FUTURECAST

INNOVATION R&D AND EDUCATION CENTRE



National Construction, Quarrying, Agricultural Centre



Who We Are

- Innovation, R&D, Education & Science Centre for Construction, Quarrying, Agricultural & Manufacturing supply chain
- Industry 4.0, 5.0, & 6.0 Centre for Industry
- A team of 22: Engineers, Scientists, Lecturers, Building Technicians – 4 new starts coming in 2026
- Outer Team of 75 PHDs and Masters in Colleges in Ireland, EU and USA
- Specialise in: Innovation, R&D & Science Projects
- 250 Industry companies around Ireland
- Networking and Partnership is our Strength

- **Locations : Leitrim, Roscommon Centre and Dublin office**

Industry 4.0 - Relevant Training Portfolio

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- AI Models & Agents
- BIM and Digital Twins
- Drone & photogrammetry
- Lean Construction
- Automation & Robotics
- MMC
- Quarry and Precast
- Mechanical & Electrical
- Data Analytics
- Cybersecurity
- Diversity & Inclusion

Industry 4.0
Skillnet

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CAREERS OF THE FUTURE

Building a **smarter, safer** and more **sustainable** future for quarrying and construction.



THE FUTURE WORKFORCE FOR QUARRYING & CONSTRUCTION

Future construction and quarrying careers are becoming more technology-driven, sustainable, and data-focused, combining traditional building skills with digital innovation and automation.

1 SUSTAINABILITY & ENVIRONMENTAL ROLES



- **Sustainability Managers:** Focus on eco-friendly building practices and reducing carbon emissions
- **Circular Economy Specialists:** Reuse materials and reduce waste in construction and quarrying
- **Carbon Tracking Analysts:** Measure and manage a project's environmental impact

2 ENERGY & SMART SYSTEMS



- **Renewable Energy Technicians:** Install solar panels, wind systems, and energy storage in buildings
- **Smart Building Engineers:** Design automated systems for lighting, heating, and security
- **Energy Efficiency Consultants:** Improve building performance and reduce energy use

3 DATA & AUTOMATION ROLES



- **Data Analysts (Construction/Quarry):** Interpret real-time site and machinery data
- **Machine Learning Engineers:** Improve automation systems and predictive maintenance
- **Automation Systems Integrators:** Connect robotics, software, and equipment

4 ADVANCED ENGINEERING & DESIGN



- **Parametric Designers:** Use algorithms to create smart, efficient building designs
- **Robotics Engineers:** Design and develop construction and quarry robots
- **Geospatial Analysts (GIS Specialists):** Map and analyse land for construction and quarrying

MATERIALS INNOVATION



- **Advanced Materials Engineers:** Develop stronger, lighter, and eco-friendly materials
- **3D Printed Materials Specialists:** Create new materials for additive manufacturing
- **Recycling Technology Experts:** Turn waste materials into usable construction products

SITE & SAFETY INNOVATION



- **Digital Safety Managers:** Use AI and wearables to improve worker safety
- **Remote Site Operators:** Control machinery from off-site control rooms
- **Human-Robot Interaction Specialists:** Ensure safe collaboration between workers and machines

Science Education - FUTURE CAST LABORATORY







OVERVIEW

Future Cast's Laboratory Capabilities

A guide of what we can test, from fresh concrete to water chemistry, plus our **partner equipment** and live projects.

01

3D concrete printing/Precast concrete

Full-scale COBOD printer – state of Art Precast beds

02

Concrete & Stone

Workability, air and density

03

Bio-Materials

Strength, durability, Carbon

04

In-situ testing

Non-destructive checks on site

05

Cement and mortar

Fineness, setting, soundness

06

Aggregates and soils

Grading, wear, ground strength

07

Water, and chemistry

pH, salts, metals, pXRF

08

Partner: ATU / PEM Centre

SEM, FTIR, thermal, 3D printing



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00:00:20

3D Concrete shorts_3

3D PRINTING

3D concrete printing: what we can do

We take a concrete mix from the mixer to a full-size printed product, then test it.

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STEP 1

Mix design in-house

Trial mixes in the pan mixer, tested fresh before printing.



STEP 2

Full-scale printing

COBOD gantry printer for building elements and housing-scale structures.



