

Technical Factsheets Construction & Demolition Waste**Recycled Aggregates (example The Netherlands)**

Recycling of Construction & Demolition Waste (C&DW) is a success story in some Member States. As most C&DW concerns inert waste, the major product from recycling is recycled aggregates. An important use of recycled aggregates is in road construction, for which they are very suitable. Other applications are also highlighted in this factsheet. As an example, this factsheet describes the approach and situation in The Netherlands.

Full replacement of primary materials

Since the early eighties until 2010 the amount of recycled aggregates used in road construction in The Netherlands has grown from 4 million tons to 18 million tons (bound asphalt aggregates excluded). This equals about 20% of the total aggregates use in The Netherlands. The full amount of demolition waste is used and hardly any primary materials are needed for road bases (except for the natural occurring sands; rock is not available). Since 2010 the amounts used in road construction stagnate, due to economic crisis but also because the amount of demolition exceeds the amount needed in road construction. New uses of aggregates are needed and found, for example in concrete.

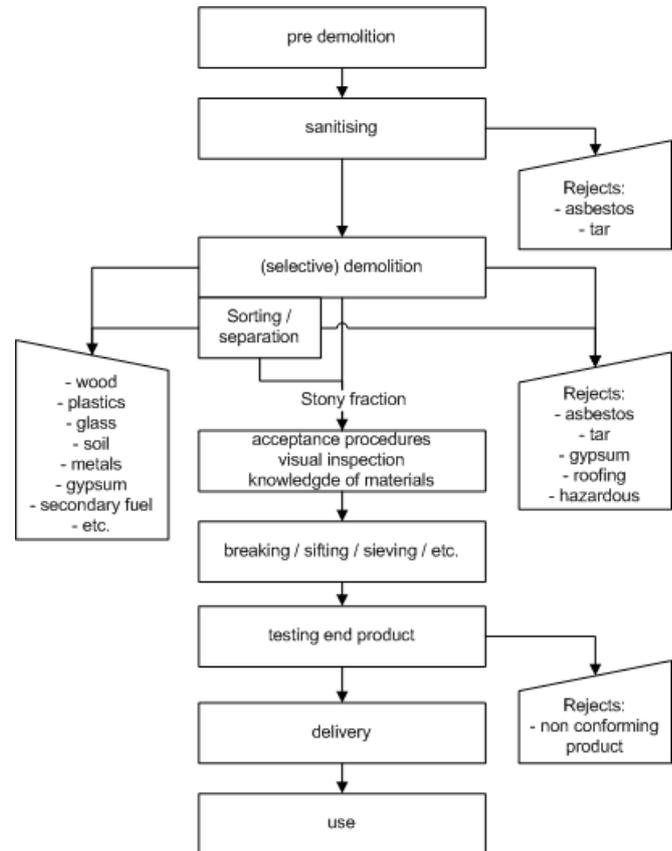
Legislation as prime driver

The main driver for recycling in The Netherlands is the solid framework of legislation, banning the landfilling of many waste streams including C&DW. The safe use of recycled materials in road construction (and other applications in or on soil) is regulated by the Soil Quality Decree, which sets limit values for leaching. Furthermore several pieces of legislation (for instance concerning asbestos) assure that only non-hazardous inert waste arrives at recycling facilities. During the acceptance process at the gate of the recycling facility, a final check is performed to ensure the quality of incoming waste. According to a national regulation for end-of-waste most recycled aggregates are a product and not a waste anymore.

About recycled aggregates

Demolition of building constructions and road constructions leads to the generation of debris or stony rubble. This material can be processed and crushed to recycled aggregate. The regular production process consists of crushing (with jaw crusher, impact crusher (rotary breaker) or cone crusher) with sieves and magnets. In addition, emerging techniques further widen the range of applications of recycled aggregates. Examples include screening techniques, washing techniques, optical sorting, thermal processing of asphalt and new technologies that offer opportunities to bring back the original source materials and new applications within reach.

In fact the processing of good quality recycled materials starts well before demolition. The Dutch National Building Decree and Soil quality decree require that during demolition and recycling substances present may not cause negative effect for health or environment.



