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Recommendations for amending green building standards to increase incentives for using plastic recycled material in the construction sector in Israel

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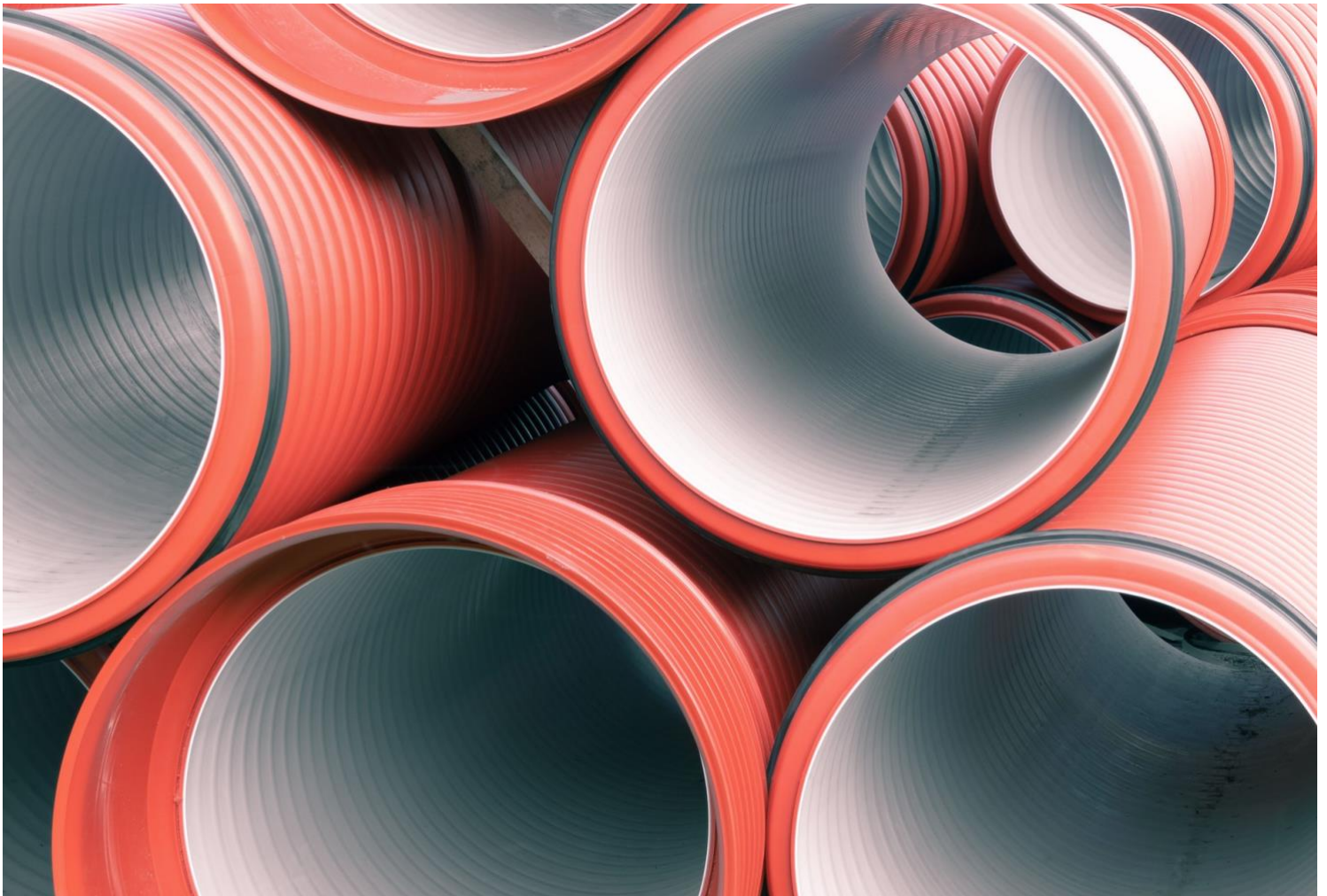
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Executive summary

Work has been going on globally to integrate recycled plastic in the infrastructure and construction sector, and numerous organizations are developing work programs and technologies. National and voluntary building standards such as BREEAM and LEED also address the topic and award points to products/solutions with recycled (plastic) content.

In chapters 1-2 we will briefly describe the global efforts. In chapters 3-4 we describe opportunities and recommendations for inclusion in the Israeli market.