STEP 3

Coarse aggregate mixes

Printing with coarse-aggregate concrete to reduce cement content – ***Reducing Carbon Footprint.***



STEP 4

Print to test

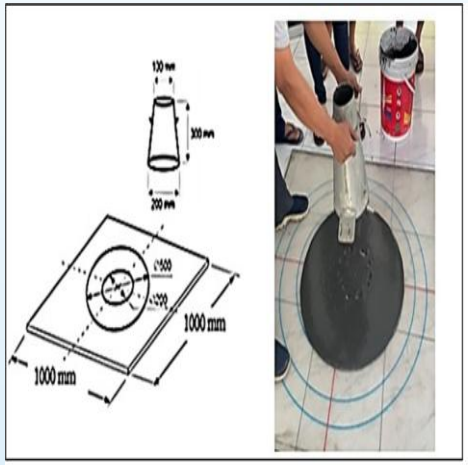
Printed samples cut to specific size and tested for strength and durability.

CONCRETE

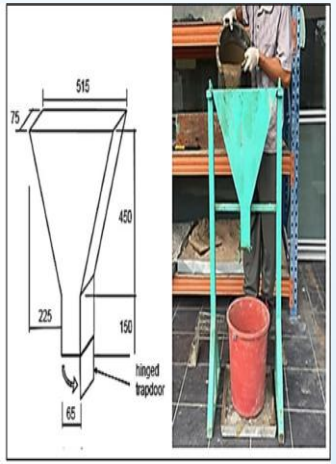
Concrete testing equipment

Before concrete sets, we check it flows, fills the mould and holds the right amount of air.

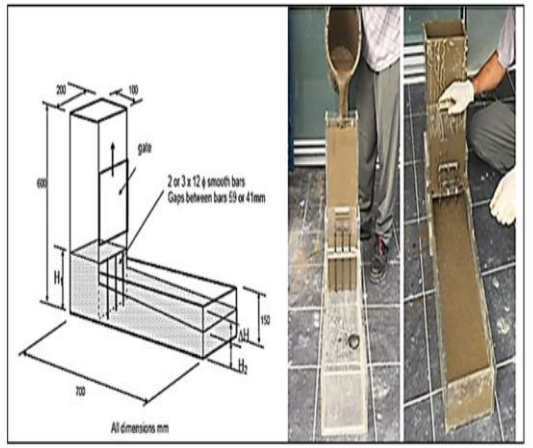
TEST	WHAT IT TELLS YOU	EQUIPMENT	STANDARD
Slump / consistence	How easily fresh concrete flows (workability)	Slump cone; electrical slump test	EN 12350-2 ASTM C143
Flow table test	Consistency of flowing concrete	Flow table	EN 12350-5
Vebe consistency	Workability of stiff, dry mixes	Vebe consistometer	EN 12350-3
Air content (pressure)	How much air is in the mix	Air entrainment meter	EN 12350-7 ASTM C231
SCC slump-flow	How far self-compacting concrete spreads	SCC flow test	EN 12350-8 ASTM C1611
SCC V-funnel	How quickly self-compacting concrete flows	V-funnel stand	EN 12350-9
Fresh density	Weight per cubic metre when fresh	Balances; measuring containers	EN 12350-6 ASTM C138
Trial mixes / mixing	Small batches to perfect a recipe	Pan mixer	EN 12350-1 BS 1881-125



