reinsertion of these materials into lower-impact production chains necessary. This article aims to analyze the use of construction waste in mortars and non-structural concretes, strictly regulatory requirements, recycled aggregate properties, fresh and hardened performance, replacement limits, and recommended applications. The research was conducted as a narrative literature review, selecting recent national and international publications from 2020 to 2026, as well as technical standards essential to the subject. The results indicate that class A recycled aggregates have potential for use in rendering and masonry mortars, screeds, blocks, pavers, curbs, gutters, sidewalks, and non-structural concrete, provided that they are properly processed, segregated, characterized, and proportioned with water absorption control. Partial replacements tend to exhibit greater technical stability, whereas high replacement ratios often require particle-size correction, impurity control, pre-wetting, or adjustments to the water/cement ratio. It is concluded that the reuse of construction and demolition waste is technically feasible and environmentally relevant. However, its adoption depends on quality management, traceability, characterization tests, and compatibility between the required performance and the final application.

Keywords: Construction and demolition waste. Recycled aggregates. Mortar. Non-structural concrete. Sustainability.

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1. Introduction

The construction industry occupies a strategic position in the economy, but it also stands out for... high consumption of mineral resources, energy and water, as well as areas intended for Final disposal of waste. Among this waste are materials from construction, renovations, Demolitions, excavations, and repairs form a large-volume, heterogeneous flow of activity. potential for reuse when subjected to segregation and processing. In the case In Brazil, the discussion is especially relevant because of the generation of construction waste. It grapples with on-site losses, improper disposal, logistical costs, and increasing pressure for... Practices aligned with the circular economy (Nunes and Mahler, 2020; Silva and Melo, 2023).

Construction waste, when classified as class mineral materials A, they can be transformed into recycled aggregates and reintroduced into cementitious applications. The updated ABNT NBR 15116 standard consolidated requirements for the production, reception, and use of Recycled aggregates in Portland cement mortars and concretes, promoting a A safer technical approach compared to empirical recycling practices. This article focuses on mortars and concretes without a structural function, since these... Applications tend to allow for greater variability without compromising structural safety. building, provided that the performance requirements are met (ABNT, 2021; Palhares et al., 2023).

The relevance of the topic stems from three converging factors. The first is environmental, because... Utilizing waste materials reduces the demand for natural sand and gravel, decreasing the volume. intended for landfills and helps prevent illegal dumping. The second is technical, a since recycled aggregate has its own characteristics, such as greater absorption, presence of Adhered mortar, particle size variability, and possible contamination by materials. Ceramics, plaster, wood, or soil. The third is economical, as reuse can reduce costs in certain regions, especially when there are processing plants nearby. place of consumption (Salles et al., 2021; Joseph et al., 2023).

The application in mortars is promising, as recycled fine aggregate can... Partially replace natural sand in coatings, masonry, and subfloors. However, performance depends on the type of residue, the substitution rate, and the composition. particle size distribution, fineness, water absorption, powder content, and compatibility with cement and additives. Recent studies indicate that partial substitutions may maintain acceptable mechanical properties and even promote particle size packing in

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Some dosages may be effective, but high levels can increase shrinkage, absorption, and demand for... water (Rodrigues et al., 2024; Castro, Silva and Almeida, 2023).

In non-structural concrete, the use of recycled aggregates is common in blocks. pavers, flooring, sidewalks, gutters, curbs, leveling surfaces, and precast concrete elements without a functional purpose. structural. These applications demand strength and durability compatible with the use and the They are exposed, but do not require the same level of structural responsibility as pillars and beams. and slabs. Therefore, they constitute a suitable field for disseminating the use of C&D waste, provided that... maintain a minimum level of technological control, including the characterization of aggregates, rational dosage, proper curing, and verification of compressive strength, absorption, and of wear, when applicable (Contreras Llanes et al., 2022; Akbarimehr et al., 2024).

The research problem guiding this article can be formulated as follows: Under what technical conditions can construction waste be used in mortars? and non-structural concrete without compromising the expected performance of these materials? A The hypothesis adopted is that the processed, segregated, and characterized RCC (Construction and Demolition Waste) can replace aggregates. natural materials in partial or controlled percentages, especially in non-structural applications. provided that their effects on absorption, workability, porosity, and other properties are taken into account. Mechanical strength and durability (Nanya, Ferreira and Capuzzo, 2021; Salgado and Silva, 2022).

The overall objective is to analyze the use of construction waste in mortars and non-structural concrete, based on recent technical literature and regulatory requirements applicable. As specific objectives, the aim is to: characterize the main types of C&D waste. applicable as recycled aggregate; discuss its effects in mortars and concretes without structural function; systematize limits, precautions, and recommended applications; and indicate criteria. for technical adoption in civil works. It is, therefore, an applied review, aimed at decision-making in projects, specifications and construction site practices (ABNT, 2021; Silva and Melo, 2023).

2. Theoretical framework and literature review results

2.1 Construction and demolition waste and recycled aggregates

Construction waste results from construction, renovation, repair and other activities. demolition, forming a material flow with mineral, metallic, and polymeric fractions, organic and contaminating materials. For use in mortars and concretes, the interest lies in... primarily concerning the class A mineral fraction, composed of concrete waste,

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mortar, blocks, bricks, tiles, soil and ceramic materials that can be reused as aggregates. CONAMA Resolution No. NBR 307 established general guidelines for management of these wastes, while ABNT NBR 15116 updated the technical requirements for the Incorporation of recycled aggregates from construction and demolition waste into cementitious products. (Brazil, 2002; ABNT, 2021).