Types of recycled aggregates

Generally, the following types of recycled aggregates are distinguished:

- Concrete aggregate (BG)
- Mixed aggregate (MG)
- Masonry aggregate (MWG)
- Hydraulically bound aggregate (HMG)
- Asphalt aggregate (AG)
- Fine aggregate (FG)

Typical for this classification is the physical composition of the granules on the basis of the contents of stone types in the blends. The following table gives the requirements for the composition of the typical mixes of the aggregates. The markings in the table are conforming to the European Product Standards for this type of aggregates (EN 12620 and EN 13242).

Aggregate type	Composition	Note
Concrete aggregates (BG)	R_{C80} R_{CuG90} R_{b10-} R_{a5-} X_1- FL_{10-}	Rc = concrete, concrete products Ru = natural stone, slag, LD-slag, other stony material Rb = masonry stone, ceramic, limestone, lightweight concrete, mortars, other Rb comparable stone. Ra = bituminous bound stony material (asphalt) Rg = glass

Mixed aggregates (MG)	<i>Rc</i> ₄₅ declare <i>d</i> , <i>Rcug</i> ₅₀ <i>Rb</i> ₅₀ - <i>Ra</i> ₅ - <i>X</i> ₁ <i>FL</i> ₁₀ -	X = contaminants (clay, metals, plastics, rubber, other non-stony materials, gypsum) FL = other contaminants with mass < 1,0 Mg/m ³ (cellcrete, plastics, wood, rope, paper, organic materials in cm ³ /kg)
Masonry aggregate (MWG)	<i>Rb</i> ₈₅ <i>Ra</i> ₁₀ - <i>X</i> ₁ - <i>FL</i> ₁₀ -	The figures are contents (%). For instance <i>Rc</i> ₈₀ means 80% or more concrete. “—” states a maximum.
Asphalt aggregate (AG)	<i>Ra</i> ₈₀ <i>X</i> ₁ - <i>FL</i> ₁₀ -	

Concrete aggregate (BG)

Concrete aggregate results from the crushing of concrete coming from (building) construction. It consists of at least 80% of concrete and at least 90% of stony materials that have a quality that can be compared with concrete. Concrete aggregate is used for heavy trafficked areas and industrial areas.

Mixed aggregate (MG)

Mixed aggregate results from the breaking and sieving of concrete and masonry coming from construction. It consists of at least 50% concrete aggregate and maximum 50 % masonry (or alike quality stony rubble). Mixed aggregates are used in all types of road bases, including highways.

Masonry aggregate (MWG)

Masonry aggregate results from the breaking and sieving masonry building works. In the Netherlands the amount of certified masonry aggregate is very limited. It is used in lower grade road bases, not in highway bases. Masonry aggregate consists of at least 85% masonry aggregates, e.g. bricks, ceramic roofing or tiles.

Hydraulically bound aggregate (HMG)

Hydraulically bound aggregate is concrete- or mixed aggregate with the addition of 5 to 20% hydraulic slag. The slag has to consist of granulated blast furnace slag, LD-slag, Electric arc furnace slag or a mixture of these slags. The maximum grain size of the slag is 11,2 mm.

Asphalt aggregate (AG)

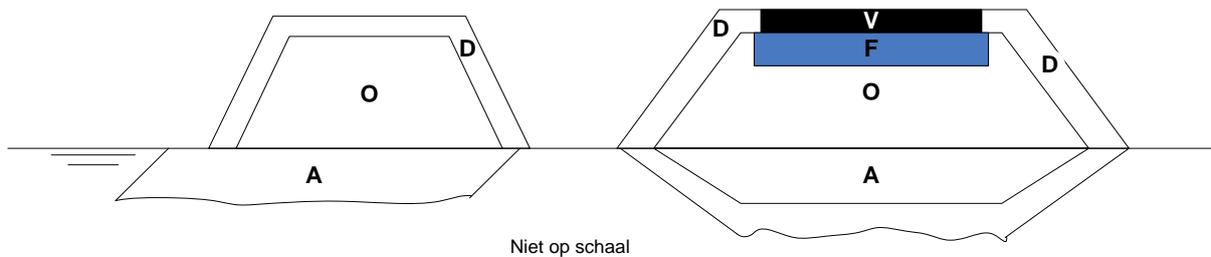
Asphalt aggregate results from the breaking and sieving of asphalt (bituminous bound layers) from roads. Asphalt aggregate mixed with sand and cement performs as a good base layer. Nevertheless, the obvious use of asphalt aggregate is the use in new asphalt. For this reason no requirements for asphalt aggregates are drawn up in the national standards. TAR containing asphalt is not reused but treated thermally to ban the PAH from the recycling-chain.