(a) flowability using slump-flow test



(b) filling-ability test using V-funnel



(c) passing-ability test utilizing L-Box

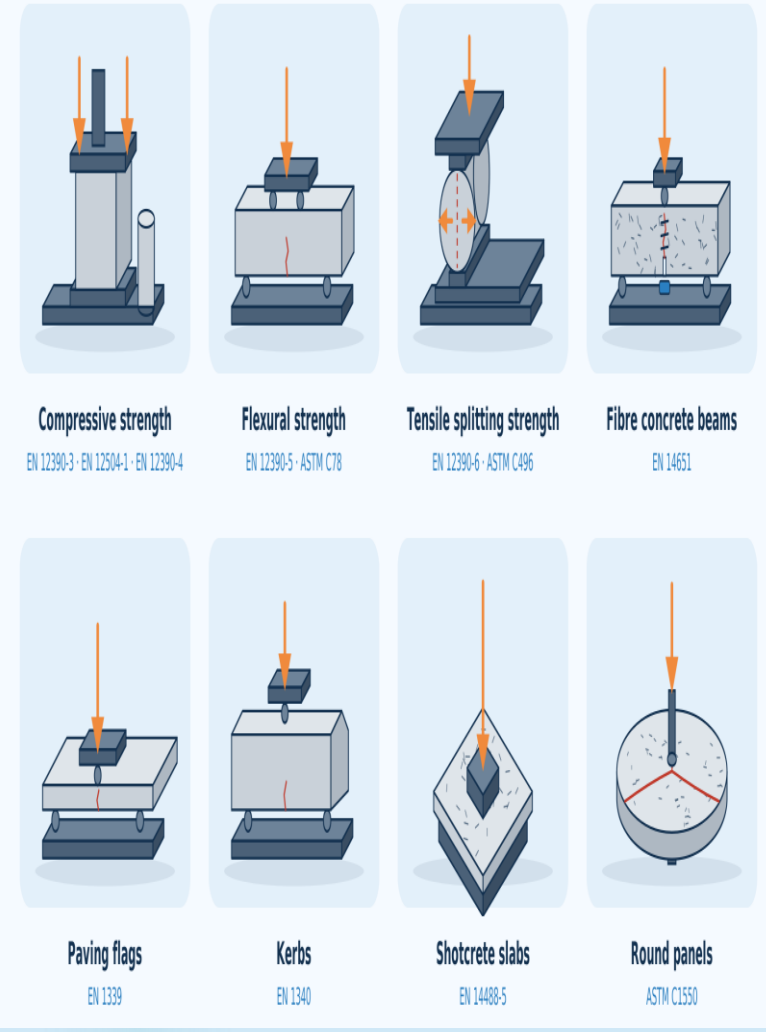
CONCRETE

Hardened concrete: strength and mechanical properties

Once concrete has set, we measure how much load it can take, and test precast products.

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TEST	WHAT IT TELLS YOU	EQUIPMENT	STANDARD
Compressive strength (cubes / cores)	Load it carries when squeezed	Compressive strength tester; cube shaker; curing tank	EN 12390-3 EN 12504-1 EN 12390-4
Flexural strength	Resistance to bending and cracking	Flexural strength testing machine	EN 12390-5 ASTM C78
Tensile splitting strength	Resistance to being pulled apart	10K splitting equipment	EN 12390-6 ASTM C496
Fibre concrete beams	Toughness of fibre-reinforced concrete	Flexural strength testing machine	EN 14651
Paving flags	Bending strength of paving slabs	Flexural strength testing machine	EN 1339
Kerbs	Bending strength of kerb units	Flexural strength testing machine	EN 1340
Shotcrete slabs	Strength of sprayed concrete	Flexural strength testing machine	EN 14488-5
Round panels	Energy fibre-concrete panels absorb	Flexural strength testing machine	ASTM C1550