Transforming construction and demolition waste (CDW) into recycled aggregate involves steps of sorting and removal. of contaminants, crushing, screening and, eventually, washing or classification into fractions. Without these procedures, the residue tends to exhibit great heterogeneity and Unpredictable performance. Recent literature emphasizes that segregation by origin is a factor. decisive: predominantly concrete waste generally produces better aggregates. Higher quality than mixtures with a high content of ceramics, gypsum, soil or organic impurities. This difference is reflected in the specific gravity, water absorption, and wear resistance. in the adhesion between the paste and the aggregate (Salles et al., 2021; Saiz Martínez et al., 2023).

Compared to natural aggregates, recycled aggregates usually exhibit... greater porosity and greater water absorption capacity, mainly due to the old mortar. adhered to concrete particles and the presence of ceramic materials. This characteristic alters The workability of the mixtures may require pre-humidification and water correction. kneading or the use of plasticizing additives. When this adjustment is not made, part of the Water intended for hydration and consistency is absorbed by the aggregate, which can reduce the... fluidity and impair material compaction (Joseph et al., 2023; Akbarimehr et al., 2024).

Another relevant aspect is particle size distribution. Crushed RCC (Recycled Construction and Demolition Waste) may exhibit an excess of... fine particles, discontinuous distribution, or lamellar particles, which interferes with the packing of Grains and paste demand. In mortars, the fine fraction directly influences retention. Water content affects adhesion and surface finish. In non-structural concrete, the coarse fraction Recycled material can reduce specific gravity and increase total absorption, but when properly dosed, It can meet resistance standards compatible with sidewalks, pavers, blocks, and low-pressure elements. request (Rodrigues et al., 2024; Palhares et al., 2023).

The Brazilian technical standard has provided greater security to the specification. to differentiate the criteria for use and to require control over the origin, composition and properties. In the non-structural universe, the application tends to be broader, but that doesn't It eliminates the need for prior testing. The mere fact that the residue is mineral does not guarantee that be suitable for any mortar or concrete. Suitability must be demonstrated by

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means of characterization, experimental dosage, and compliance with minimum performance requirements. required for the application (ABNT, 2021; Silva and Melo, 2023).

2.2 Technical characteristics that influence performance

The performance of mortars and concretes with RCC depends on a set of physical, chemical, and mechanical properties of the recycled aggregate. Among the most relevant These include composition, specific gravity, water absorption, and powdery material content. particle size distribution, grain shape, abrasion resistance, presence of contaminants and compatibility with cement. Analysis of final strength alone is not sufficient. sufficient, as problems with shrinkage, permeability, and adhesion can compromise the material even when the compressive strength is apparently satisfactory (Nanya, Ferreira and Capuzzo, 2021; Joseph et al., 2023).

Water absorption is one of the parameters with the greatest practical impact. Aggregates Recycled concrete and ceramics can absorb a significant portion of the water. The mixture alters the effective water/cement ratio and the consistency of the material. In mortars, This absorption can impair workability and adhesion to the substrate, especially in coatings. In non-structural concrete, it can reduce slump, increase voids and to hinder compaction. Controlled pre-saturation or water adjustment by absorption is a recurring strategy to mitigate this effect (Robalo et al., 2021; Rodrigues et al., 2024).

The presence of ceramic materials can have an ambiguous effect. On the one hand, Ceramic particles tend to be more porous and can increase absorption and variability. of the mixtures. On the other hand, when well ground or in suitable fractions, they can contribute for packaging or even to exhibit some limited pozzolanic activity, depending on the composition and degree of burning. The central problem lies in the unpredictability of residues. mixed aggregates with no control over their origin, which is why the literature recommends separating them. Recycled concrete, ceramic and mixed materials whenever possible (Saiz Martínez et al., 2023; Salles et al., 2021).

The fines content also requires attention. Recycled fines can improve the cohesion of the... Mortars reduce segregation, but excess powdery materials increase water demand. and shrinkage. This condition is particularly noticeable in coatings, where cracking and Detachment can occur due to incompatibility between shrinkage, adhesion, and rigidity.

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Therefore, particle size control should seek a balance between compactness, workability, and... dimensional stability (Castro, Silva and Almeida, 2023; Batista et al., 2022).

The shape and surface texture of the recycled aggregates promote adhesion. Mechanical factors are superior to cementitious paste, but they also increase internal friction and water consumption. In Dry or poorly workable concretes, such as pavers and vibro-pressed blocks, have this texture. This can be advantageous when combined with proper compaction. In plastic concretes, the The same characteristic may require additives or increasing the paste to achieve the desired consistency. compatible with planting and densification (Contreras Llanes et al., 2022; Akbarimehr et al., 2024).

Table 1 - Technical constraints for the use of recycled concrete aggregate (RCC) in cementitious materials

Condition	Expected effect	Recommended care
High water absorption	Reduced workability, altered effective water/cement ratio, and possible increase in porosity.	Pre-moisten the aggregate, correct the mixing water, and record the absorption by batch.
Heterogeneity of the residue:	Variation in specific gravity, strength, and durability between batches.	Segregate by origin, remove contaminants, and characterize each supply.
Excess of fines	Increased water demand, shrinkage, and risk of cracking. in mortars.	Sieving, adjusting the particle size distribution curve, and limiting the... powdery materials.
Presence of ceramics	Increased absorption and reduced density; potential gain in packing in controlled fractions.	Adjust the application dosage and avoid unknown or contaminated mixtures.
rough texture	Increased grip, but also increased internal friction and water consumption.	Use additives or adjust the paste if it loses consistency.