Recycled aggregates as road base

The most common use of recycled aggregates in the Netherlands is in road base. In the seventies this use grew to a large scale, when problems arose with the common materials such as sand-cement and slags which were used by that time. The experience since then showed that very reliable and strong base layers could be built by using recycled aggregates.

The Netherlands uses a simple approach of road construction. On a raise or fill, mostly consisting of local sources like sand or local soil, a base layer is constructed. This base layer is the basis for top layers such as asphalt or concrete roads. Other countries distinguish different kinds of layers.

The covering layer is meant for growing purposes (grass).



- A = fill
- O = raise
- F = base layer
- V = Top layer
- D = covering layer

Base layers have a function to improve the local bearing of the underground, to prevent the construction from moisture problems, reduce the thickness of (expensive) top layers and to keep costs in hand. The base layer dimensions are designed on the basis of underground quality and anticipated load (axle load: intensity and load). The most important property of the base layer is bearing capacity which is determined in particular by the elastic deformability of the resistance against it. The deformability is the resilient e-modulus, which is expressed in mega-pascal (MPa).

A relation exists between grading properties and road-base properties (functional properties). This has been proven on a lab scale as well as in practice research. Together with the long term experience in the Netherlands with empirical measurements on roads and road bases, knowledge has been built up for reliable design parameters. Some key figures:

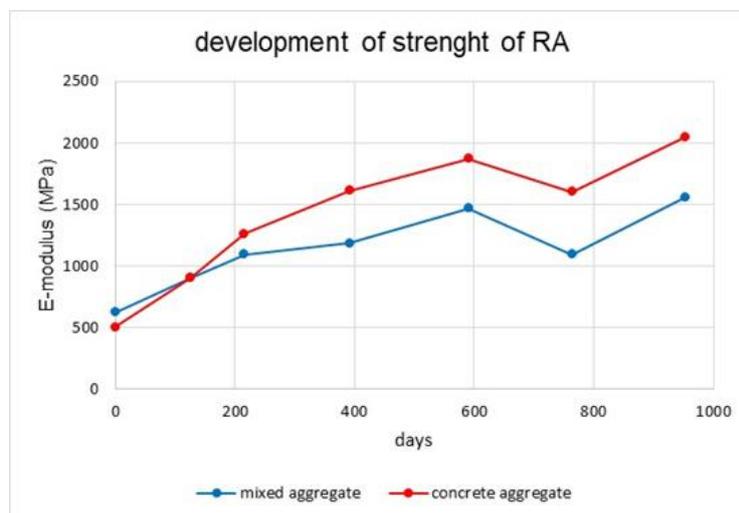
Aggregate type	Stiffness (E-modulus MPa)
Concrete aggregate (BG)	600 – 800
Mixed aggregate (MG)	400 – 600
Masonry aggregate (MWG)	150 – 250
Hydraulically bound aggregate (HMG)	600 – 800
Cement bound Asphalt aggregate (AGRAC)	2500 – 5000
Lean concrete	15000 – 30000
Sand	75 -150
Lava aggregate	50 – 300
Natural stone	100 -400

The design of roads is supported by modelling. The input for models are data from expected load (intensity and load of road use) and soil conditions, underground. Top-layers are relatively expensive and designers look for cost reduction by reducing layer thickness without loss of quality. It is proven that recycled aggregates do contribute to these goals. Comparison with the common design of a sand road based construction shows that a 60 mm thinner asphalt layer is required when using 25 centimetres of mixed aggregate ($E_{\text{underground}} = 100\text{MPa}$). On a weaker underground these savings on asphalt can add up to 90 mm ($E_{\text{underground}} = 50\text{MPa}$).

Using recycled aggregates results in a reduction of the asphalt layer. This results in significant reduction of CO₂ emissions. Long term use of recycled aggregates has therefore contributed to greenhouse gas reduction. This feature is often not taken into account when assessing the sustainability of recycled aggregates.