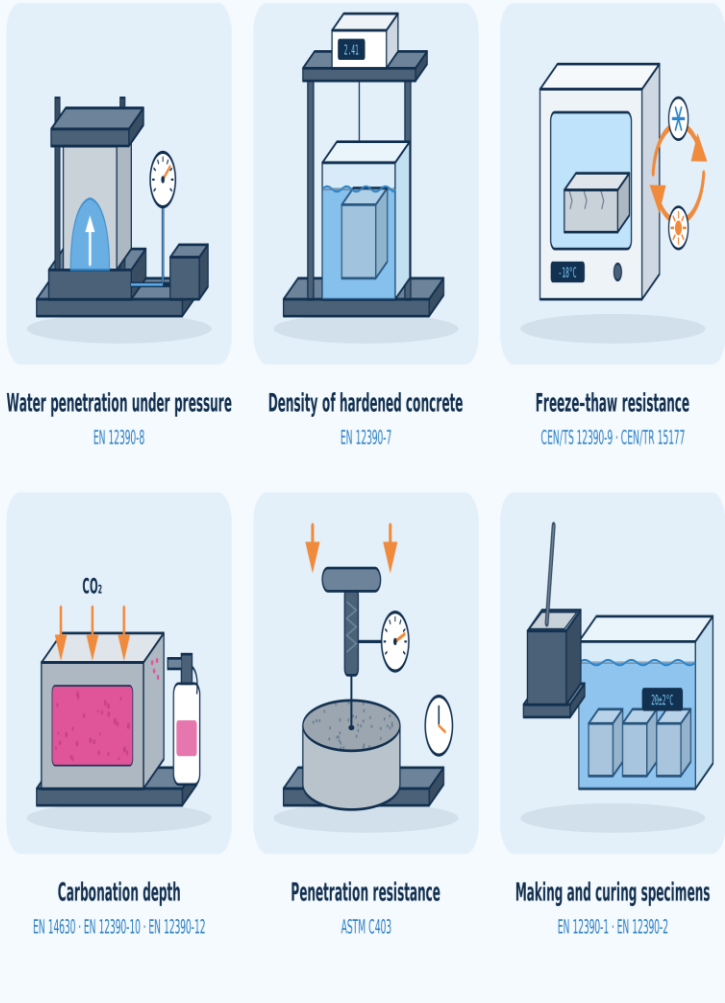


CONCRETE

Hardened concrete: durability

How well concrete keeps out water, survives frost and resists ageing over its life.

TEST	WHAT IT TELLS YOU	EQUIPMENT	STANDARD
Water penetration under pressure	How far water gets in under pressure	Water penetration kit; air compressor	EN 12390-8
Density of hardened concrete	How dense and compact the set concrete is	Balances; specific gravity frame	EN 12390-7
Freeze–thaw resistance	Survival through repeated frost cycles	Temperature and humidity cabinet	CEN/TS 12390-9 CEN/TR 15177
Carbonation depth	How far CO_2 has reacted into the concrete	Concrete carbonation test kit	EN 14630 EN 12390-10 EN 12390-12
Penetration resistance	How quickly the mix sets and stiffens	Concrete penetration test kit	ASTM C403
Making and curing specimens	Standard samples, cured correctly	Thermostatic curing tank; concrete saw	EN 12390-1 EN 12390-2



CONCRETE

Non-destructive and in-situ testing

Checking concrete in real structures without breaking it, on site or in the lab.

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Rebound hammer
Surface hardness
EN 12504-2 · ASTM C805

Ultrasonic pulse velocity
Internal quality and hidden cracks
EN 12504-4 · ASTM C597

Rebar location and cover
Where the steel is and how deep
Bar tracker · BS 1881-204

Core and sample cutting
Samples cut to exact size
Concrete saw, EN 12504-1

Temperature / maturity
Strength gain as concrete cures
Data logger · ASTM C1074

On site or in the lab
Wherever the concrete is
Existing and new · EN 13791



MATERIALS

Cement, mortar and binders

Checking the 'glue' in concrete: how fine it is, when it sets and whether it stays stable.

TEST	WHAT IT TELLS YOU	EQUIPMENT	STANDARD
Fineness (Blaine)	How finely the cement is ground	Blaine apparatus	EN 196-6
Setting time (Vicat)	When cement starts and finishes setting	Setting time test, mortar	EN 196-3 ASTM C191
Soundness (Le Chatelier)	Whether cement expands after setting	Le Chatelier mould	EN 196-3
Autoclave expansion	Long-term expansion, sped up by heat	Pressure autoclave	ASTM C151
Mortar prism strength	The strength class of a cement	Vibration prisms + comp./flex. machines	EN 196-1
Mortar expansion	Swelling of mortar over time	Mortar expansion prisms	ASTM C1260 ASTM C490
Loss on ignition	Weight lost on heating (impurities)	High-temperature furnace	EN 196-2



MATERIALS

Aggregates

Sand, gravel and crushed stone make up most of concrete and roads. We check their size, cleanliness and toughness.

TEST	WHAT IT TELLS YOU	EQUIPMENT	STANDARD
Particle size distribution	The mix of particle sizes (grading)	Sieve shaker; riffle splitter	EN 933-1 EN 933-2
Sand equivalent	How clean the sand is	Sand equivalent test kit	EN 933-8
Los Angeles abrasion	Resistance to crushing and wear	Los Angeles abrasion machine	EN 1097-2
Micro-Deval abrasion	Resistance to wear when wet	Micro-Deval abrasion machine	EN 1097-1
Polished stone value (PSV)	Skid resistance of road stone	Accelerated polishing machine	EN 1097-8
Aggregate impact value	Toughness under sudden impact	Impact factor test	BS 812-112
Particle density / absorption	Density and water uptake	Specific gravity frame; oven	EN 1097-6
Flow coefficient	How freely fine aggregate flows	Sand flow meter	EN 933-6
Crushing / sample preparation	Reducing samples for testing	Jaw crusher; hammer mill; ball mill	EN 932-1 EN 932-2



MATERIALS

Soils

What the ground is made of, how wet it is and how much load it can carry.

