



S.R. 21 - ANNEX E: 2016



NOV 2017

A CRH COMPANY

Introduction

In March of 2016 the NSAI published the updated version of Standard Recommendation 21 (S.R. 21.)

The Standard Recommendation's full title is,
S.R.21: Guidance on the use of I.S. EN 13242:2002 +A1 :2016 – Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction

As you will be aware this includes,
Annex E: Aggregates for use under (and adjacent to) concrete floors and footpaths.

S.R. 21 also covers a wide range of products which are as follows,

| | |
|----------------|---|
| Annex A | Aggregates for pipe bedding, haunching and surrounding material. |
| Annex B | Aggregates for backfilling of filter drains |
| Annex C | Aggregates for general fill material |
| Annex D | Aggregates for unbound sub-bases for road pavements |
| Annex F | Aggregates for cement bound materials |

With the exception of Annex E, each of these Annexes will refer you to the NRA Specification for Roadworks which will give more detailed information on the specified requirements for each material.

The NSAI have also published I.S 888:2016:Code of Practice for the procurement and use of unbound granular fill hardcore material for use under concrete floors.

It specifies requirements for post manufacturing operations of unbound granular fill (hardcore) for use under concrete floors and footpaths such as procurement, haulage, delivery and receipt, storage and handling, placing, traceability and record management, with an aim of improving the chain of custody within the supply chain and ensuring the complete traceability of hardcore suitable for this particular end-use, from the original manufacture and source of the location where it is incorporated into the works.

ANNEX E BACKGROUND TO CHANGES:

In 2007, Annex E was added to SR21 in response to concerns about deleterious materials containing excessive pyrite having entered the supply chain from a small number of suppliers and resulting in structural damage to a significant number of houses mainly in the Greater Dublin region.

The 2014 revision is substantially on foot of the Pyrite Panel Report 2012 issued by DECLG following an enquiry into the matter. It had been revised by request of the Minister for the Environment to ensure granular fill used under concrete floors and footpaths will not cause an issue due to pyritic heave.

Further additions were made in 2016 to incorporate an optional structural unbound granular fill (hardcore) material, for use at depths greater than 900mm depending on site conditions, settlement potential and other engineering factors and the new Building Regulation requirements for a Radon Sump to be included in the sub-floor of all occupied new build projects, i.e. anywhere a person might be for work, leisure or residence.

The Unbound Granular Fills now covered by SR 21 Annex E are described as follows,

T.0 Structural

Suitability graded structural unbound granular fill material (0/125mm), for use at depths greater than 900mm below the radon barrier/damp proof membrane

T.1 Structural

Structural unbound granular fill material is an all in graded aggregate (0-32mm) or gravel (0/40mm) to facilitate placing and compactability. (Current material)