Better performance: increased stiffness

A unique property of Recycled Aggregates is that as a result of the cementing and hydraulic properties of the constituents the strength (stiffness) increases in time. This (slow) increase of strength (stiffness) results in less cracking of top layers. Research of the Netherlands Road Administration (Rijkswaterstaat) shows that, when old base layers are re-used, this increase of strength will appear again. The following figure shows the development of stiffness in time for 3 types of recycled aggregate.



In the early days of recycling in the Netherlands a lot of soil and organic materials were mixed with the stony materials during excavation and loading of trucks. Pre-sieving has improved the quality of the end products and meanwhile the demolishing techniques and processing technology have improved further. In most cases pre-sieving is not necessary anymore to achieve the desired quality level.

Technical properties

The requirements for use of materials in road construction are laid down in a national guideline, the Standard RAW Provisions. The main properties that are required to specify are described below. Recycled aggregates meet all requirements for save application in road construction.

Grading

Aggregate can be supplied in many grading variations. The most common grading is Gc75 0/31,5 following EN 13285. The average to coarse gradings lead to a stiffer road base than the finer gradings. It appears that a discontinuous grading gives a lower performance. Within the range of the grading as prescribed in the Netherlands (1978 until version RAW 2015), the influence of grading on the performance of the recycled aggregates is small. In more extreme cases it was found that with a uniform maximum grain size, the coarser mixtures have lower resilience to permanent deformation.

Angularity

Angular grains lead to higher stiffness. By breaking the stony wastes coming from construction, rounded grains are hardly produced. That's why testing of this property is not obliged. If natural ballast or gravel is added to the recycled aggregates this has to be regarded. Because recycled sands have good angularity properties, it is a wanted product for brick roads.

Grains strength

Failure of road bases depends partly on the strength of the individual grains and the deformation of materials. Normal recycled aggregate fulfils Los Angeles Coefficient requirements of the Netherlands regulations (LA <60).

Density

Density of aggregates correlates with strength: a higher density means a stronger construction. The density of recycled aggregates allows regular use in all types of road construction. Also for some high demanding applications such as landing strips some types of recycled aggregates can be used. Very high demands for instance where basalt is required are out of reach.

Differences in particle density might lead to segregation, but this can be managed by proper processing. The grain strength of masonry is lower, which results in more fines when being compacted or under load. In wet circumstances this leads to a possibility that the base fluidizes quicker.

Composition/constituents

The composition of recycled aggregates is important for the behavior of the mixture in the road base. Concrete aggregate for instance results in higher stiffness values than mixed aggregates. Mixed aggregates on the other side have better tolerance for grain size distribution and perform, depending on stresses in the mixture, evenly. It is also proven that mixed aggregate is not an average of concrete aggregate and masonry aggregate. At lower stresses in the mixture mixed aggregates perform better than expected while at higher stresses the performance is between concrete and masonry aggregate.

The stiffness of foundations with slag bound mixed aggregates can be compared with foundations based on concrete aggregates. Compared with cement bound road bases, the choice for slag bound aggregates in weak underground areas like in the Dutch polders, is advised for the slow growth of strength and the prevention of cracking.