Suggested elements to consider:

- Policymakers and procurers need to decide whether minimum standards on recycled content are voluntary or mandatory and how many points they award for higher than minimum compliance
- Verification of recycled material could be an issue and should be addressed
- Integration of recycled material can take place across all life cycle stages of the building: construction, use phase, overhaul, demolition, development of the construction site surrounds the building.
- Supportive waste management policy can impact construction decisions. Examples are landfill bans for construction waste, or criteria for accepted C&DW at landfills - Extend EPR to the plastic used in construction.
- Adopt a certification scheme for recycled content (see annex 1 for a list of such schemes)
- Integration of recycled plastic into specific national standards and public works specs is possible and should be promoted (see chapter 4)
- Procurement of products containing recycled content is practical as the offering in this market is expanding
- Begin to manage the data on building content through "building passports", and conduct demolition audits prior to demolition works to salvage materials for recycling/reuse

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1. Global Context and Examples

This review is focused on products and processes in the construction and infrastructure sectors that can use recycled plastic. In this context we are referring to these main plastic materials:

- High-density polyethylene (HDPE)
- Low-density polyethylene (LDPE)
- Polystyrene (PS) & Expanded Polystyrene (EPS)
- Polypropylene (PP)
- Polyethylene Terephthalate (PET)

The use of recycled (plastic) materials in building materials and works is prevalent in several international standards:

- [CEN/TC 249](#): (EN 15343:2007) “Plastics – Quality requirements for the application of plastic recyclates in products/Guidelines for the development of standards for recycled plastics”.
- [CEN/TC 155](#): “Plastics pipes and fittings – Utilization of thermoplastics recyclates”.
- [ISO 21930:2017](#): “Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services”. - [ISO 20819](#): “Plastics- Wood-plastic recycled composites (WPRC)”.¹

[The International Green Construction Code](#) (2018) regulates the construction of new and existing commercial buildings (mainly used in the US). Several sections contain frameworks for the use of recycled content:

- Section 901.4.1.1.1 “**Recycled Content**” states: the recycled content of material shall be the **postconsumer recycled content plus one-half of the pre-consumer recycled content determined by weight (mass)**. The recycled fraction of the material in a product or an assembly shall then be multiplied by the cost of the product or assembly to determine its contribution to the 10% requirement.

Singapore has set itself the goal to get 80% of its building stock (excluding logistics and industrial facilities) certified with its [Green Mark tool](#) by 2030. To encourage recycling, points are given to the following actions as stated in its [Technical Guide and Requirements](#):

- Design stage (p.113):

¹ Other **general standards** that could indirectly play a role: [CEN/TC 350](#): “Sustainability of Construction works”, [EN 15978:2011](#): “Sustainability of construction works – Assessment of environmental performance of buildings – Calculation Method”, [ISO 219310-1:2010](#): “Sustainability in Building Construction – Framework for methods of assessment of the environmental performance of construction works”, [ISO 21929-1:2011](#): “Sustainability in building construction — Sustainability indicators — Part 1: Framework for the development of indicators and a core set of indicators for buildings”, [EN 14942](#): “Sustainability of construction works - Environmental product declarations - Communication format business-tobusiness”, [EN 15804:2012+A2:2019](#): “Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products” (EDP), [ISO 21930:2017](#): “Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services”, [ISO 14040:2006](#):

“Environmental management — Life cycle assessment — Principles and framework”.

- Pre-demolition assessment records of demolition site showing clear recovery/ recycling targets and **estimated quantities of salvageable materials**.
- Waste management plans such as plan layout showing locations of **recycling bins for collection and storage** of different recyclable waste, records of waste movement from site to recycling facilities, proposed usage of the various types of recovered waste

1.1 EU Standards

EC [Roadmap to a Resource Efficient Europe](#) 2020 milestones for the building sector include a specification that 70% of non-hazardous construction and demolition waste will be recycled (while keeping in mind the **Red Lists for Building Materials** which contain chemicals that have been designated as harmful to living creatures, including humans, or the environment. Examples of these lists are the [list of the Living Building Challenge](#) or [the Cradle to Cradle Banned List of Chemicals](#).) While not specific to the construction sector, the roadmap also discusses extend producer responsibility to the full life cycle of the products they make (including via new business models, through guidance on take-back and recycling schemes and support for repair services) which could also be applied to materials in construction.

Level(s): a framework of the European Commission to help design and construct sustainable buildings with the whole lifecycle in mind (leverages [CEN/TC 350](#) standards for sustainable construction). Created the [One Click LCA tool](#); LCA software for buildings (complies with 40+ certifications and EN/ISO standards).