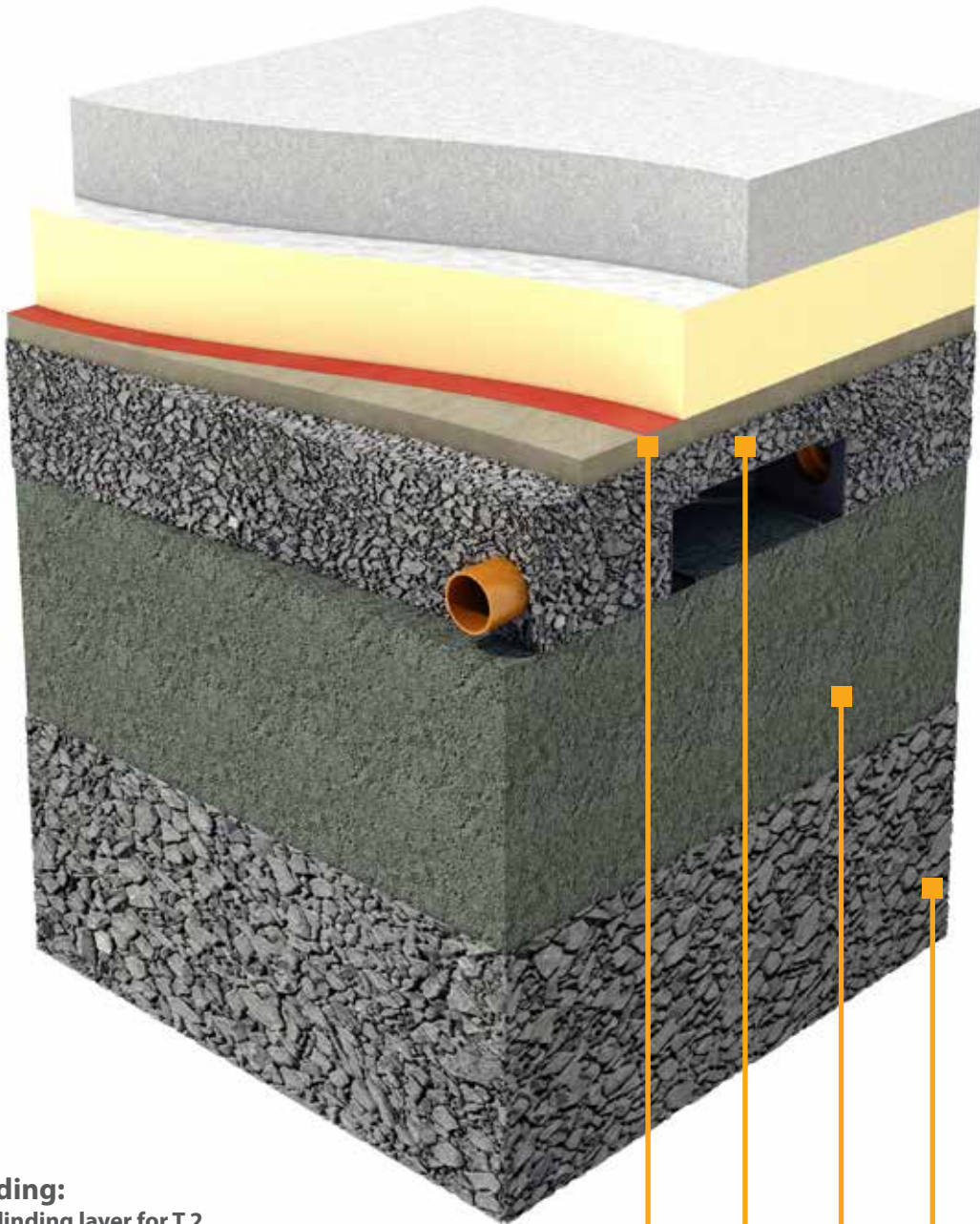
T.2 Permeable

Suitably graded unbound granular fill material (4/40mm) to facilitate the free movement of radon gas within the hardcore area.

T.3 Blinding

Fine aggregate (0/4mm) GF 80, for blinding the top surface of the T2 Permeable material.

GRANULAR FILL UNDER CONCRETE FLOOR:



T.3 Blinding:
0/4mm blinding layer for T.2
- Max depth 50mm max

T.2 Permeable:
4/40mm
Gas Permeable layer
(Radon) Min depth 200mm

T.1 Structural:
0/31.5mm crushed rock
(0/40mm for crushed gravel)
for use in depths of <900mm

T.0 Structural:
0/125mm -for use in depths
of > 900mm

1. Application of T.0 Struc 0/125mm

T.0 Struc Unbound Granular Fill material is recommended for use where; a) the fill material will be subject to substantial loading and /or dynamic loading, or b) the depth of fill is greater than 900 mm to the top of the subsoil.

2. Application of T.1 Struc 0/31.5 Unbound Granular Fill (Crushed Rock) or 0/40mm Gravel

T.1 Struc Unbound Granular Fill material is recommended for use where; a) the overall depth of fill to subsoil is less than 900mm. (Most rising walls are 3 blocks high in the domestic/office scenario) and b) the loading would be normal domestic/office loading.

2.1 Advantages of the use of T.1 Struc material exclusively include a) Most dwelling sites would only need one type of material, b) Less confusion in ordering and placing of material, c) Current construction methods are maintained, d) Designer/ assigned certifier makes the decision on the material to be specified based on the site/loading conditions.