TEST	WHAT IT TELLS YOU	EQUIPMENT	STANDARD
Moisture content (oven)	Water content of a soil sample	Oven; balances	EN ISO 17892-1 BS 1377-2
Rapid moisture (field)	Quick water content on site	Speedy moisture tester; moisture meter	ASTM D4944
Particle size distribution	Grading of soil particles	Sieve shaker	EN ISO 17892-4 BS 1377-2
California Bearing Ratio (CBR)	Ground strength under roads	Compressive strength tester	BS 1377-4 EN 13286-47
Constant head permeability	How fast water drains through soil	Constant head permeameter	EN ISO 17892-11 BS 1377-5
Direct shear strength	Resistance to sliding failure	Shear box	EN ISO 17892-10 BS 1377-7
Unconfined compressive strength	Strength of stabilised soil	Compressive strength tester	EN ISO 17892-7 EN 13286-41



CHEMISTRY

Water, chemical, elemental and conditioning

Chemistry that protects concrete and the environment, plus controlled storage for test samples.

Water chemistry

Is it safe to mix concrete with? (EN 1008)

- pH (ISO 10523)
- Sulphate, chloride (EN 1744-1)
- Phosphate (ISO 6878); metals by UV-Vis

Sample preparation

Getting samples ready to analyse

- Acid digestion (EN 13657)
- Vacuum filtration
- Bottle-roll leaching (EN 12457)

Elemental analysis (pXRF)

Which metals are present?

- Metals in soil, cement, alloys
- Contaminated-land screening (US EPA 6200)

Specimen conditioning

Keeping samples in set conditions

- Temperature / humidity cabinet
- Thermostatic curing (EN 12390-2)
- Controlled drying



PXRF with desktop kits.

WHO WE HELP

Who these capabilities serve

From quarries to researchers, here is who uses the lab and what for.

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Ready-mix and precast

Fresh and hardened concrete QC; kerbs, flags and panels

Quarries and road works

Aggregate grading, abrasion, PSV and impact

Site investigation

NDT on structures; soil strength and moisture

Environmental

Water chemistry and pXRF metal screening

3D printing developers

Printable mixes and full-scale printed elements

Research and training

Student projects, PhD research and vocational training

PARTNER

Partner capability: PEM Centre, ATU, Belfast

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Through our partner, we can look inside materials down to the microscopic level.

Mechanical testing

- 600 kN UTM (ISO 6892-1)
- Instron bi-axial (axial + torsion)
- Low-force tensile
- Hardness (ISO 6507, 6508, 6506, 4545)

Microscopy and metrology

- SEM + EDS (×900,000)
- Zeiss optical microscope
- OGP CNC SmartScope

Thermal analysis

- DSC, −40 to 600 °C (ISO 11357)
- TGA, new (ISO 11358)

Chemistry and flow

- FT-IR spectroscopy (ASTM E1252)
- Gas pycnometer (ISO 12154)
- Rotational and capillary rheometers



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PROJECTS IN PROGRESS OVERVIEW

PROJECTS

Three projects, one goal: lower-carbon concrete

Live research that puts the lab to work.

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INTERREG NPA

Bio2Print

Testing seaweed, hemp, wool and birch bark residue in printed non-structural concrete.

INTERREG NPA

Circ-Blade

Recovered wind turbine blade fibres in concrete and 3D printed concrete.

PHD RESEARCH

ATU · Future Cast

30% less cement in 3D printed concrete using limestone coarse aggregate and sand.

BIO2PRINT

Bio2Print: bio-fibres in printed concrete

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Replacing raw materials in the concrete mix with local bio-fibres and residues, to print non-structural elements.

- **Seaweed (kelp)**
- **Hemp hurds**
- **Sheep wool**
- **Birch bark residue**

Mix design and testing

Each fibre tested as a replacement for raw materials, with the binder chosen to suit it, then checked for printability and strength.