The Commission has introduced a [renovation wave](#) of public and private buildings, as part of the [European Green Deal](#). The strategy for this “wave” is called “[A Renovation Wave for Europe - greening our buildings, creating jobs, improving lives](#)”, and includes the following:

[...full **integration of circularity principles across the value chain**: sourcing safe, sustainable, and secondary raw materials, **reuse and recycling, and waste management**. Industrialization can trigger a virtuous circle between higher demand for deeper renovation and falling costs for smarter and more sustainable products.

The Commission **promotes the environmental sustainability of building solutions and materials**, including wood and bio-based materials, **nature-based solutions, and recycled materials** on the basis of a **comprehensive life-cycle assessment approach**. It will address the sustainability performance of construction products in the context of its revision of the Construction Product Regulation and it will develop **by 2023 a roadmap leading up to 2050 for reducing whole life-cycle carbon emissions in buildings**. The Commission will also accelerate work with standardization organizations on climate resilience standards for buildings.

By the end of 2024, the Commission will review the material recovery targets set in EU legislation for construction and demolition waste. **The Commission will put in place**

measures to increase reuse and recycling platforms and support a well functioning internal market for secondary raw materials. Level(s), the Circular Economy principles for buildings design and the EU Construction and Demolition

Waste management protocol guide the user to apply these principles in renovation projects..]

Under the [European Strategy for Plastics in a Circular Economy](#) is it mentioned that "To further support the integration of recycled plastics in the market, the Commission will also explore more targeted sectoral interventions. For instance, certain applications in the construction and automotive sectors show good potential for uptake of recycled content (e.g. insulation materials, pipes, outdoor furniture, or dashboards).

The Circular plastic alliance report "[State of play for collected and sorted plastic waste from construction](#)" describes the following:

The European Commission Construction & Demolition Waste Management Protocol published in 2016 provides non-binding guidelines to improve waste identification, source separation, and collection. It promotes the use of pre-demolition audits and waste management plans which need to be carried out before any renovation or demolition project.

As laid out by the protocol a pre-demolition audit should be undertaken before the project and identify how the building should be demolished and identify any materials that should be reused recycled or treated separately E.g. hazardous materials. According to the protocol, a good pre-demolition audit should consist of:

- Information on the quantity, quality, and location in the building of all waste materials to be generated
- Information on which materials should be separated at source, which materials can be recycled; and
- Information about how the waste will be managed and what the recycling options are, taking into account local markets for the individual waste streams.

This process is of particular importance for construction plastics, which are often embedded in the building behind walls and under floors and roofs. such as insulation, pipes. They are also usually firmly attached to the building, such as flooring, which can be adhered to the subfloor using adhesives or windows, that need to be dismantled separately. According to the Deloitte report, 17 countries have made pre-demolition either mandatory or they are regulated regionally or voluntarily. fig 15 shows countries that have embedded the pre - demolition audits in their law in green and those that have regional requirements or voluntary codes for pre-demolition audits are shown in blue.



Figure 1 EU Countries having implemented pre demolition audits

Green, by law in country regulation

Blue, private sector initiative or, only in specific regions or on voluntary basis

It should also be noted that pre-demolition audits will be greatly helped by the use of product or building passports, which identify the products used in the building, the materials they are made of, etc. These are only available in newer buildings and not mandatory, but the impact of product passports on demolition projects in the future should be significant. Digitalization will play a key role in identifying product composition at end of life and should greatly increase the potential for collection and sorting.

1.2 BREEAM & LEED

Many countries have developed their own green building standards, such as BREEAM (Building

Research Establishment's Environmental Assessment Method) in the UK, CASBEE (Comprehensive Assessment System for Building Environmental Efficiency) in Japan, and LEED (Leadership in Energy and Environmental Design) in the USA.

We provide here a brief overview of BREEAM and LEED specifications regarding recycled material and plastics.

[BREEAM](#) is a globally used sustainability assessment method for master-planning projects, infrastructure, and buildings. BREEAM does this through third-party certification of the assessment of an asset's environmental, social, and economic sustainability performance, using standards developed by [BRE](#). Besides BREEAM's International schemes, it also has schemes that are developed locally together with national organizations. Examples are [BREEAM-NL-2014](#) (together with the Dutch Green Building Council), [CEEQUAL \(UK's](#) industry scheme for assessing environmental and sustainability performance in civil engineering and public realm projects), and [BREEAM ES](#) (sustainable construction in Spain).

