PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Title page. The title reads “Recycling Polyethylene Terephthalate (PET) Bottle Waste into Sustainable Building Materials: A Systematic Review of Technical Performance, Environmental Safety and Circular-Economy”. The article-type field on the title page is recorded as “Systematic Review”.
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Abstract. The four databases searched reported, the 798 records identified, the 69 studies that met the eligibility criteria, the 28 of those that reported the quantitative performance data synthesised in the review, the recycling routes and building-material applications compared, the principal findings and the main research gaps discovered.
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Section 1, paragraphs 1-6. Scale of PET waste and low recycling rates, the emissions and raw-material demand of the construction sector, and the scope limits of earlier reviews.
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Section 1, final paragraph (objectives i to iv); Section 2, PICOS framework (population, intervention, comparison, outcomes and setting).
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Section 2, “Eligibility criteria” (inclusion and exclusion criteria; publication window 1 January 2000 to 31 May 2025). Studies are grouped by material class for synthesis (Section 2, “Data extraction”; Section 4).
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Section 2, search strategy paragraph. Databases: Scopus, Web of Science Core Collection, Google Scholar and PubMed Central. Reference lists of retrieved reviews were hand-searched. No registers, websites or organisations were searched.

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Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Section 2, search strategy paragraph: full core search string, database-specific field codes (TITLE-ABS-KEY; TS), date range and the statement that no language or document-type filter was applied at the search stage. Date the searches were last run: to be inserted. The line-by-line string for each of the four databases is not reproduced.
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Section 2, “Screening and selection”. Two reviewers screened titles, abstracts and full texts independently; unresolved disagreements were decided by a third reviewer; agreement was quantified with Cohen’s kappa. The level of agreement is to be inserted.
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Section 2, “Data extraction”. A standardised form was piloted on ten studies and then applied to all included studies. The number of reviewers who extracted data, whether extraction was independent and any procedure for confirming data with study authors are not reported.
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Section 2, PICOS “Outcomes” and “Data extraction” (all reported performance outcomes: mechanical, physical, durability, environmental and economic). Whether all results compatible with each outcome and all time points were sought is not reported.
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Section 2, “Data extraction”: PET waste source and form, matrix material, dosage and dosage basis, specimen preparation, curing and conditioning, test standard and specimen geometry. Funding sources of the included studies are not reported.
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Section 2, “Quality and risk-of-bias appraisal”: purpose-built six-item tool, each item scored 0 to 2, total 0 to 12, classified low (10-12), moderate (7-9) or high (6 or below); high-risk studies were retained for qualitative description only and excluded from the reported ranges. The number of assessors and whether assessment was independent are not reported. Item-level results: Supplementary Table S2.
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Not applicable. No meta-analysis was performed; outcomes are reported in the units used by each primary study, and dosages reported on different bases were not pooled (Section 2, “Data extraction”).
Synthesis	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis	Section 2, “Quality and risk-of-bias appraisal” and “Avoiding double counting”: only primary studies

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methods		(item #5)).	were used for data extraction, and studies at high risk of bias were excluded from the quantitative ranges. Studies are grouped by material class. Separate per-synthesis eligibility criteria are not reported.
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics or data conversions.	Section 2, “Data extraction”: dosages were converted to a common basis only within a material class and only where the conversion was reported by the authors. Unit conversions and the normalisation behind Figure 3, Table 1 and Figure 4: Supplementary Table S3.
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Table 1 (recycling methods); Table 2 (studies contributing the performance evidence, with dosage basis and test information); Table 3 (reported mechanical and thermal properties); Figures 3–7; Supplementary Tables S1–S4.
	13d	Describe any methods used to synthesise results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Section 2, “Data extraction” and “Avoiding double counting”: narrative synthesis without statistical pooling, with the rationale for not pooling dosages reported on different bases. No meta-analysis model was required.
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	Not applicable: no statistical synthesis was performed. Sources of variation between studies are discussed narratively in Section 4 and Section 6.1.
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesised results.	Section 2, “Quality and risk-of-bias appraisal”: studies at high risk of bias were excluded from the quantitative ranges reported in Section 4. No further sensitivity analyses were conducted.
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	Not assessed. No statistical synthesis was performed, so an assessment of risk of bias due to missing results was not applicable.
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	Not assessed with a formal framework such as GRADE. The strength of the evidence behind each conclusion is stated in Section 8, and study-level risk of bias is reported in Section 2 and Supplementary Table S2.
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Section 2, “Selection outcome”; Figure 1 (PRISMA 2020 flow diagram). Identified 798; after duplicate removal 512; screened 512; excluded 384; sought