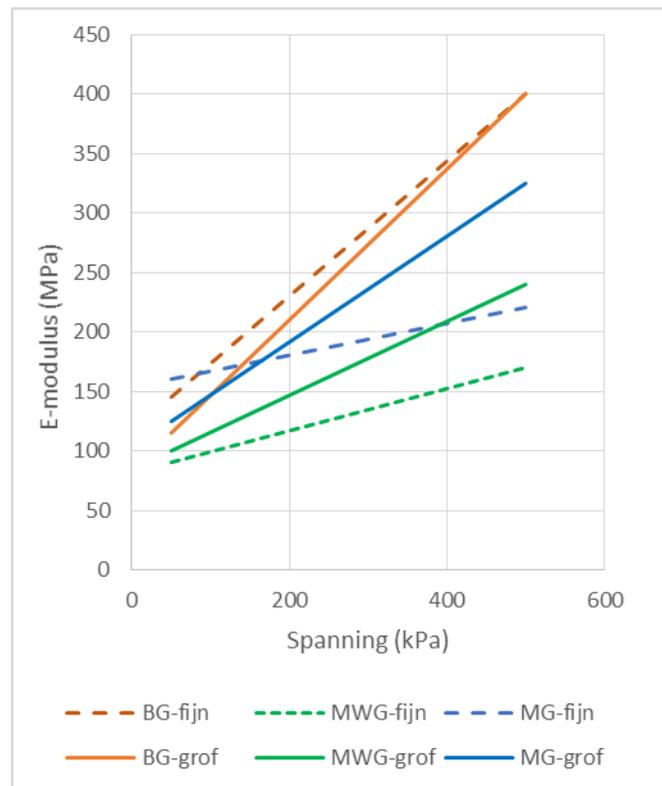
Asphalt has a tough breaking behavior. The amount of fines mostly has to be complemented with sand. The availability of bitumen around the particles leads to a more viscous material with more resilient deformation behavior, which leads to rutting. This is also the case with cement bound asphalt layers. Unbound use of asphalt aggregate is therefore less common and reuse in new asphalt is more obvious, also for sustainability reasons.

Compaction

Stiffness of a construction is a main feature. As expressed above, stiffness is a result of various properties of materials such as composition, density and grain strength. Stiffness of a construction is above all a result of the compaction of the construction (the force exercised during construction works). The effect on permanent deformation is at a compaction of 103% of the maximum proctor much smaller than at 100% compaction. Research of the University of Delft shows that on a road base with 103% compaction 40 mm asphalt was needed to absorb all loads. At a compaction of 100% this was 80 mm asphalt. The water content of the recycled aggregate is important for compaction. The relation with compaction and water content is found with the proctor test. For practical reasons mostly the single point proctor test is used.

Resume

Through the years, starting in the 1970's, it has been proven that unique properties of recycled aggregates in combination with proper processing management, make that a reliable and durable road base can be guaranteed, with good bearing capacities, low frost damage, cracking or other damages. Durability of road bases with recycled aggregates normally supersedes the service life of top layers.



Notes to the figure.

Testing of bearing capacity of foundations is done using the triaxial test. This test uses a large specimen. The specimen has to be built in a very accurate manner with stresses compared to traffic load, simulating the weight and load in practice. In practice, these extremes of stresses vary from 50 to 500 kPa.

Due to these loads (stresses), applied in different combinations, elastic and resilient deformation can be measured to create a good image of the bearing capacity. It has been found that mixtures that perform well here (high E-modulus), do so in practice.

Sustainability

When assessing the sustainability of aggregates for roads, the following can be considered.

- Use of recycled aggregate means useful recycling of stony wastes from the direct region of the project.
- Landfilling is prevented;
- Supply and quarrying of alternative or primary source materials is not needed;
- A maintenance-free, reliable and durable is the result;
- Top (asphalt) layers can be dimensioned smaller;
- Use of mixed aggregates enables the use of (pure) concrete aggregates in concrete;
- High recycling rates are possible for asphalt aggregate in warm asphalt.
- Old layers of recycled aggregates can easily be reused in new layers, maintaining all good properties of the original aggregate.

Recycled aggregates are save to be used from an environmental point of view. They meet all requirements with regard to leaching laid down in the Soil quality decree. Recycled aggregates are fit for unrestricted use in any application.

Quality Assurance

A main requirement for the uptake of recycled aggregates in road construction is trust by clients and authorities. Full trust has been gained in The Netherlands due to the national scheme for Quality Assurance, the BRL 2506. Based on this scheme, recycled aggregates can be produced as certified materials. The certificate provides additional assurance with respect to the statutory approvals: CE marking and Netherlands Environmental certificate (NL-Bsb certificate). This last certificate is related to the Soil quality decree and assures the sound and save use.

CE marking	Required by Construction Products Regulation	Covers quality control of the product (FPC) and the producer declares material quality through a declaration of performance (DoP). Only for products in the scope of harmonized standards. A legal DoP does not guarantee that a product is fit for specific use e.g. in road base.
NL-Bsb certificate	Required by the Netherlands Soil Quality Decree	Covers environmental quality of end products to be used in or as soil. Alternative is the batch-procedure ¹⁾
BRL 2506 certificate	Not legally required	Covers all (other) quality aspects. Guarantees that the end products fulfill all requirements for use.