The [Technical Manual of CEEQUAL V6](#) contains the following specifications on “Reclaimed or Recycled materials (fixed) (7.4.12)”:

“Where materials are re-used or recycled, the highest grade of re-use possible will be the most environmentally beneficial. There are several opportunities to re-use or recycle materials:

- Reusing or recycling materials already on-site in the new works (which will also minimize transport impacts)
- Bringing reclaimed or recycled materials from off-site without imposing high transport impacts
- Seeking opportunities for use elsewhere of reclaimed or recycled on-site materials that cannot be used on-site (also without imposing high transport impacts)
- Ensuring that opportunities for the re-use and recycling of materials at the end of the structure’s lifetime are maximized

The following metric is suggested to report the recycled content by total project construction value:

Value (£) or Volume of recycled content per £100k construction value, using a formula such as:

$$\frac{\text{Volume of recycled content in all materials implemented in permanent works}}{\text{Total project construction value } \pounds} \times 100,000$$

[The BREEAM International](#) manual (used for example in the USA, Norway, and Sweden) includes the adoption of alternative means of design or construction that result in lower materials usage and lower wastage levels including off-site manufacture and use of pre-assembled service pods. Recycled plastics are included in their list of secondary aggregates.

The [U.S. Green Building Council](#) (USGBC) developed the [Leadership in Energy and Environmental Design](#) (LEED) scheme (used in 164 countries).

[LEED Materials and Resources Credit 2.1 Construction Waste Management](#) contains the following specifications:

- Achieve sustainable purchases of 50% of total purchases (by cost) during the performance period. Sustainable purchases shall meet 1 or more of the following criteria:
 - Purchases contain at least 10% post-consumer and/or 20% postindustrial material.
 - Purchases contain at least 70% material salvaged from off-site or outside the organization.
 - Purchases contain at least 70% material salvaged from on-site, through an internal organization materials and equipment reuse program.
 - Purchases contain at least 50% of material harvested and processed or extracted and processed within a 500 mile (800 kilometers) radius of the project.

Opportunities for integration in the Israeli green building standard SI 5281 will be discussed below.

1.3 Integration in procurement

The municipality of Amsterdam has created a [“Roadmap voor Circulaire Gronduitgifte”](#) (roadmap for circular land tendering – an introduction to circular construction projects).

Under the theme “Materials” under the topic “Sustainable purchasing of materials: Certification of purchased renewable materials and metals”, it talks about products formulated with recycled materials and requests the following data on each element:

- Materials passport / MPG/overview of all materials/elements of the building Division into main building components
- A statement of the number of elements that make up the main building part - An overview of the elements (name) that make up the main building part
- The total volume of each element
- The volume of each material present in the element (this adds up to the total volume of the element, see the previous line) The Tier level of all materials, as far as this is known or can be filled in.

*the more completed and the lower the tier level, the higher the score.

*uses the MAT5 tool of [BREEAM-NL-2014](#)

Under the BREEAM-NL-2014 section in **“Tier levels and compliance”**, **C2C certified products (dependent on level) or Recycled materials with certified EMS for the production process of the final product, receive a higher rating.**

2. Plastics used in the construction sector

One needs to differentiate between disposable plastic in construction (packaging and paint products, shrink for construction products, plastic films, protective layers, bags, and other uses on the construction site) and products that are part of the building - profiles for windows and doors, pipes, ducts, insulation, wiring, end products, etc. as each type should have its own strategy.

The following organizations have workgroups active in recycled plastic in construction:

- The [alliance for sustainable building products](#) had published a [guide](#) on plastic in construction
- [European Plastics Converters \(EuPC\)](#) together with [PlasticsEurope](#) has a dedicated site "[plastics in construction](#)"
- The association of plastic manufacturers has a dedicated site "[plastics in building and construction](#)"

Main applications found around the world for recycled plastic in construction are in the following fields/products:

2.1. Road paving

Road paving is gaining attention as a sink that could use recycled plastic in large quantities. The British government had published a [study](#) and there is also [scientific literature](#) on the topic. The current recommendation is to use plastic mainly in side-roads. Applications and technology providers are known for example in [India](#), in the Netherlands – for example with the Dutch company [Plastic Road](#), and in the [USA](#). Recently, researchers have shown that [single-use plastic protective equipment](#) can be also used as recyclates for road paving.

Integration of plastic [in the pavement](#) is showing interesting promise and a research project is currently being conducted at the Plastic Center at Shenkr college to develop a local solution.

Finally, integration into [concrete](#) is also showing promise (also [here](#)), while another [report](#) covering the use of recyclates in construction barely mentions plastics as a source (expect a brief mentioning of PS on page 9). There is current work by the plastic center (Technion) together with Greenmix to work on separating plastic waste from C&DW and using it as filler in asphalt or as fuel for cement kilns.