3. Application of T.2 Perm 4/40mm Gas Permeable Layer

T.2 Perm 4/40mm Gas Permeable Layer: Any building where a Radon Sump is to be operational in the sub-floor including all occupied new build projects, i.e. anywhere a person might be for work, leisure or residence.

4. Application of T.3 Blind 0/4mm Blinding Layer

T.3 Blind 0/4mm Blinding Layer: For blinding the top surface of the T.2 Permeable material to ensure the radon barrier is not punctured and there is a level surface upon which to place the insulation and pour the concrete.

5. Combination of T0/1 and T2&3 materials

T 0/1 and T 2&3 materials where the site /loading conditions requires T.0 or T.1 Struc materials but also requires a gas permeable layer, (Type T.2 &T.3 material), the installation should incorporate a hybrid of the materials. This would involve the placing of a layer of the T.2 Perm material above the compacted T.0 or T.1 layer and below the blinding, where the radon extraction method can be placed. The layer should be in the order of 200mm depth.

B.1 MATERIAL PROPERTIES

B1.1 Grading

T.0 STRUCTURAL LAYER (SR 21 Table E.3)

| CRUSHED ROCK OR GRAVEL (0/125MM) | |
|----------------------------------|--|
| ISO Sieve Size | Overall Grading Range Percentage passing by mass |
| 200mm | 100 |
| 125mm | 98-100 |
| 100mm | 75-99 |
| 40mm | 55-85 |
| 10mm | 15-45 |
| 6.3mm | 10-35 |
| 1mm | 5-20 |
| .063mm | f9 |

| ISO Sieve Size mm | Crushed Rock 0/31,5 | | | Gravel 0/40 | | |
|-------------------|----------------------------|---|--|----------------------------|---|--|
| | Percentage passing by mass | | | Percentage passing by mass | | |
| | Overall grading range | Supplier Declared Value Grading Range (SDV) | Tolerance on the Supplier Declared Value (SDV) | Overall grading range | Supplier Declared Value Grading Range (SDV) | Tolerance on the Supplier Declared Value (SDV) |
| 80 | | | | 100 | | |
| 63 | 100 | | | | | |
| 40 | | | | 80-100 | | |
| 31.5 | 80-100 | | | | | |
| 20 | | | | 55-85 | 63-77 | +8 |
| 16 | 55-85 | 63-77 | +8 | | | |
| 10 | | | | 35-65 | 43-57 | +8 |
| 8 | 35-65 | 43-57 | +8 | | | |
| 4 | 22-50 | 30-42 | +8 | 22-50 | 30-42 | +8 |
| 2 | 15-40 | 22-33 | +7 | 15-40 | 22-33 | +7 |
| 1 | 10-35 | 15-30 | +5 | 10-35 | 15-30 | +5 |
| 0,5 | 0-20 | 5-15 | +5 | 0-20 | 5-15 | +5 |
| 0,063(f) | 0-7(f7) | | | 0-7(f7) | | |

NOTE 1 Test results should fall within the overall grading range.

NOTE 2 The supplier should additionally declare the typical grading of the product - this supplier declared value (SDV) should lie within the SDV grading range. However, the SDV together with the relevant tolerances, is used solely for the purpose of the suppliers internal factory production control.

T.1 STRUCTURAL LAYER (SR 21 TABLE E.2)

| Sieve Size | 80mm | 63mm | 40mm | 8mm | 6.3mm | 4mm | 2mm |
|-----------------------|-----------------------|---|--|------|---------|---------|------|
| 4/40mm GTNR Gc80/2 | 100% | 98-100% | 80-99%* | -NR | -NR | 0-20% | 0-5% |
| | Overall grading range | Supplier Declared Value Grading Range (SDV) | Tolerance on the Supplier Declared Value (SDV) | 100% | 98-100% | 80-99%* | NR |

* The inclusion of 99 % instead of 100 % is to ensure consistency and to prevent smaller size aggregates being classified as D size aggregate. However, I.S. EN 13242:2002+A1:2007, Table 2 , footnote d specifies that the percentage passing D may be greater than 99 % by mass but in such cases the producer is required to document and declare the typical grading including the sieves D, d, d/2 and sieves in the basic set plus set 2 intermediate between d and D.