Target: printed non-structural elements such as panels, blocks and street furniture, with lower embodied carbon & reuse of waste fibres.

BIO2PRINT

Bio2Print: the four fibers we are testing

Each one is a local by-product that is mostly wasted today.

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Seaweed (kelp)

SOURCE

Allihies Seafood, via MTU

AVAILABLE

~40,000 t a year in Ireland

WHY IT'S INTERESTING

Alginate may aid internal curing and cut shrinkage; washing removes harmful sulphates and chlorides.

Hemp hurds

SOURCE

Irish Hemp Cooperative

AVAILABLE

Up to ~6,800 t stem a year

WHY IT'S INTERESTING

Organic sugars retard Portland cement, so lime binders and treatment are tested.

Sheep wool

SOURCE

Dooleys Wool

AVAILABLE

~7,000 t a year, over 80% unused

WHY IT'S INTERESTING

Could reduce micro-cracking and improve layer bond, replacing polypropylene fibres.

Birch bark residue

SOURCE

Innomost (Finland)

AVAILABLE

1.44 million m³ bark a year

WHY IT'S INTERESTING

Lignin fraction may act as a natural plasticiser once the retarding fraction is removed.

RESEARCH

Biochar in 3D-printed concrete?

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Why it may be interesting: ***lower-carbon mixes, circular materials and printable performance***

LOWER-CARBON CONCRETE

Biochar can store stable biogenic carbon and may reduce the net footprint of printable concrete.

PRINTABILITY

May influence extrusion, layer stability and buildability when the mix is carefully proportioned.

WASTE VALORISATION

Turns biomass and agricultural residues into a potentially useful construction material.

RESEARCH OPPORTUNITY

Test dosage effects on workability, strength, shrinkage and interlayer bonding.

KEY GOAL: Reduce environmental impact without compromising print quality or performance.

BIOMATERIALS

Certifications for biofibers in construction

Biochar, hemp, sheep's wool and birch bark – meet Irish and European requirements



MATERIAL & PRODUCT STANDARDS

Prove quality, safety and performance.

- **CE marking** (where applicable)
- **ETA / EAD** (for innovative products)
- **EN 13501-1** (fire performance)



IRISH BUILDING REGULATIONS

Meet Ireland's technical and safety requirements.

Building Regulations
Technical Guidance Document D
(materials and workmanship)



EUROPEAN & IRISH ASSESSMENT ROUTES

For innovative or non-standard products.

- **NSAI / Irish Agrément** (where appropriate)
- **CE marking & DoP** (when required)



WHY IT MATTERS

Builds trust, enables market access and supports sustainable construction.

Safety | Sustainability | Compliance | Market access



ROUTE TO MARKET:

Check applicable standards → Verify CE/EAD/ETA route → Ensure Irish Building Regulations (TGD D) → Confirm NSAI / Irish Agrément (if needed) → CE marking & DoP (where required)

CIRC-BLADE

Circ-Blade: circular wind turbine blades

Giving old wind turbine blades a second life instead of sending them to landfill.

30
months, Interreg NPA

3
work packages, from mapping to tools

1st
pilot: an Irish Rail signal pole



The problem: End-of-life blades are hard to move and recycle, so they are often landfilled or incinerated.

Repurpose first: Blade sections become public infrastructure.

Recycle as backup: Solvolysis recovers fibres for concrete and 3DPC, and resin for coatings.



Led by **Centria UAS (Finland)** with partners across the NPA region.

CIRC-BLADE

Circ-Blade: what Future Cast will produce

Three outputs that help regions choose what to do with old blades.

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1

Regional constraints report

Transport, climate, permitting and infrastructure profiles.

2

Fibre concrete and 3DPC mixes

Mix designs with recovered glass fibre, validated for construction use.

3

Decision support tool

Digital tool for authorities and SMEs to compare pathways.

Associated partners
Donegal Waste and Recycle and Irish Energies

Training
Through ATU and MSLETB

PHD PROJECT · ATU, ROADSTONE & FUTURE CAST

Lower-cement 3D printed concrete (3DPC)

Using local limestone and sand to print concrete that needs far less cement.