RPMA - recyclable plastic modified asphalt Dow projects to build more than 100 Km of asphalt roads containing recycled plastic across Asia, North America, and Latin America¹.

The technology seems promising, but it is relatively new and therefore needs to be tested cautiously over a long time to make sure they comply with bitumen specifications.

2.2 End products

End products using recycled plastic content are numerous. While providers in Israel are not so abundant, if procurers send a clear signal – the market can sway to include more of these solutions. Examples for applications:

- **Gas and pressure pipes** (From the [Polyolefin CE platform](#)) Polyolefin pipes are often replacing metallic systems, mainly due to their superior resistance to corrosion, abrasion, and chemical attack. They also have a wide operating temperature range up to 95°C and can provide fusion-welded leak-proof jointing. Polyolefin piping systems are fast becoming the most commonly used drinking water, wastewater, and natural gas distribution piping systems in the world.
- **Household wire** Polyolefin shrink tubing is widely used around household wires because they possess good chemical, electrical and physical properties. Besides providing extra durability and heat resistance, heat shrink tubing is also designed to give a perfect fit and does not come off with age or use.
- **Construction material** The LIFE [Repolyuse](#) project tries to recycle PU into construction material
- **Protective materials for construction sites** The Israeli company KB recycling is producing protective material for construction sites made from recycled PE, and is now expanding to Canada and France.
- **Insulation** EPS, if collected properly (currently not done in Israel) can be used as a thermal insulation
- **Indoor decorative surfaces** [Sustainable](#) is the new thin and ultra-lightweight surface made with a combination of quartz and recycled PET plastic. It can be used for kitchen countertops, backsplashes, worktops, wall panels, tabletops, bars, shower panels, etc.

In addition, one can find recycled content in these applications (non-exhaustive list)

- Flooring
- Roofing
- Windows, doors, and related building products
- Pipes
- Building profiles
- Insulation materials
- Cables
- Building membranes
- Synthetic deck
- Cladding
- Pergola
- Indoor and Outdoor furniture
- Fencing
- Housing for spotlight composed of recyclable plastic
- Carpet tiles made from recycled fishing nets

- Safety surface from recycled PE
 - Flat Solid Polycarbonate Sheet, PALGAURD®
 - Oils for furniture polishes and silicone sealant.
 - Recycled plastic lumber²
 - Ground reinforcement grid
 - Recycled plastic information stands
 - Bricks made from recycled plastic and rubber³
 - Plastic ceiling panels⁴
 - Recycled plastic gates
 - Recycled plastic raised beds for gardening
 - Recycled plastic cable cover
 - Recycled plastic trees stakes
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² <https://www.sciencedaily.com/releases/2016/07/160707140229.htm>

³ <http://conceptoplasticos.com/conceptos-plasticos.html>

⁴ <https://www.doityourself.com/stry/pros-and-cons-of-plastic-ceiling-panels>

3. Israeli building and construction standards, and public bodies buildings specifications

Current status in regard to integration of recycled plastics

3.1 Standards:

3.1.1 SI 2300 - RULES FOR RECYCLING OF PLASTIC USED IN PRODUCTION OF NONPRESSURE PIPES: POLYETHYLENE

The standard permits the use of pre commercial waste from internal production, and the use of recycled raw materials that comply with the standard's physical and chemical requirements. The standard permits the use of raw material with no acceptable characteristics (deteriorated raw material) in the middle layer of multi-layer pipes.

3.1.2 SI 5281 – GREEN BUILDING

The standard instructs and incentivizes the use of recycled materials with a content of 10% and 20% recycled material in a material that was used for the construction of the building, awarding 0.5-1 points and 1-1.5 points, respectively (Residential part, section 4.2 - Recycled materials). The building material must meet the requirements of Israeli standards and the relevant Israeli eco-label in order to obtain the points.

3.1.3 SI 1886 - SUBBASES AND SELECTED FILL MATERIALS FOR HIGHWAYS, APRONS, AND AIRFIELD

Plastic is defined as a light non-mineral substance. The standard allows a composition of 0.5-0.7% light non-mineral for subbase and subgrade. The subbed must comply with the physical specifications that are required in the standard. Similar standards abroad allow content of 0.5-2% of non-mineral materials such as plastic.

3.1.4 SI 362 - HOT ASPHALT MIXTURES

The standard does not address recycled content but instructs in clause 2.2 that the bitumen composition in the asphalt mixture is according to SI 161 – 1, which permits the use of recycled organic matter.