B1.2 Durability

LA value now required to be a maximum of LA30
Sedimentary Mudrock content of the material shall not exceed 10%
Magnesium Sulphate Soundness value shall comply with MS25.

B1.3 Chemical Requirements

Total Sulfur;
If <0.1% no Thin Section Petrography necessary
If between 0.1% and 1% Thin Section Petrography necessary
If Pyrrhotite present 0.4% Total Sulfur max
If the pyrite content is considered by the competent person (professional Geologist) to be excessive in relation to the rock type and likely to give rise to a swelling risk the material will be deemed unsuitable.
If Total Sulfur is > 1% material is unsuitable.

Acid Soluble Sulphate
A.S.S.Max 0.2%

B1.4 Geological and Petrographic Assessment

More explicit guidance is given on the geological and petrographic assessment to limit the risk of swelling or sulfur attack on concrete, due to the presence of a reactive form of pyrite.

Note: Where all of the unbound granular fill materials are derived from the same source, the geological, chemical and petrographic assessment from that source applies for both material Types.

C.1.1 Factory Production Control

The minimum test frequencies as specified in I.S. EN 16236:2013 for some properties have been increased in order to improve confidence within the supply chain.
Previous specifications generally called for chemical and physical testing of materials on a yearly or bi-yearly basis. This has been increased to the levels contained in Table E.1

TABLE E.1— Recommended properties, test methods and test frequencies for unbound granular fill for use under concrete floors and footpaths

| Properties | Test Description | Test Method | Category/Size | Minimum test frequency | |
|---------------------------|---|---|-------------------------|--|---|
| | | | | Initial Type Testing | Factory production control |
| Geometrical | Grading (crushed rock) | I.S. EN 933-1 | 0/31,5 See Table E.2 | Yes | 1 per week |
| | Grading (gravel) | I.S. EN 933-1 | 0/40 See Table E.2 | | |
| | Fines content | I.S. EN 933-1 | f7 | | |
| | Grading crushed rock or (gravel) | I.S. EN 933-1 | 0/125 See Table E.3 | Yes | 1 per week |
| | Fines content | I.S. EN 933-1 | f9 | | |
| | % Crushed or broken particles (gravel only) | I.S. EN 933-5 | C50/10 | Yes | Monthly |
| Physical | Los Angeles coefficient | I.S. EN 1097-2 | LA30 | Yes | 2 per year |
| Durability | Water Absorption | I.S. EN 1097-6 Clause 8 | WA ₂₄₂ | Yes | 2 per year |
| | Magnesium sulfate soundness | I.S. EN 1367-2 | MS ₂₅ | Yes | 1 per year |
| Chemical | Acid soluble sulfate | I.S. EN 1744-1 | AS _{0,2} | Yes | Quarterly |
| | Total sulfur | I.S. EN 1744-1 | See E.2.4.4, (SR 21) | Yes | Quarterly |
| Geological Classification | Geological examination | I.S. EN 932-3 and E2.4.3, (SR 21) | See E.2.4.3 (SR 21) | Yes | Quarterly |
| | Petrographic assessment (Thin section) | See E2.4.5, (SR 21) | See E.2.4.5, (SR 21) | Yes. For total sulfur values between 0,1 % and 1 % | Yes For total sulfur values between 0,1 % and 1 % See E.2.4.5 |
| NOTE 1 | Test frequencies may be revised based on the advice of the Professional Geologist. | | | | |
| NOTE 2 | See 3.5.5 for guidance on frequency of sampling and testing. | | | | |
| NOTE 3 | Due account should be taken of the repeatability and reproducibility of the relevant test methods when declaring categories for properties. See Clause 4 Note 4 EN 13242:2002+A1:2007 | | | | |

Please note that these test frequencies only apply during times of production. A period of production is defined as a full week, month or year. These test frequencies may be reviewed based on the advice of a Professional Geologist