Source: Author's own elaboration based on the reviewed literature (2020-2026).

2.3 Use of RCC in mortars

Mortars are among the most viable applications for the use of fine aggregate. Recycled materials are primarily used in cladding, installation, leveling, and subflooring. In materials, the sand fraction plays a fundamental role in workability and retention. water, in adhesion, mechanical resistance and finish. Partial replacement of sand. Natural waste recycling can reduce the consumption of natural resources and incorporate mineral waste. in a technically controlled manner. However, the dosage must be compatible with the function of the

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mortar, as the laying requirements differ from those for exterior or interior cladding. (Schiller, Paliga and Torres, 2022; Rodrigues et al., 2024).

Recent literature indicates that intermediate levels of substitution tend to exhibit More stable results. In some studies, the incorporation of 25%, 30%, or 50% aggregate... Recycled small parts maintained satisfactory resistance and performance consistent with that of conventional mortars, provided that the residue was processed and the particle size distribution was correct. adjusted. However, higher replacements may increase absorption, reduce consistency, and increase shrinkage, especially when the RCC contains a large amount of ceramic or of very porous old mortar (Batista et al., 2022; Rodrigues et al., 2024).

In its fresh state, recycled aggregate can increase cohesion and reduce bleeding. but it can also reduce spreading and make manual application more difficult. In construction, this leads to the temptation to add water to restore workability, a practice that can compromise Resistance, adhesion, and durability. The appropriate solution is to technically correct the... dosage, considering absorption, actual aggregate moisture, fines content and any eventual Use of additives. The decision should be based on testing, not on empirical adjustments made on the construction site. (Castro, Silva and Almeida, 2023; Joseph et al., 2023).

In the hardened state, the main control parameters are resistance to compression, tensile strength in bending, absorption, capillarity, adhesion to the substrate and Dimensional stability. Coating mortars with recycled aggregate can to perform well when the particle size distribution curve favors compaction and paste formation. It is sufficient to enclose the particles. However, increasing porosity can increase absorption. of water and susceptibility to pathological manifestations, requiring attention in outdoor areas or subject to humidity (Veloso et al., 2020; Castro, Silva and Almeida, 2023).

The application in mortar for laying bricks also requires caution. The resistance of The joint, adhesion to the blocks, and the deformability of the mortar influence the behavior. Recycled aggregate may be suitable for masonry walls and related services. Lower requirements, but should be evaluated for water retention and compatibility with ceramic or concrete blocks. When the replacement content is high, the variability of RCC can be reflected in joints with uneven performance (Schiller, Paliga and Torres, 2022; Rodrigues et al., 2024).

In subfloors and leveling layers, the use of recycled concrete aggregate (RCC) is particularly interesting. because the aesthetic and structural requirements tend to be less than those for finishes. apparent. Still, the mortar must have sufficient strength and low pulverization,

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Adhesion to the substrate and crack control. For these layers, well-recycled aggregates are recommended. Graduates can reduce the consumption of natural sand and incorporate waste without compromising the function, provided that there is control of humidity and curing (ABNT, 2021; Batista et al., 2022).

2.4 Use of RCC in non-structural concrete

Non-structural concrete is concrete used in elements that do not participate in the structural process. The main structural load-bearing component of the building. This group includes sidewalks and low-level floors. Request for materials including guides, gutters, sealing blocks, subfloors, ballast, pavers, fills and parts. precast elements without a structural function. These applications allow for greater flexibility in Dosage is important, but technological control is still necessary, as failures can lead to wear and tear. premature, superficial disintegration, cracking, excessive absorption and need for maintenance (Palhares et al., 2023; Contreras Llanes et al., 2022).

Replacing natural aggregate with recycled aggregate in non-structural concrete can... This can occur in the fine fraction, the coarse fraction, or both. The recycled coarse fraction tends to... to affect specific gravity, absorption, wear resistance, and compressive strength. Already The recycled fine fraction impacts water demand, cohesion, shrinkage, and porosity of the matrix. In both cases, performance depends on the origin of the waste, its processing and due to the degree of substitution. Therefore, it is recommended to start with partial substitutions and gradually increase the... The theory is only available after experimental validation (Salgado e Silva, 2022; Akbarimehr et al., 2024).

Studies with recycled construction and demolition waste (RCD) concrete indicate that moderate levels can produce strengths compatible with non-structural applications. Palhares et al. evaluated concretes with different levels of C&D waste were tested and it was found that ceramic residues were present. influenced porosity, absorption, and abrasion wear. These results reinforce that the The problem is not limited to the percentage of substitution, but also to the composition of the residue and to the relationship between this and the required property. For floors and pavers, for example, resistance to Abrasion and absorption can be as important as compression resistance (Palhares et al.) al., 2023).

In pavers and vibro-pressed blocks, the use of recycled aggregates shows potential. because the vibrocompression molding process can compensate for some of the lower density. of the aggregates through mechanical compaction. In addition, the rough texture can favor Internal interlocking. However, the mixture must be adjusted to maintain cohesion and avoid... Breaking edges, reducing absorption, and ensuring strength after curing. Replacement should

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to be accompanied by the control of specific mass, resistance, absorption and variation dimensional dimensions of the parts (Contreras Llanes et al., 2022; Robalo et al., 2021).