1) The requirements of the Soil Quality Decree can also be fulfilled by testing individual batches, following a detailed set of provisions for sampling, sample preparation, analyses, evaluation and reporting. Given the duration of a batch inspection of approximately 6 weeks, producers primarily choose for certification, under which the product can be supplied continuously and directly after production.

End of waste regulation

In 2015 the Dutch Government has published national End of Waste criteria for recycled aggregates. The criteria mainly relate to the existing EU product standards and to Dutch regulations for aggregates, including the Soil quality decree. This means that most technical and environmental issues are covered. Furthermore the End of Waste criteria include an acceptance policy to assure the quality of source materials and requirements for asbestos and TAR. The production of recycled aggregates must include quality assurance covering the criteria of the regulation. A End of Waste-conformity document must be available and

referred to in transporting documents. The regulation functions quite smoothly because Dutch companies already fulfilled the basic requirements for many years.

Other uses of recycled aggregates

Top layer of (temporary) work roads and other roads

Recycled aggregates can also be used as top layer for minor road and work roads. When grading and water content are adequate, the material can be compacted and levelled so that a good surface can be obtained. This layer can be used for instance for parking facilities, (temporary) work roads, cycle paths and walking paths.

For top layers there is the issue of the visual aspect. Standard requirements allow a small percentage of lightweight materials (e.g. wood), metals and glass to be present. In practice this could raise questions from the user. However, serious problems have not been encountered (for instance: the recycling operation makes glass less sharp).

Cement treated base (CTB)

CTB is used for areas where severe load of the base layer can be expected, for example at container terminals, airport landing strips and other airport uses. A good possibility is to make CTB with a mixture of recycled aggregates, sand, cement and water. Typical CTB in the Netherlands contains 70% recycled concrete aggregate, 30% asphalt aggregate and 7-9 % cement. This mixture can reach high performance and durability, with a stiffness up to and over 10.000 MPa. This mixture can also be used for areas where the bearing capacity of the underground is problematic.

Lean concrete

Lean concrete is a mixture of recycled aggregate, cement and water. Compared to normal baselayers high strengths can be reached. The actual strength can be set by choosing the appropriate cement content based on laboratory research. In the Netherlands this material is used as mortar for curbstones and in the past for high performance base layers.

Water buffering and drainage

The advantage of recycled aggregates is that the capillary properties decrease the risks of water damage or frost susceptibility. Concrete- and mixed recycled aggregates in a standard grading have a water cavity that gives the possibility for a quite effective water storage, up to 25% of the volume. These properties are also used for water buffering storages when there is a large built space with insufficient area for water to drain into the soil.



Waterbuffering

The water buffering capacity can easily be enlarged when the 0/4 fraction is sieved out. Without fine fraction, the bearing capacity of the layer cannot be compared anymore with the normal graded recycled aggregate. Also the recycling company will have to find other uses for the fine fraction which sometimes is difficult.

Aggregates for asphalt

Most common is the use of recycled asphalt aggregate in new asphalt. The asphalt industry has developed processes that can apply more than 50% reuse of asphalt. Incidentally higher percentages are used, up to nearly 100%. Source separation of tar containing asphalt is required. This must be banned from the recycling chain, which in The Netherlands is done by recycling in thermal treatment plants where PAH (polycyclic aromatic hydrocarbons) is destroyed. Asphalt is normally crushed to 0/20 aggregate. Milled asphalt is mostly delivered directly to the asphalt producer conforming to Dutch requirements, laid down in private regulations (Standard RAW requirements) and conforming to EN 13108-8..

Aggregates for concrete, concrete products and mortar

Concrete-, mixed- and fine aggregates can be used for the production of concrete. It replaces gravel or sand from primary sources or from far away sources. The technical performance of recycled aggregates in concrete have extensively been researched and tested. In the meantime there is a large practical experience and a set of standards has been published. The most important are:

- EN 206: concrete mixtures (and in The Netherlands also NEN 8005)
- EN12620 Aggregates for concrete (and in The Netherlands also NEN 5905)
- CUR recommendation 80, concrete with mixed aggregates
- CUR recommendation 106, concrete with fine aggregates
- CUR recommendation 112, concrete with concrete aggregates

CUR recommendations are specific for the Dutch situation and can be regarded as pre-standards.