3.1.5 SI 161 – 1 - BITUMEN FOR ASPHALT PAVEMENTS: ASPHALTIC BITUMEN (ASPHALT CEMENT)

The standard determines that the bitumen will be produced from oil distillation residues and permits the addition of organic matter including recycled organic matter, as long as it complies with the physical and chemical specifications required in the standard.

3.1.6 SI 5111-2 - PLASTIC PIPING SYSTEMS FOR HOT AND COLD WATER INSTALLATIONS INSIDE BUILDINGS- POLYPROPYLENE (PP) PIPES (an adaption of ISO 15874-2)

Clause 4.1 - The material from which the pipe is made shall be polypropylene (PP).

There is no reference to recycled polypropylene. Issues that might prevent the use of recycled PP are the appearance (clause 5.1), mechanical characteristics (clause 7, table 9), and physical and chemical characteristics of pipes (Clause 8, Table 10).

3.1.7 SI 4427-2 PLASTICS PIPING SYSTEMS - POLYETHYLENE (PE) PIPES AND FITTING FOR WATER SUPPLY, DRAINAGE AND SEWERAGE UNDER PRESSURE: PIPES (an adoption of ISO 4427-2)

Clause 4.6 – Compound shall be designated by the material type (PE). Issues that might prevent the use of recycled PE are the appearance (clause 5.1), mechanical characteristics (clause 7.2, table 3), and physical characteristics of pipes (Clause 8, Table 5).

3.1.8 SI 4427-3 – PLASTICS PIPING SYSTEMS - POLYETHYLENE (PE) PIPES AND FITTINGS FOR WATER SUPPLY, DRAINAGE, AND SEWERAGE UNDER PRESSURE: FITTINGS

Similar to 3.1.7

3.1.9 SI 8779 - PLASTICS PIPING SYSTEMS-POLYETHYLENE (PE) PIPES FOR IRRIGATION – SPECIFICATIONS (an adoption of ISO 8779)

The standard permits use of re-processable and recyclable material (Clause 4.2) – clean reprocessable material generated from the manufacturer's production process may be used, if it is derived from the same resin as used for the relevant production.

The material used for the manufacture of pipes shall conform to the physical characteristics given in table 1 that appears in the standard (Clause 4.3).

3.1.10 SII Specification 53 - WASTE FITTINGS MADE OF PLASTICS: WASTE SYSTEMS FOR BATH

Clause 105 – the fittings will be made from polypropylene or other similar plastic with similar physical and mechanical characteristics.

3.1.11 SII Specification 54 - WASTE FITTINGS MADE OF PLASTICS: WASTE SYSTEMS FOR SHOWER BATH

Similar to 3.1.10

4.2 Public bodies' specifications

4.2.1 The Government facilities administration

The Government facilities administration specifications are used for new construction and generally do not address specific products or materials to be used. Nonetheless the following sections of the specs were found to be relevant for inclusion of requirements for products made of recycled plastic (see specific recommendations in chapter 5)

Clause no.	Clause name	Explanation
0.49	Recycling	Expanding the clause about plastic and not only 'recycled construction materials'
90.18	Materials and products	Reference about recycled plastic
90.805	Ceiling\ Paving\ Flooring	Reference about recycled plastic
90.806	Interior walls	Reference about recycled plastic
90.1003	Roads and parking lots	Reference about recycled plastic

Recommended products with the potential to contain recycled material that can be added to the government facilities administration building specs:

- Synthetic deck
- Cladding
- Fencing
- Housing for spotlight composed of recyclable plastic
- Safety surface from recycled PE
- Recycled plastic lumber
- Ground reinforcement grid
- Recycled plastic information stands
- Bricks made from recycled plastic and rubber
- Plastic ceiling panels
- Recycled plastic bench
- Recycled plastic gates
- Recycled plastic raised beds for gardening
- Recycled plastic cable cover
- Recycled plastic trees stakes

4.2.2 The Blue Book - General specification for construction works

Clause no.	Explanation
<u>Part 1 – Earthworks</u>	
Clause 01.04.04	<p>The use of recycled materials is allowed.</p> <p>The composition of non-mineral materials must not exceed 0.5% (w/w).</p>
Clause 01.04.05	<p>The subbed for roads must comply with the specifications in part 51 – Road construction works</p>
<u>Part 51 - Road construction works</u>	
	<p>The composition of the asphalt mixture must comply with SI 362 and there is an additional reference regarding the composition of recycled organic matter.</p> <p>The specification of the asphalt mixture must comply with tables 11.14/13, 11.14/15 ,11.14/11.</p>

4. Recommendations for integrating recycled plastic in Israeli standards and building specifications

4.1 Recommendation 1

The main opportunity for using recycled plastic is as a filler material in subbed and asphalt roads.