For sidewalks, gutters, leveling, and ballast, C&D waste can be used with less risk. Structural risk, provided that the element is not subjected to heavy traffic or stress. special unforeseen circumstances. In situations of environmental aggression, continuous contact with water, In the presence of sulfates or exposure to wetting and drying cycles, the specification must be more conservative. The presence of plaster, salts, or harmful materials can compromise the Durability should be controlled during screening (ABNT, 2021; Saiz Martínez et al., 2023).

The concept of non-structural concrete should not be confused with uncontrolled material. Even in secondary applications, the material needs to withstand wear, weathering, and... Exposure conditions. The use of C&D waste is technically defensible when there are Dosage, testing, and suitability for end use. When the residue is used only as When crushed rubble is processed without control, the practice ceases to be technical recycling and becomes a form of... risk to professional performance and responsibility (Silva and Melo, 2023; Joseph et al., 2023).

2.5 Substitution limits, dosage and technological control

There is no universal replacement percentage valid for all types of C&D waste. Mortars and concretes. The literature presents viable ranges, but their application depends on... particle size distribution, composition, absorption, required strength, type of cement, ratio Water/cement, additives, mixing process, compaction and curing methods. In terms In practical terms, partial replacement is the safest strategy to begin adoption, as it allows to assess environmental benefits without exposing the material to excessive variations in performance. (Salgado and Silva, 2022; Joseph et al., 2023).

In mortars, replacement percentages of fine aggregate between 20% and 50% are frequent in experimental studies and reviews. Still, feasibility must be confirmed through testing, especially when the mortar will be used as For exterior cladding or in damp areas. In non-structural concrete, replacements of the fraction High levels of sugars at moderate levels may be technically acceptable, while higher levels... They require stricter control and may demand additives, particle size correction, or... increase in cement paste (Rodrigues et al., 2024; Palhares et al., 2023).

The dosing stage must take into account the actual absorption of the recycled aggregate. An error It is common to apply conventional mixes directly, replacing the natural aggregate with

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Recycled, without compensating for water, specific gravity, and particle size. Like aggregate. Recycled material is more porous, so the same mass dosage can result in different volumes and in... Inadequate paste consumption. The trace amount should be recalculated based on the absolute volume or adjusted based on preliminary tests, preventing the mixture from becoming dry, porous, or with excess water (Robalo et al., 2021; Akbarimehr et al., 2024).

The mixing process also influences performance. Strategies such as pre-Humidifying the aggregate, mixing in two stages, and gradually adding water can improve... Consistency and reduced workability loss. In construction environments, control should include the identification of the recycled aggregate batch, the moisture content, the visual appearance, the absence of contaminants, particle size distribution, and the results of basic tests. The lack of Traceability is one of the main obstacles to the technical acceptance of RCC (Nunes and Mahler, 2020; ABNT, 2021).

Table 2 - Indicative replacement ranges and recommended applications

Material/application	Initial track recommended	Technical observations
Interior coating mortar	20% to 50% recycled fine aggregate	Check the workability, adhesion, absorption, and shrinkage; avoid excessive fines.
Mortar for laying bricks	20% to 40% recycled fine aggregate	Control water retention and compatibility with ceramic or concrete blocks.
Subfloor and leveling	30% to 70% recycled fine aggregate	Favorable application, provided there is curing, crack control, and minimum resistance.
Concrete for sidewalks, curbs and gutters	20% to 50% recycled aggregate	Evaluate absorption, compressive strength, and Surface wear.
Pavers and non-structural blocks	20% to 50% recycled aggregate	Require dimensional, absorption, compaction, and strength control per batch.
Ballast and fill materials without a structural function.	Even higher levels, as determined by testing.	It is feasible when there are no structural requirements, but it still requires impurity control.

Source: Author's own elaboration based on the reviewed literature (2020-2026).

2.6 Environmental and economic benefits

The use of recycled concrete aggregate (RCC) in non-structural mortars and concretes helps to reduce... extraction of natural aggregates, consumption of land for final disposal and associated impacts

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to waste transportation. In a circular economy approach, waste ceases to be Previously understood solely as an environmental liability, it is now treated as a secondary raw material. This change, however, depends on reverse logistics, processing plants, and demand. local for recycled aggregates and technical specifications that guarantee safety to designer and to the executor (Nunes and Mahler, 2020; Contreras Llanes et al., 2022).

The economic benefit is not automatic. It depends on the distance between generation, processing and consumption; sorting costs; technological control; scale of production; and the availability of natural aggregates in the region. In places where sand and gravel If construction debris disposal is expensive or costly, recycled aggregate can be a viable alternative. competitive. Conversely, if the waste requires long-distance transportation or processing. In complex situations, the financial advantage may decrease (Silva and Melo, 2023; Joseph et al., 2023).

Even when the direct cost is similar to that of the natural aggregate, C&D waste can add value. value in reducing environmental liabilities and facilitating compliance with sustainability criteria. in public works, environmental certifications and waste management policies. For this, the The specification must be accompanied by verifiable criteria, such as origin and class of... residue, characterization tests, contaminant limits, and product performance. Finally, without this traceability, the sustainable argument loses technical force (ABNT, 2021; Nunes and Mahler, 2020).

Local production of recycled aggregates can further reduce urban impacts. associated with improper disposal. Waste dumped on land, riverbanks or Public roads cause silting, proliferation of vectors, obstruction of drainage, and associated costs. Urban cleaning. Recycling cementitious materials alone does not solve the entire management of RCC, but it creates a value-added route for the larger volume mineral fraction and can stimulate segregation even on the construction site (Brazil, 2002; Silva and Melo, 2023).