According to EN 206 up to 50% use of coarse recycled aggregates in concrete is possible, depending on the environmental class for the concrete. Dutch standards are based upon this EU standard. Higher content of recycled aggregate is easily possible, regarding the CUR recommendations. When small adjustments on shrink and creep in the construction are calculated, up to 100% replacement of primary fine and course aggregates is possible.

The concrete industry primarily wants to close its own concrete supply chain by using concrete aggregates. However also mixed aggregates, railway ballast or aggregate obtained from the thermal treatment of tar containing asphalt are good and reliable alternatives.



Use of concrete with recycled aggregate in a cycle path

Recycled aggregates for concrete have to fulfil high requirements for cleanliness and strength. Recycling companies have invested in equipment and knowledge to fulfil these requirements.

Aggregates for ceramic industry

When ceramic materials are collected separately, broken and milled, these can be used as source material for the ceramic industry. This material replaces high quality clay sources.

Gabions

Course recycled aggregates can be used as a filling for gabions, sometimes only for the inner layers but sometimes it is also used for the whole filling. Gabions are used as walls, field separation and visual landscaping elements.

Streetsand

The fine fraction of recycled aggregates (0/4 fraction) is very useful as streetsand. This sand is used under pavers. The sharp edged grains are very stable between the pavers and underneath. The hydraulic binding capacity of the material increase the durability of the street layer significantly.

Aggregates for pole mattresses

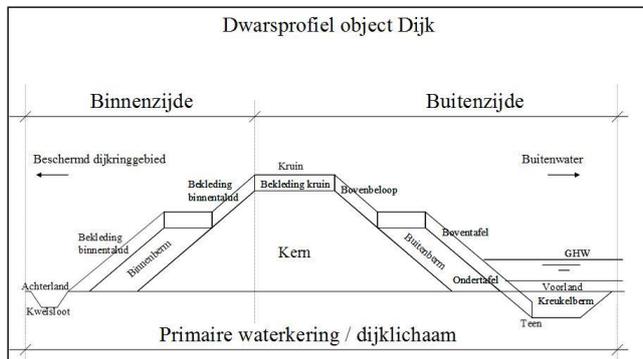
Pole mattresses are base layers enforced with piles. On top of the piles a thick (1m) layer is constructed of 3 or more sublayers with mixed aggregate, divided by geomembranes. It has been shown that the mixed aggregate contributes highly to the strength of the construction, so less piles are required. In practice these pole mattresses are used in areas with very poor bearing capacity, such as peat areas. The piles rest on sand layers under the peat layer (sometimes more than 20m deep). For very deep layers the adhesive forces are used. Also for joining railroad base layers to the rigid construction of the railway station, pile mattresses are proven successful.



Fills and raises

Material requirements for fills and raises are less demanding than for road base. Materials that can be used for road base are therefore very suitable for these applications. Depending on market conditions and prices, the use of recycled aggregate for this application is less attractive. In other words: the recycling aggregate is too good for this application.

Dutch environmental regulations require “useful” and “functional” application of building materials. This means that only the required amounts of materials are used and no excess material is used (which in the past was a means of getting rid of waste). This could raise the question if in raises or fills this requirement is actually met. Dutch regulations are such that this is indeed the case. Recycled aggregates have added value in the construction and are therefore used in a functional way.



Dike constructions

Most elements in dikes can be constructed with recycled aggregates.

Protection of embankments

Coarse recycled aggregate is very useful for application in embankments along rivers and canals. A grading of 40/200 is often used.

Armourstone

See protection of embankments.

Fillers

The fine fraction of recycled aggregates can be used as filler for concrete or asphalt. It is often mixed with binders to create a better dosage or to fill pores and increase the volumetric mass of the end product. One step ahead is the replacement of binders, which is possible after smart crushing. This is a novel process developed in The Netherlands which however is not yet available on full scale.

Annex A. Requirements for recycled aggregates related to CE marking

Most types of recycled aggregates are in the scope of EU hEN standards and have to fulfill the requirements of the Construction Products Directive. Therefore the quality of the product has to be declared on the Declaration of Performance (DoP). These are shown in the table in this annex.

