
Wind Blade Repurposing Solutions: The “BladeBridge”

Lawrence Bank*, Russell Gentry*, Benjamin Tasistro-Hart, Zoe Zhang,
Asha McDonald, Ammar AlShannaq (GT)

Paul Leahy*, Angela Nagle (UCC), Kieran Ruane (MTU)

Jian-Fei Chen, Jennifer McKinley*, Raj Suhail, Conor Graham, Emma Delaney,
Marios Soutsos, An Huynh (QUB)



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Outline

- Overview of Re-Wind project
(Re-Wind – www.re-wind.info)
- Blade Repurposing Solutions
 - Background
 - The BladeBridge

Re-Wind Partners, Projects, Funding

Network University Members:

- Georgia Tech
- City University of New York
- University College Cork
- Queens University Belfast
- Munster Technological University

Funding (~\$2m 2014-current)

- NSF (CBET, PFI, I-CORPS)
- NYSERDA
- SFI
- DfE
- ENEL Green Power

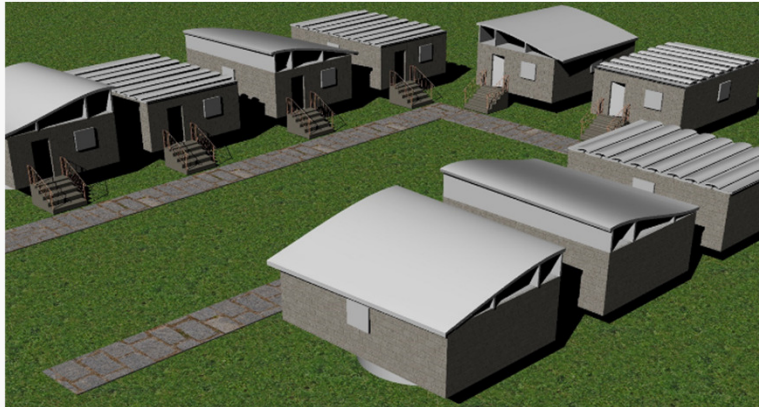
Current Project Partners:

- Logisticus Group
- ENEL Green Power
- Siemens-Gamesa RE
- Cork County Council
- NYC Dept of Design and Construction (DDC)
- IEA Task 45

Blade Repurposing Concepts

- **BladeBridge**
- BladeHousing
- BladePole
- BladeBarrier
- BladeTower
- **BladeMachine**





BladeHousing



BladeBarrier



BladePole

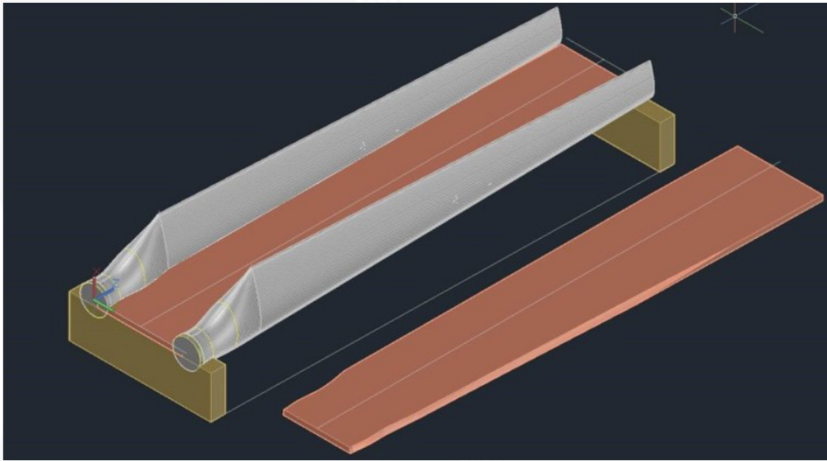


BladeTower

The BladeBridge (2016 – to-date)