2.7 Risks, restrictions and technical responsibilities

The adoption of recycled concrete aggregate (RCC) in non-structural mortars and concretes presents risks when performed without specification. Among the most common problems are contamination by plaster, Wood, plastic, organic soil and metals; abrupt change in particle size; excess of fines; absorption not considered in dosage; and absence of assays. These factors can lead to Cracking, loss of strength, surface powdering, efflorescence, poor adhesion and Lower than expected performance (Salles et al., 2021; Saiz Martínez et al., 2023).

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The use in structural elements requires more rigorous criteria and is not the focus of this [resource/approach]. study. The choice for non-structural applications represents a gradual strategy and Technically more conservative, especially for small producers, smaller projects. Size and municipalities that are starting recycling chains. Still, the person in charge The technician must clearly specify the permitted application, the substitution content, and the tests. minimum requirements and usage restrictions, preventing the material from being improperly applied to functions. resistant (ABNT, 2021; Salgado and Silva, 2022).

Professional responsibility also involves communication with the construction site. Recycled materials should not be treated as undifferentiated substitutes for sand or... crushed stone. The team must understand that recycled aggregate requires moisture control. Separate storage, protection against contamination, and dosage according to approved mix design. Without these routines, even a trait that has been technically validated in the laboratory can fail to detect it. execution (Rodrigues et al., 2024; Palhares et al., 2023).

Minimum technological control should include particle size distribution and mass analysis. Specific gravity, absorption, fines content, visual analysis of contaminants, and final product tests. For mortars, consistency, strength, adhesion, and absorption tests are recommended. depending on the application. For concrete and artifacts, resistance to stress must be evaluated. compression, absorption, specific gravity, and wear or abrasion, when applicable. The level of control should be proportional to the criticality of the use (ABNT, 2021; Contreras Llanes et al.) al., 2022).

3. Materials and methods

This research is characterized as a narrative literature review of a qualitative nature. and applied purpose. The methodological procedure consisted of selecting, reading and systematization of scientific publications and technical documents on the use of waste from civil construction in mortars, recycled concretes and non-cementitious products structural. The choice of narrative review is justified by the objective of integrating results from different studies and convert them into technical application criteria, instead of carrying out statistical meta-analysis or proprietary laboratory assay (Silva and Melo, 2023; Joseph et al., 2023).

References published between 2020 and 2026 were prioritized, including national articles. and international, papers from technical meetings, civil engineering journals, standards and regulatory documents. The databases and sources consulted included open access journals,

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SciELO, national scientific journals, MDPI, Springer, ScienceDirect, PubMed, repositories Institutional and technical records of ANTAC were also incorporated. Brazilian standards were also incorporated. indispensable to the topic, especially ABNT NBR 15116, as it establishes requirements for Recycled aggregates in Portland cement mortars and concretes (ABNT, 2021; Nunes and Mahler, 2020).

The inclusion criteria were: direct relevance to the topic of C&D waste, recycled aggregate, Mortar, non-structural concrete or recycled concrete; recent publication; availability data on properties, dosage, performance or management; and relevance to application Practical experience in cementitious materials. Opinion pieces without a technical basis were excluded. publications without minimal attribution of authorship, studies exclusively focused on waste. non-mineral materials, unrelated to mortars or concretes, and works that did not present direct contribution to the proposed scope (Rodrigues et al., 2024; Salgado e Silva, 2022).

The analysis of the material followed three stages. In the first, the studies were classified. depending on the type of application: mortars, non-structural concretes, recycled aggregates and C&D waste management. In the second phase, recurring technical parameters were identified, such as the content of replacement, absorption, particle size, strength, workability, durability and viability environmental. In the third stage, the results were synthesized into interpretive tables, with recommendations for use, risks and precautions in technological control (Palhares et al., 2023; Castro, Silva and Almeida, 2023).

As a methodological limitation, it should be noted that the results do not replace further trials of Specific dosages for a project or for a batch of recycled aggregate. RCC is a The material is variable by nature, and the literature provides trends, not universal guarantees. Therefore, the conclusions should be understood as preliminary technical guidelines, useful for specification, planning and decision-making, but dependent on validation. local experimental when applied in real work (Saiz Martínez et al., 2023; ABNT, 2021).

4. Results and discussion

4.1 Technical feasibility in mortars

The review indicates that the use of recycled concrete aggregate (RCC) in mortars is technically feasible when... The replacement of natural aggregate is planned, and the residue is subjected to appropriate processing. Most favorable results are associated with partial replacements, as these

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They balance environmental benefits with performance stability. In mortars of For coating and bedding, the replacement of fine aggregate must take into account consistency. Water retention, compressive strength, adhesion, and capillary absorption. Final performance depends not only on the C&D content, but also on the quality of the waste and of the trait adjustment (Rodrigues et al., 2024; Schiller, Paliga and Torres, 2022).

The incorporation of recycled fine aggregate can improve the particle size distribution curve. when the residue contains fractions that complement those of natural sand. In this case, there is better packing and void reduction. However, when the residue has an excess of fines, With highly porous particles or poorly distributed particle size, the demand for water increases and the Mortar can exhibit greater shrinkage. This result explains why different studies... They arrive at different conclusions: RCC is not a single material, but a family of materials. dependent on origin and processing (Castro, Silva and Almeida, 2023; Batista et al., 2022).