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			for retrieval 128; not retrieved 3; assessed for eligibility 125; excluded 56; included 69.
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Figure 1 lists the 56 reports excluded at full-text assessment by reason (full text not available, 12; duplicate dataset or companion paper, 18; no PET-specific data, 15; off-topic application, 11). Individual excluded reports are not listed by citation.
Study characteristics	17	Cite each included study and present its characteristics.	Table 2 in Section 4 lists the 28 studies that supply the quantitative performance ranges discussed in Sections 4 and 5, giving material class, PET form, dosage and the basis on which it was reported, test standard and key reported outcome for each; the reference number of each study is given in square brackets. The characteristics of all 69 included studies, including the 41 that do not report dosage-based quantitative data, are recorded in Supplementary Table S1, which has one row for each included study and uses the same columns as Table 2. Risk-of-bias and quality appraisal of the same 69 studies: Supplementary Table S2.
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Supplementary Table S2 is the appraisal sheet: six items scored 0 to 2, total 0 to 12, with the risk-of-bias classification, completed for all 69 included studies. Twelve studies scored 10-12 (low risk of bias) and fifty-seven scored 7-9 (moderate risk); no included study fell in the high-risk band, so no study was excluded from the quantitative ranges on quality grounds. The studies are identified by the reference numbers of the revised manuscript.

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Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Sections 3-5 report the outcomes of individual studies in the text, and Supplementary Table S1 records the key reported outcome for each of the 69 included studies. Group-level summary statistics and effect estimates with confidence intervals are not tabulated, because the primary studies report heterogeneous outcome measures and dosage bases.
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Section 4, opening paragraphs and each subsection summarise the characteristics of the contributing studies for each material class; Section 8 states the quality of evidence behind each conclusion.
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	Not applicable: no statistical synthesis was performed.
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	Not applicable: no statistical synthesis was performed. Variation between studies is discussed narratively in Section 4 and Section 6.1.
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	Not applicable: the only robustness procedure was the exclusion of studies at high risk of bias from the quantitative ranges (Section 2, “Quality and risk-of-bias appraisal”; Section 4).
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	Not assessed; see item 14.
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	Not assessed with a formal framework; see item 15. Section 8 states the strength of evidence for each of the four conclusions.
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Section 8 (“Conclusions”) and Section 5. Comparison with earlier reviews is in Section 1.
	23b	Discuss any limitations of the evidence included in the review.	Section 6.1 (scarcity of long-term durability data; uneven distribution of the evidence base; narrow usable dosage ranges) and Section 8, where each conclusion is qualified by the quality of the evidence behind it.
	23c	Discuss any limitations of the review processes used.	Section 6.4 (“Limitations of the review”) discusses the limitations of the review process: the four databases searched and the exclusion of trial registers, standards databases and non-English sources; the absence of prospective registration, so that

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			the eligibility criteria and extraction fields were fixed after the searches had been executed; the uneven distribution of the evidence across material classes; the restriction of quantitative comparison to studies that stated their dosage basis; and the transfer of some environmental and health evidence from PET in other matrices.
	23d	Discuss implications of the results for practice, policy and future research.	Section 6 (Barriers to adoption"); Section 7 ("Future research directions", subsections 7.1-7.5); Section 5.4 (economic viability and market readiness).
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Not registered. Section 2 states that the review protocol was not registered prospectively because the work began as a narrative review and the protocol was formalised only during revision, by which time the searches had already been executed, so prospective registration was not possible.
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	No protocol was prepared in advance. The protocol was formalised during revision, and the search strings, PICOS framework, screening procedure, quality appraisal and extraction fields are reported in full in Section 2.
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	Not applicable. No protocol was registered or published before the searches were run, so there were no registered amendments to report.
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Funding statement: this research received no external funding. Author contributions are stated on the title page.
Competing interests	26	Declare any competing interests of review authors.	Conflicts of interest statement: the authors declare no conflicts of interest.

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Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	Supplementary Materials Statement: Supplementary Tables S1 to S4 and Table S4b—study characteristics for all 69 included studies, risk-of-bias appraisal of the same 69 studies, per-source data behind Table 1 and Figures 3 to 7, together with the Marshall-stability conditions, and the reference verification log for all 107 references—together with the completed PRISMA 2020 checklist—are provided as supplementary files. Data Availability Statement: the search strategy and the data-extraction fields are described in Section 2; the characteristics of all 69 included studies, the quality and risk-of-bias appraisal of those studies and the per-source values behind Table 1 and Figures 3 to 7 are provided in Supplementary Tables S1 to S3; the reference verification log is given in Supplementary Table S4.

The table below records where each item of the PRISMA 2020 statement is reported in the manuscript and in its Supplementary Materials. Section, figure and table numbers refer to the revised manuscript; entries such as “Supplementary Table S1” refer to the accompanying Supplementary Material file. Reference numbers are those of the revised manuscript. Supplementary tables are those of Supplementary_Tables_v3.docx; this version of the checklist was updated in the third revision so that it agrees with that file and with the revised manuscript.

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Recycling Polyethylene Terephthalate (PET) Bottle Waste into Sustainable Building Materials: A Systematic Review of Tech-nical Performance, Environmental Safety and Circular-Economy

Supplementary Material for manuscript sustainability-4573855, submitted to Sustainability (MDPI). Corresponding author: S. L. Mak, Youth College (Kwai Chung), Vocational Training Council, Hong Kong SAR, China.

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71. This work is licensed under CC BY 4.0. To view a copy of this license, visit https://creativecommons.org/licenses/by/4.0/