Harmonized:

Mixed, concrete, masonry and asphalt aggregates:

- EN 13242, unbound aggregates for use in unbound and hydraulically bound civil engineering works.
- EN 12620, Aggregates for concrete

Non harmonized:

Mixed concrete, masonry and asphalt aggregates:

- EN 13285, aggregates for mixtures
For recycled aggregates there is an overlap in the scopes of EN13242 and EN 13285. Netherlands interpretation is that recycled aggregates have to be CE marked following EN13242 for the respective requirements in that standard.

Slag bound mixtures with recycled aggregates:

- EN 14227-2, slag bound aggregates
Netherlands interpretation is that slag bound recycled aggregates, when delivered to the market as a mix, do not have to be CE marked, also not for the requirements following EN13242 to which EN14227-2 refers.

Asphalt aggregate for use in asphalt:

- EN 13108-8

Declaration of Performance
Nr. 001CPR2015-02-17

1. Unique identification code of the product-type:	Mixed recycled aggregate 0/31,5																									
2. Intended use/es:	Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction																									
3. Manufacturer:	Minerals Recycling b.v., Stoneroad 123, 3333 BA Rubbletown, Netherlands Tel. +31 12 98765432, Fax: +31 12 34567890 Email: mineral@mnt.nl																									
5. System/s of AVCP:	System 4																									
6a. Harmonised standard:	EN 13242:2002+A1:2007																									
Notified body/ies:	Not applicable																									
7 Declared performance/s:	typical grading																									
	<table border="1"> <thead> <tr> <th>sieve</th> <th>average passing (%)</th> <th>limits % passing</th> </tr> </thead> <tbody> <tr> <td>63 mm</td> <td>X</td> <td>100</td> </tr> <tr> <td>31,5 mm</td> <td>X</td> <td>75 – 100</td> </tr> <tr> <td>16 mm</td> <td>X</td> <td>50 – 90</td> </tr> <tr> <td>8 mm</td> <td>X</td> <td>30 – 75</td> </tr> <tr> <td>4 mm</td> <td>X</td> <td>20 – 60</td> </tr> <tr> <td>2 mm</td> <td>X</td> <td>13 – 45</td> </tr> <tr> <td>1 mm</td> <td>X</td> <td>8 – 35</td> </tr> </tbody> </table>	sieve	average passing (%)	limits % passing	63 mm	X	100	31,5 mm	X	75 – 100	16 mm	X	50 – 90	8 mm	X	30 – 75	4 mm	X	20 – 60	2 mm	X	13 – 45	1 mm	X	8 – 35	
sieve	average passing (%)	limits % passing																								
63 mm	X	100																								
31,5 mm	X	75 – 100																								
16 mm	X	50 – 90																								
8 mm	X	30 – 75																								
4 mm	X	20 – 60																								
2 mm	X	13 – 45																								
1 mm	X	8 – 35																								
particle shape	F_{20}	EN 13242:2002+ A1:2007																								
particle size	0/31,5 G _{A75}																									
particle density	2.50 +/- 100 Mg/m ³																									
cleanliness - fines - fines quality	f_7 NPD																									
% of crushed particles	$C_{90/3}$																									
resistance fragmentation	LA_{60}																									
volume stability	NPD																									
waterabsorption	10 +/- 3 %																									
composition - classification - water soluble sulfate - total sulfur - influence on setting time	R_{C45} declared, $R_{cu}g_{50}$, R_{b50-} , R_{a5-} , X_{1-} , FL_{10-} NPD NPD NPD																									
resistance to attrition	NPD																									
emission radioactiviteit	NPD	-																								
release of heavy metals	Free use conforming to National Soil Quality Decree	-																								
release of other dangerous substances Asbestos Content Emission of anions	< 100 mg/kg d.s. weighed Free use conforming to National Soil Quality Decree Free use conforming to National Soil Quality Decree	-																								
Durability against freeze-thaw	NPD	EN 13242:2002+ A1:2007																								
10. The performance of the product identified above is in conformity with the set of declared performance/s. This declaration of performance is issued, in accordance with Regulation (EU) No 305/2011, under the sole responsibility of the manufacturer identified above. Name and address, Date of issue, Signature																										