For coatings, the greatest care lies in the relationship between absorption, adhesion and Cracking. A mortar with a high RCC content may adhere well initially, but it may... It can exhibit excessive shrinkage and cracking if the mixing water is increased without control. Therefore, the dosage should aim for the right consistency without sacrificing the water/cement ratio. Tensile adhesion and absorption tests become especially important when the The material is intended for facades or wet areas (Veloso et al., 2020; Rodrigues et al., 2024).

For laying and subfloors, the feasibility tends to be greater, as the requirement for The surface finish is less pronounced, and the material can tolerate rougher textures. However, The replacement content must be compatible with the expected performance. In subfloors, for example... For example, controlling cracking and curing is crucial. In masonry mortars, the Water retention influences cement hydration and adhesion to masonry units. (Schiller, Paliga and Torres, 2022; ABNT, 2021).

4.2 Technical feasibility in non-structural concrete

In non-structural concrete, the review demonstrates that RCC (Recycled Concrete Composite) can meet various applications. of lesser structural responsibility, especially when recycled aggregates They partially replace natural aggregates. The most stable performance occurs when... The recycled fraction is pre-sorted and the mix design is adjusted through testing. The concrete Recycled non-structural material should not be specified solely by its compressive strength, because Properties such as absorption, abrasion resistance, and surface durability can determine

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the service life of sidewalks, floors and precast pieces (Palhares et al., 2023; Contreras Llanes et al., 2022).

The presence of recycled coarse aggregate can reduce specific gravity and strength. compared to conventional concretes, especially at high levels. However, For curbs, gutters, pavers, and non-structural blocks, the required strength can be achieved. with proper dosage. The critical factor is to prevent the performance reduction from exceeding the permissible limit for application. Thus, final performance control is preferable to control is based solely on the percentage of replacement (Robalo et al., 2021; Akbarimehr et al., 2024).

International studies reinforce that recycled aggregates can be applied in paving and concrete components with less environmental impact, offering benefits and in preservation of natural resources. Contreras Llanes et al. verified the feasibility of using Recycled aggregates in concrete for paving, while Akbarimehr et al. observed that unsorted waste can yield satisfactory results in some applications, although the presence of clays and fines impairs the mechanical properties. This finding reinforces the importance of screening and characterization (Contreras Llanes et al., 2022; Akbarimehr et al., 2024).

In the Brazilian context, its use in artifacts and non-structural elements can represent a path to greater technical acceptance. Municipal or private recycling plants can directing higher quality aggregates towards concrete and mortar, while fractions of Lower-performance materials may be used for bases, sub-bases, leveling layers, and fills. This prioritization prevents misuse and increases the overall utilization of the waste. (Nunes and Mahler, 2020; Silva and Melo, 2023).

4.3 Summary of applications, advantages and limitations

Integrated analysis allows us to state that the main advantage of C&D waste is environmental, but Its adoption is only justified when technical performance is proven. The most common applications Recommended options are those in which the variability of the recycled aggregate can be absorbed. through the system without compromising safety or lifespan. Therefore, mortars of Leveling, subfloors, sidewalks, sealing blocks, pavers, curbs and gutters are uses. Preferred applications. Applications with severe exposure, high aesthetic requirements, or high responsibility. Structural issues should be treated with greater caution (ABNT, 2021; Joseph et al., 2023).

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The most common limitation is the lack of standardization of recycled material. In many cases... In these municipalities, construction and demolition waste (CDW) arrives mixed, contaminated, and without segregation by origin. This condition makes processing more expensive and the final product more uncertain. Technical use This requires management to begin on the construction site, with the separation of mineral waste and the removal of... contaminants and proper packaging. Efficient recycling is not just a matter of... industrial process, but also the result of an organized chain (Nunes and Mahler, 2020; Salles et al., 2021).

From a design perspective, it is recommended that descriptive reports and specifications be included. clearly indicate the possibility of using recycled aggregates, the type of waste accepted, The maximum initial content, the required tests, and the permitted applications. In small projects, these... Requirements can be simplified, but not eliminated. Minimal control prevents... Inadequate materials are used under the generic argument of sustainability. (ABNT, 2021; Silva and Melo, 2023).

From an academic point of view, there are still significant gaps. Studies are needed with greater comparability between traits, standardization of aggregate characterization, analysis of Durability in real-world environments, life cycle assessment, and regional economic studies. There is also room for research on additives, pretreatments, accelerated carbonation, and use. of recycled fines and integration between C&D waste and other mineral waste in cementitious products (Salgado and Silva, 2022; Vintimilla and Etxeberria, 2025).

Table 3 - Feasibility matrix for the use of RCC in non-recycled mortars and concretes structural

Application	Feasibility technique	Main risk	Decisive control criterion
Coating internal	High, with partial replacement	Cracking due to shrinkage and excess water.	Consistency, adherence and absorption
Coating external	Average requires greater control.	Absorption, cracking, and loss of adhesion.	Tensile adhesion, capillarity and cure
Masonry installation of sealing	Medium to high	Water of retention variation	Strength, workability, and adhesion
Subfloor	High	Surface and cracking and powdering	Curing, resistance, and particle size
Lightweight and sidewalks	High, if there is no heavy traffic.	Wear and absorption	Resistance, abrasion and absorption

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Application	Feasibility technique	Main risk	Decisive control criterion
Pavers and (non-structural blocks)	Medium to high	Broken edges and high absorption.	Compaction, strength and dimensional control
Structural elements	Restricted and outside the central area	Structural responsibility and durability	Only with full project compliance standard and specific

Source: Author's own elaboration based on the reviewed literature (2020-2026).