D.1.1 System of Attestation and Verification -

The system of assessment and verification of constancy of performance has changed from system 4, to system 2+ for this particular end-use aggregate. Under the EU Construction Products Regulation this means that the quarry and the factory production control system, is subject to initial inspection and to continuous surveillance, assessment and approval by a notified factory production control Certification Body. The manufacturer is responsible for carrying out the initial type testing and the factory production control

E.1.1 Documentation

The following information shall appear on your Roadstone delivery docket:

i) Supply Location ii) Product description and size iii) Date of dispatch iv) Docket serial number v) Product code

| Product Description | Product Code |
|---|--------------|
| S.R 21 Annex E, T.0 Structural (0/125mm) | 1152112 |
| S.R 21 Annex E, T.1 Structural (0/31.5mm) | 1152017 |
| S.R 21 Annex E, T.1 Structural (0/40mm) | 1465030 |
| S.R 21 Annex E, T.2 Permeable (4/40mm) | 1152111 |
| S.R 21 Annex E, T.3.Blinding (0/4mm) | 1570040 |

It is the responsibility of the material purchaser/user to ensure an adequate system of traceability is in operation on site from the point of delivery to the location within the works where the material is incorporated.

Roadstone Ltd have a long and successful history of supplying a wide range of building materials to the Irish construction industry with no issues relating to pyritic heave or swelling.

We are happy to confirm that all relevant Roadstone Ltd locations have been tested and inspected by independent geologists at a frequency set out in Annex E of SR 21.2016 and found to be in full compliance with S.R 21, and all other S.R's such as:

- S.R 16 Aggregates for Concrete (including blocks)
- S.R 17 Aggregates for Bituminous Mixtures and Surface Treatments
- S.R 18 Aggregates for Mortar

Declarations of Performance are available to download for the relevant locations from the Support & Certification section of the Roadstone website.