It is important to consider that the technologies are in the early stages and must comply with other specifications of the subbed and asphalt.

The asphalt and subbed with the recycled content must comply with the physical and chemical specifications. Various plastic mixtures might achieve different results and should be used cautiously.

It is also very important to make sure that the use of recycled plastic will not harm the environment and will not contaminate soil and water sources. Relevant standards to implement: SI 161 – 1.

4.2 Recommendation 2

Products related to standards SI 5111-2, 4427-2, 4427-3 and 8779, (standards that permit the usage of recyclable content) have the potential to implement recycled content. Further testing is needed to calculate the maximum recycled content possible that will also match the physical and chemical requirements in the standard. Examples from other places in the world can be found in Australia⁵, North America⁶ and more.

4.3 Recommendation 3

SI 5281 Green building standard:

More than 35 local authorities in Israel require implementation of the SI 5281 Green building standard in new buildings and it is expected to become mandatory across all new construction by the end of 2023.

4.3.1 Recommendation 3.1

The standard supports the use of recycled building materials (including plastic) by giving credits for recycled materials used in the construction project. Currently the standard is going through a revision - an opportunity to increase the number of credits given to recycled plastic content.

⁵ <http://rmpip.es.com.au/>

⁶ <https://www.drainagecontractor.com/making-pipe-from-recycled-plastic-to-reduce-plastic-waste-2466/>

4.3.2 Recommendation 3.2

Section 9 (Innovation) – adding a possibility to get credits for creating a "Building material Passport" - a document listing all the materials and amounts used for the construction of the building. The passport can be used for more efficient recycling as the amounts of each material in the building will be known and the relevant recycling process can be planned and executed. It is recommended to instruct for such a document in every new building in Israel and establish a format and a national database for all these documents which will become Israel's construction materials inventories database.

4.3.3 Recommendation 3.3

Green building standards must relate to the quality of waste separation at the construction site ('at source') and award points for projects that provide separated waste. The previous SI 5281 from the year 2011 had provided credits for waste separation on the construction site (element 8.1). The current standard (SI 5281 2016) no longer provides credits for waste separation on site. We recommend to re-implement the credits provided for waste separation on-site in the revision of the SI 5281 that is in the works now and is expected to be finalized in 2023.

4.4 Recommendation 4

The demolition process of buildings has a great potential for recycling. The lack of an Israeli demolition standard (such as BS 6187:2011 or similar) allows the demolition process of buildings to be breached and with little supervision. There should be a standard for full and partial demolition with guidance on material recycling.

Current demolition standard only relates to subjects such as noise, dust, air pollution, and asbestos treatment but a comprehensive standard will cover recycling potential as well. It is recommended that the standard requires an expert audit before the demolition, to recommend the most suited practices to increase salvage and recycling potential relevant for the specific building and area.

4.5 Recommendation 5

It is recommended to add the following texts to the government facilities administration specifications

Clause no.	Suggested specification
0.49	The contractor will apply to the instruction of the accountant general: prefer usage of recycled materials (including recycled plastics)
0.49	Requiring a "Building material Passport" to increase the potential of recycling the building materials at the end of life of the building.

90.08.1	All materials will be top quality and if possible, with recycled content that does not harm the quality
90.806.4	Usage of thermal insulation with recycled content will be preferable for the same performances of virgin material
90.806.5	Usage of acoustic insulation with recycled content will be preferable for the same performances of virgin material
90.1003.6	The usage of asphalt with recycled plastic content will be tested and preferred if possible

Annex 1: certification schemes

[Guide to Sustainable Building Certification](#) by the Danish Green Building Council includes an overview of the frequently used building certifications with a specific section on recycling. The certification schemes that are analyzed are Active House, BREEAM, DGNB, Green Star, HQE, LEED, Living Building Challenge, Miljöbyggnad, Nordic Swan, and WELL, all to be found in the table below.

The certifications with an environmental focus according to the guide are Active House, BREEAM, Green Star, LEED, Miljöbyggnad, and Nordic Swan. Certifications with a primary focus on the social dimension: HQE, Living Building Challenge, and WELL (almost entirely focused on social aspects). DGNB is focusing almost equally on the three sustainability dimensions: social, environmental, and economic.