4.4 Proposed guidelines for practical application

Based on the literature, it is proposed that the practical adoption of RCC follow a sequence. minimum number of decisions. First, the end application and its requirements must be identified. Performance. Next, the type of acceptable residue is defined, prioritizing mineral fractions. Class A waste is removed, and contaminated materials are rejected. Then, beneficiation is carried out by... Crushing and screening, followed by basic physical characterization. Only after this step, the The design must be adjusted and tested (ABNT, 2021; Silva and Melo, 2023).

The second guideline is to start with partial replacements. Instead of replacing entirely composed of sand or gravel, it is recommended to work with progressive proportions and compare the results. results with a reference point. This strategy allows identifying the point at which the Environmental benefits are still maintained without significant technical loss. For many uses, this is not... Structurally, the intermediate ranges offer a better balance between performance, cost and utilization of waste (Rodrigues et al., 2024; Palhares et al., 2023).

The third guideline is to control moisture and absorption. The recycled aggregate must be... stored separately and protected from contamination. Before production, it must be To understand the moisture content and estimate the water absorbed during mixing. When necessary, apply... Pre-moistening or adjusting the kneading water reduces variations in... workability and avoids improvised corrections on the construction site (Robalo et al., 2021; Joseph et al., 2023).

The fourth guideline consists of validating the final product. For mortars, validation should... Consider consistency, strength, and adhesion, as well as absorption in exposed applications. For non-structural concrete, compressive strength and absorption of water, specific gravity and resistance to wear when there is circulation of people or Light vehicles. The control must be documented, as traceability increases safety. technical aspects and acceptance by the client (Contreras Llanes et al., 2022; ABNT, 2021).

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Finally, it is recommended that municipalities, construction companies, and designers create specifications. Standardized for recycled materials. The lack of specification leads to underutilization of C&D waste. or to its improper use. A well-defined technical policy allows for the transformation of waste into predictable quality inputs, favoring the circular economy and reducing pressure on natural deposits (Nunes and Mahler, 2020; Saiz Martínez et al., 2023).

Final Considerations

The use of construction waste in non-structural mortars and concretes. It has proven technically feasible, provided that the material is classified and processed. Characterized and dosed according to the application. The review indicates that RCC should not be used. as a generic substitute for sand or gravel, but as recycled aggregate with properties specific, which require control of absorption, particle size, fines content, composition and of contaminants. Thus, the hypothesis that utilization is possible under certain conditions is confirmed. controlled, especially in applications without a structural function (ABNT, 2021; Silva and Melo, 2023).

In mortars, the best results tend to occur with partial replacements of fine aggregate, especially when the particle size distribution is suitable and the mixing water It is adjusted according to absorption. Coating mortars require greater attention to adhesion, shrinkage, and absorption, while subfloors and leveling surfaces present a field of most favorable application. In all cases, performance must be verified by means of tests compatible with the function of the material (Rodrigues et al., 2024; Castro, Silva and Almeida, 2023).

In non-structural concrete applications, RCC (Recycled Concrete Composite) can be used in sidewalks, curbs, gutters, etc. pavers, blocks, ballast and precast pieces of lesser responsibility, provided that the resistance, absorption and wear should be compatible with the intended use. National and international literature demonstrates that moderate replacement percentages can deliver performance. satisfactory, but high levels require greater rigor in dosage and technological control. (Palhares et al., 2023; Contreras Llanes et al., 2022).

The main environmental contribution lies in the reduction of the extraction of natural aggregates. and the improper disposal of waste. However, the environmental benefit must be accompanied by Technical and logistical feasibility. Reuse is only consolidated when there is segregation in construction site, in processing plants, in design specifications, in applicable standards and

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in market acceptance. Without this chain, RCC remains underutilized or employed by informal way (Nunes and Mahler, 2020; Joseph et al., 2023).

As a practical recommendation, it is suggested that the application begin with the non-elements. structural components of lower criticality, with partial levels of substitution and validation through tests. It is also recommended that further studies evaluate durability in the field, the Hygrothermal performance, life cycle, regional cost, and standardization of mixtures. In this way, C&D waste can cease to be an environmental liability and assume an effective role as technical input in sustainable civil construction (Salgado and Silva, 2022; Vintimilla and Etxeberria, 2025).

References

Brazilian Association of Technical Standards. NBR 15116: Recycled aggregates for use in Portland cement mortars and concretes - requirements and test methods. Rio de Janeiro: ABNT, 2021.

AKBARIMEHR, D.; ESLAMI, A.; NASIRI, A.; RAHAI, M.; KARAKOUZIAN, M. Performance study of sustainable concrete containing recycled aggregates from non-selected construction and demolition waste. Sustainability, vol. 16, no. 7, article 2601, 2024. DOI: https://doi.org/10.3390/su16072601.

BATISTA, BCC; SILVA, Á. BBM; NOÉ, AF; LOPES, RK; CHRISTOFORO, A. L.; ALMEIDA, DH Influence of the addition of mixed recycled concrete and demolition waste on the compressive strength and porosity of mortar. Revista Principia, v. 59, n. 3, p. 934-946, 2022. DOI: https://doi.org/10.18265/1517-0306a2021id5005.

BRAZIL. National Council for the Environment. CONAMA Resolution No. 307, of July 5, 2002. Establishes guidelines, criteria and procedures for the management of construction waste. Brasília, DF: CONAMA, 2002.