QUARRY LOCATIONS

Cork

1. Ballygarvan
2. Carrigtwohill
3. Castlemore
4. Classis
5. Keim
6. Mallow
7. Middleton

Clare

8. Ballyquinn
9. Bunratty
10. Ryan's of Ennis

Donegal

11. Ballintra
12. Carndonagh
13. Laghey

Dublin

14. Belgard Central
Dispatch / Belgard
Weighbridge
15. Huntstown Finglas
16. Head Office,
Tallaght
17. Swords, Feltrim

Galway

18. Two-Mile-Ditch
19. Kilchreest

Kerry

20. Ballyegan
21. Killarney
22. Killorglin

Kildare

23. Allen, Naas

Kilkenny

24. Bennettsbridge
25. Kilmacow

Laois

26. Ballyadams

Limerick

27. Creeves Quarry
28. Joseph Hogan's

Longford

29. Moyne

Mayo

30. Castlebar

Meath

31. Barley Hill
32. Duleek
33. Mullaghcrone
34. Slane

Offaly

35. Tullamore

Roscommon

36. Boyle
37. Cam
38. Castlemine

Tipperary

39. Ballyknockane
40. Killough

Waterford

41. Cappagh

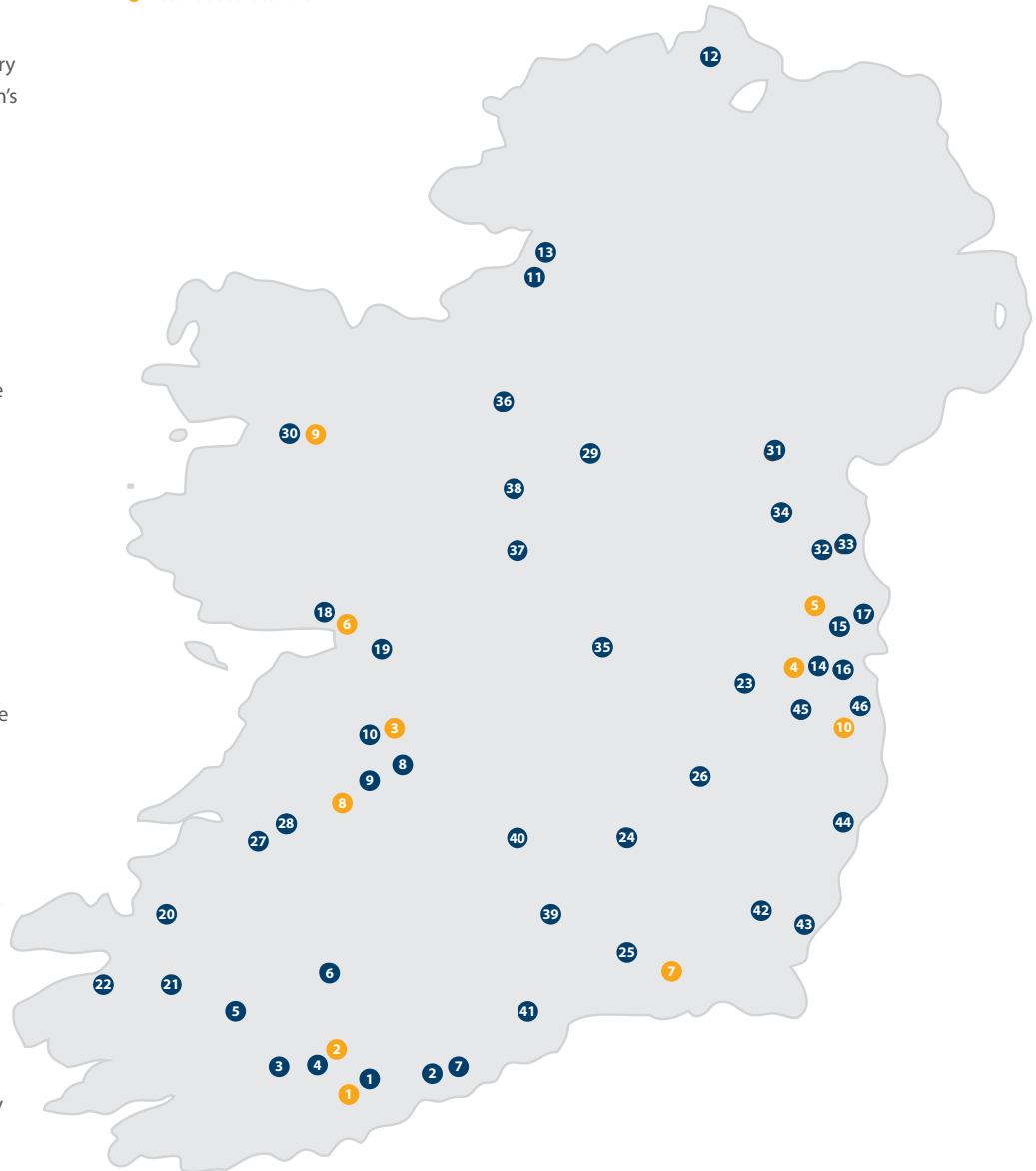
Wexford

42. Brownswood,
Enniscorthy.
43. Kilmuckridge

Wicklow

44. Arklow
45. Dorans Pit
46. Fassaroe, Bray

- Quarry Locations
- Retail Outlet Locations



RETAIL OUTLET LOCATIONS

Cork

- 1 Ballygarvan
- 2 Classis

Clare

- 3 Ryan's of Ennis

Dublin

- 4 Belgard
- 5 Feltrim, Swords

Galway

- 6 Two-Mile-Ditch

Kilkenny

- 7 Kilmacow

Limerick

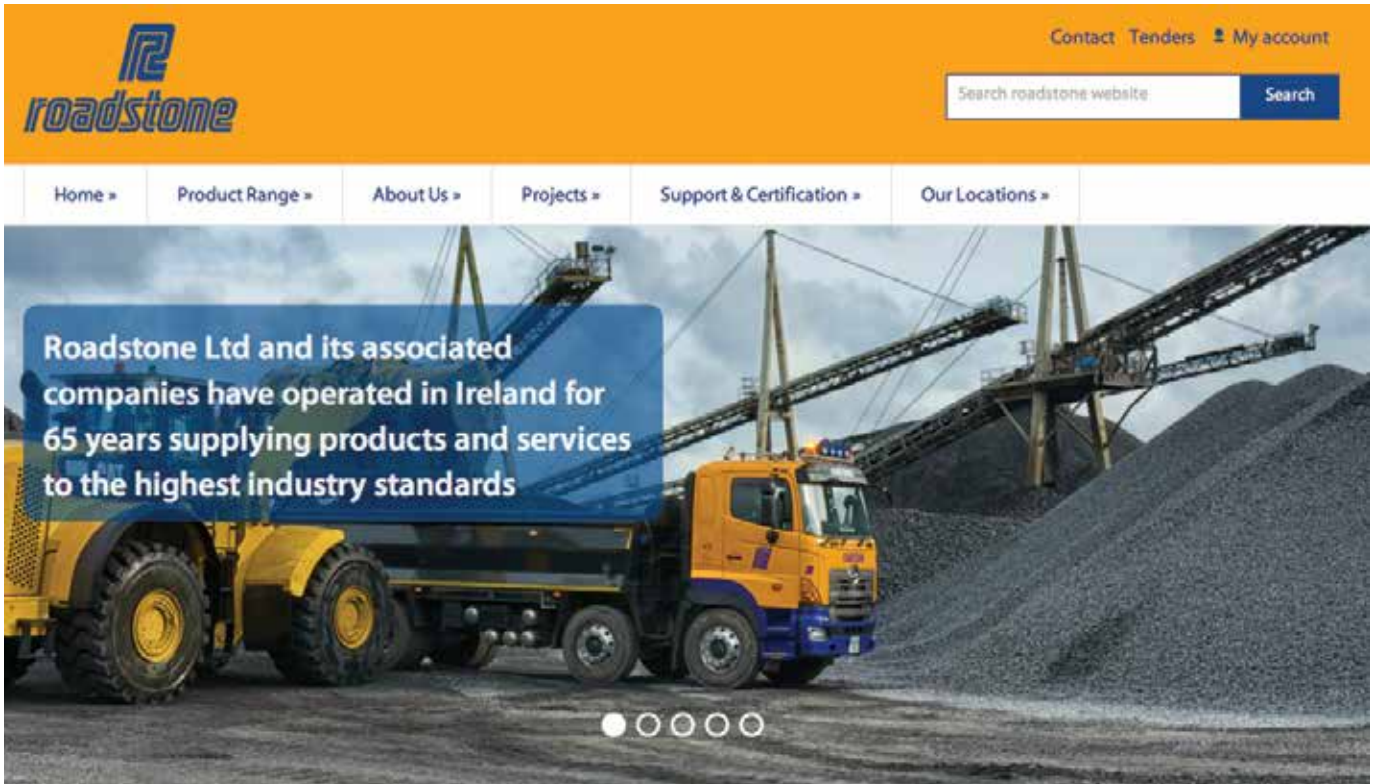
- 8 Gooig

Mayo

- 9 Castlebar

Wicklow

- 10 Fassaroe, Bray



Visit our website
www.roadstone.ie

Roadstone.ie has been developed to assist you find information about Roadstone and its products and services.

Continuous updates and developments are planned and your ideas and comments are welcomed.

The following new facilities are available on our website:

- Updated company and product news
- Find a location
- Quotation requests
- Technical Certification downloads
- Product specification details
- Picture gallery
- Case studies
- Video guide on how to lay paving





What do I do if I want more information on Granular Fill to Annex E of S.R. 21?

Contact info@roadstone.ie or check Frequently Asked Questions at www.roadstone.ie



www.roadstone.ie

Phone: 01 4041200 - Fortunestown, Tallaght, Dublin 24.

Email: info@roadstone.ie



This publication is for information purposes only. The information contained herein is offered in good faith and is believed to be accurate. However, no representations or warranties, express or implied, are given by Roadstone, its directors, employees or advisors as to the accuracy, reliability or completeness of the information contained herein or any other written or oral information which has been or may be made available. Accordingly, none of Roadstone, its directors, employees or advisors accept any responsibility or liability whatsoever resulting from the information contained in this publication. Roadstone reserve the right to seek indemnification from any persons to whom this publication has been furnished in respect of any third party claims, losses or demands that may be made against Roadstone.