380	266	−30%
kg/m³ cement (reference)	kg/m³ cement (new mix)	cement content





Coarse aggregate
Natural limestone coarse aggregate and sand in printable mixes

Print and test
Printed on the COBOD gantry and tested in the MTL lab

Lower carbon
Less cement per cubic metre means a smaller carbon footprint

National Fire Test Centre

Material & Product Fire Testing Certification Centre

1. National Lead In Product And Material Fire Certification, CE Marking And R&D Under Fire Products
2. Integral Part Of The Manufacturing Companies On The Island Of Ireland.

Education - ATU

- Fire Safety And Fire Engineering Courses
- Industry Experience For Students

Innovation and R&D

Through Collaborative Projects Within The Fire Engineering Industry

Science

Future Cast Geological & Material Testing laboratory will become a one-stop-shop for the construction and heavy manufacturing industry with the development of Fire Laboratory



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Pyrolysis Stream 1

Circular Carbon Recovery Platform

5 million capex – extra 3 million for power
Tyre pyrolysis / Blades R&D platform
18 to 30 tons/day throughput

Turbine Blade outputs:

- Recovery of carbon fibre
- Glass fibre fractions
- Syn Gas
- Power Generation - extra 3 million in plant

Tyres outputs

- Recovered carbon black
- steel
- oil / gas fractions

Poles Outputs

- Biochar,
- Syngas / Heat,
- Steam / Electricity

Feedstock

Tyres / Chipped Wind Turbine Blades / ESB Poles









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Pyrolysis Stream 2

Biomass Pyrolysis Plant

Process / outputs

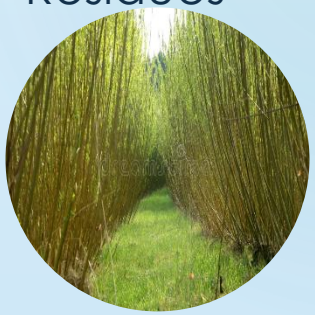
- Biochar,
- Syngas / Heat,
- Steam / Electricity

Plant

- Approx. €3 Million Capex
- Biomass Pyrolysis + CHP Plant.

Feedstocks:

Willow, Hemp, Sitka Spruce, Chipped Timber Residues








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Adoption of the Delegated Act on Carbon renewal and Carbon farming (CRCF)

🗓️ 9 July

On the 9th July, the Commission adopted a Delegated Act establishing methodologies to certify carbon sequestration in:

- agriculture and agroforestry
- peatland rewetting
- Afforestation
- Biocar

The adoption of the Delegated Act will enable farmers and foresters, certified under the EU Regulation on Carbon Removals and Carbon farming (CRCF) to access result-based payments, complementing their income and supporting them in the transition towards a more resilient production system. This will support enhancing the land sector resilience to climate change by ensuring soil health, resource independence, and a reliable supply of bio-based materials.

The EU Delegated Regulation will now be transmitted to the European Parliament and the Council of the EU for a two-month scrutiny period, which may be extended by a further two months. In the absence of objections, it is expected to be published in the Official Journal of the European Union in early Autumn, with entry into force 20 days thereafter.

The Commission is assessing CRCF compliance of five certification schemes

DG CLIMA CRCF website

Delivery model

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Practical Learning	Face-to-Face	Hybrid	Online
Hands-on workshops, site visits, drone operations, BIM labs, technology demonstrations	Classroom-based programmes, leadership development, masterclasses and networking events	Combination of online learning and in-person practical sessions	Live virtual classrooms, webinars, masterclasses and self-paced learning
Learning by doing	Peer-to-peer collaboration	Reduced disruption to operations	Maximum flexibility

Accessible. Practical. Industry-Led.
Delivering skills development when, where and how your workforce needs it.

Training Facilities



ME Centre, Ballaghadereen	St Clares, Manorhamilton	W8, Manorhamilton
Two training rooms	Training rooms	Four Training rooms
Mechanical and Electrical Set up	Diggers/dumpers/ Teleporter/ Crushers etc	
Lazer Cutter	Industry Makerspace	
8 Welding rigs	Robotic Training Cells	
Industry Electrics units	3d Construction Printer	
Mechanical setups	Material Testing Laboratories (x3)	



Learning that fits your workforce, your location and your business needs.



We have funding under innovation, R&D and Education under SREI-EI, FE2, Data Sustain, Industry 4.0 Skillnet, All Island Grasp Education Funding and EU programs

THANK YOU