CASTRO, TEC; SILVA, PHV; ALMEIDA, FCR. The state of the art regarding the incorporation of recycled fine aggregate in cementitious mortars. National Meeting on Waste Utilization in Construction, v. 8, p. 1-8, 2023.

CONTRERAS LLANES, M.; ROMERO PÉREZ, M.; GÁZQUEZ GONZÁLEZ, MJ; BOLÍVAR RAYA, JP Construction and demolition waste as recycled aggregate for environmentally friendly concrete paving. Environmental Science and Pollution Research, vol. 29, p. 9826–9840, 2022. DOI: https://doi.org/10.1007/s11356-021-15849-4.

JOSEPH, HS; PACHIAPPAN, T.; AVUDAIAPPAN, S.; MAUREIRA-CARSALADE, N.; ROCO-VIDELA, Á.; GUINDOS, P.; PARRA, PF. A comprehensive review on recycling of construction demolition waste in concrete. Sustainability, v. 15, n. 6, article 4932, 2023. DOI: https://doi.org/10.3390/su15064932.

MAIA, PS; SILVA JÚNIOR, LA; SALLES, PV; CARVALHO, MVS. Technical evaluation of structural concrete manufactured with coarse aggregate from construction and demolition waste. Research, Society and Development, v. 11, n. 8, e45011830582, 2022. DOI: https://doi.org/10.33448/rsd-v11i8.30582.

NANYA, CS; FERREIRA, FGS; CAPUZZO, VMS. Mechanical properties and durability of concrete with recycled aggregate. Matéria, v. 26, n. 4, 2021. DOI: https://doi.org/10.1590/S1517-707620210004.1373.

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Year VII, v.1 2026 | Submission: 05/30/2026 | Accepted: 05/31/2026 | Publication: 06/03/2026

NUNES, KRA; MAHLER, CF Comparison of construction and demolition waste management between Brazil, the European Union, and the USA. Waste Management & Research, vol. 38, no. 4, p. 415–422, 2020. DOI: https://doi.org/10.1177/0734242X20902814.

PALHARES, MJDO; SANTOS, WJS; BONALDO, E.; SILVEIRA, GTR. Study of non-structural concrete with different contents of recycled coarse aggregates from construction and demolition waste. National Meeting on Waste Utilization in Construction, v. 8, p. 1–7, 2023. DOI: https://doi.org/10.46421/enarc.v8i00.2958.

ROBALO, K.; COSTA, H.; CARMO, R.; JÚLIO, E. Experimental development of low cement content and recycled construction and demolition waste aggregates concrete. Construction and Building Materials, 273, article 121680, DOI: https://doi.org/10.1016/j.conbuildmat.2020.121680. v. 2021.

RODRIGUES, VT; FOLCHINI, LA; SILVA, RA; BONSEMBIANTE, FT; LERMEN, RT. Utilization of construction waste in mortar composition as a substitute for fine aggregate. Revista Foco, v. 17, n. 3, e4581, 2024. DOI: https://doi.org/10.54751/revistafoco.v17n3-042.

SAIZ MARTÍNEZ, P.; FERRANDEZ, D.; MELANE-LAVADO, A.; ZARAGOZA-BENZAL, A. Characterization of three types of recycled aggregates from different construction and demolition waste: an experimental study for waste management. International Journal of Environmental Research and Public Health, vol. 20, no. 4, article 3709, 2023. DOI: https://doi.org/10.3390/ijerph20043709.

SALGADO, F.; SILVA, FA Recycled aggregates from construction and demolition waste towards an application on structural concrete: a review. Journal of Building Engineering, vol. 52, article 104452, 2022. DOI: https://doi.org/10.1016/j.jobe.2022.104452.

SALLES, PV; GOMES, CL; POGGIALI, FSJ; RODRIGUES, CS The importance of segregation of recycled aggregate in the strength and durability of structural concrete.
Built Environment, v. 21, n. 3, p. 177-196, 2021. DOI: https://doi.org/10.1590/s1678-86212021000300545.

SCHILLER, APS; PALIGA, CM; TORRES, AS Literary review - mortars with incorporation of construction waste. Research, Society and Development, vol. 11, no. 6, e11011628866, 2022. DOI: https://doi.org/10.33448/rsd-v11i6.28866.

SILVA, DA; MELO, CEL. Challenges for sustainable concrete. Brazilian Journal of Environmental Management and Sustainability, v. 7, n. 17, p. 1543-1562, 2020. DOI: https://doi.org/10.21438/rbgas(2020)071732.

SILVA, DA; MELO, CEL. Recycled aggregate: a sustainable source of raw material — a review. Revista Principia, v. 60, n. 2, p. 370-386, 2023. DOI: https://doi.org/10.18265/1517-0306a2021id6033.

VELOSO, CKS; PERTILE, BHP; NASCIMENTO, LG; SOARES, TKF; LOPES, PD; MOURA, AOC; SOUSA, RML; MELO, ST. Performance evaluation of mortar incorporating ceramic waste. Brazilian Journal of Development, v. 6, n. 1, p. 822–837, 2020. DOI: https://doi.org/10.34117/bjdv6n1-057.

VINTIMILLA, C.; ETXEBERRIA, M. Limiting the maximum fine and coarse recycled aggregates - Type B used in structural concrete. Construction and Building Materials, vol. 459, article 139791, 2025. DOI: https://doi.org/10.1016/j.conbuildmat.2024.139791.

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