Verification Scheme	Description
Leadership in Energy and Environmental Design (LEED)	Building standards to address energy efficiency, water conservation, site selection, material selection, daylighting, and waste reduction.
Building Research Establishment Environmental Assessment Method (BREEAM)	Rating system measured across 9 categories: management, health and wellbeing, transport, water, materials, land use and ecology, and pollution. Aims at making buildings more sustainable, as well as improving building performance and efficiency.
BREEAM New Construction	Used to assess the design, construction, intended use, and futureproofing of new building developments, including the local, natural or manmade environment surrounding the building.
DGNB	Covers the assessment of the whole life cycle of the building, including end-of-life and thereby CDW.
HQE	HQE is the French certification awarded to building construction and management as well as urban planning projects. HQE promotes best practices, sustainable quality in building projects and offers expert guidance throughout the lifetime of the project.

<p>EDGE</p>	<p>EDGE is a green building certification system developed by the International Finance Corporation, which is part of the World Bank. EDGE stands for Excellence in Design for Greater Efficiencies, and the certification has the goal of reducing the environmental impact of buildings in three areas: direct energy consumption, water consumption, and the energy footprint of construction materials (e.g., Asia Green Real Estate requires all projects that apply for financing to commit to EDGE certification before they can receive funding).</p>
<p>WELL Building Standard (IWBI)</p>	<p>A roadmap for creating and certifying spaces that advance human health and well-being.</p>
<p>Green Globes</p>	<p>An online assessment protocol, rating system, and guidance for green building design, operation, and management. It is interactive, flexible and affordable, and provides market recognition of a building’s environmental attributes through third-party assessment.</p>
<p>Miljöbyggnad</p>	<p>Green building certification program created by the Sweden Green Building Council in 2010. Including both new construction and existing building pathways, buildings can earn gold, silver, or bronze certification levels. Focuses on indoor environmental quality, energy use, and material use. Miljöbyggnad uses principles from LEED and BREEAM to develop its certification attributes.</p>
<p>Living Building Challenge (Core)</p>	<p>10 best practice achievements that a building must obtain to be considered a green or sustainable building. It puts the connection to nature, equity and the need for a building to be loved on even footing with the typical water, energy, and materials concerns.</p>
	<p>20% or more of the materials construction budget must come from within 500 kilometers of the construction site.</p> <p>The project must divert 80% of the construction waste material from the landfill and provide dedicated infrastructure for the collection of recyclables and compostable food scraps during occupancy. When a project is targeting all Materials Imperatives, it is not necessary to document this Imperative, since all requirements are superseded by Imperatives 13-16.</p>
<p>BCA Green Mark Scheme (Singapore)</p>	<p>Green certification program on the development of sustainable buildings in Singapore. Focuses on energy efficiency, water efficiency, environmental protection, indoor environmental quality, and innovation features.</p>

<p>Beam Plus (Hong Kong)</p>	<p>BEAM Plus New Buildings covers the demolition, planning, design, construction, and commissioning of a new building project.</p>
<p>CASBEE (Japan)</p>	<p>Used for both new construction and existing buildings throughout Japan. Starting in 2005, earning a CASBEE certification became mandatory in 24 Japanese municipalities. Designed to reduce the life cycle of resource use, as well as improve the quality of life for building occupants and the surrounding community.</p>
<p>Pearl Rating System for Estidama (UAE)</p>	<p>The PBRS encourages water, energy, and waste minimization, local material use and aims to improve supply chains for sustainable and recycled materials and products.</p>
<p>EuCertPlast</p>	<p>Recognizes plastic recyclers operating to high standards. In addition, the certification gives confidence to suppliers that any waste plastic they deliver to recyclers certified under the scheme will be recycled as per best practice, with respect for the environment, and in accordance with national legislation and to customers. The certification also indicates that the outputs produced comply with all relevant legal and environmental legislation.</p>
<p>Cradle to Cradle</p>	<p>Cradle to cradle can be defined as the design and production of products of all types in such a way that at the end of their life, they can be truly recycled (upcycled), imitating nature's cycle with everything either recycled or returned to the earth, directly or indirectly through food, as a completely safe, non-toxic and biodegradable nutrient</p>
<p>DuboCalc</p>	<p>With DuboCalc all embedded environmental impacts of material used can be calculated, from raw material extraction and production up to and including demolition and recycling (the entire life cycle). DuboCalc also calculates the energy consumed by infrastructure works during the use phase.</p>
<p>INSIDE/INSIDE MCI</p>	<p>Material Circularity Indicator for buildings.</p>

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