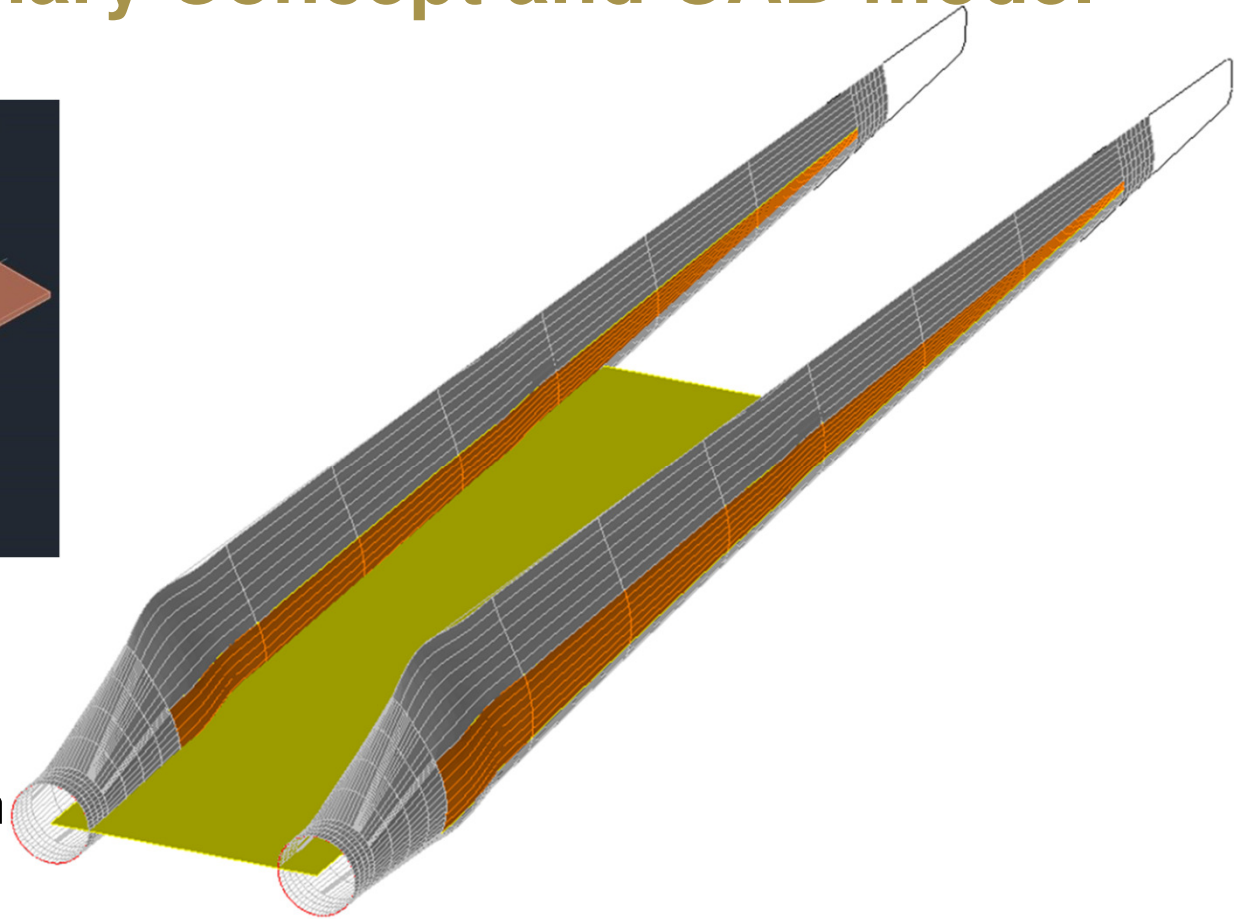
- 2016- 2017 – Initial Concepts and Alternative Designs; Specific blade identification for demonstration project (A29 aka V29), Blade LiDAR scanning; 8.5m long BladeBridge in Northern Ireland (on hold)
- 2018 – Blade mechanical and structural properties determined; Preliminary bridge structural analysis and design completed
- 2019 - First (ever) paper published on the BladeBridge analysis and design
 - R. Suhail, J-F. Chen, T.R. Gentry, B. Tasistro-Hart, Y. Xue and L.C. Bank, (2019), “[Analysis and Design of a Pedestrian Bridge with Decommissioned FRP Windblades and Concrete](#),” Proceedings of FRPRCS14, Paper 176, Belfast, UNITED KINGDOM, USB-ROM.
- 2020 - N29 (LM 13.4) Blade sourced from Everun in Northern Ireland and delivered to Munster Technological University in Cork; Bridge design engineer Kieran Ruane joins team; 5m long BladeBridge in County Cork, Ireland
- 2021 – Blade characterization and testing.
- 2021 Autumn – BladeBridge constructed and installed.

2017-2018 – Preliminary Concept and CAD model

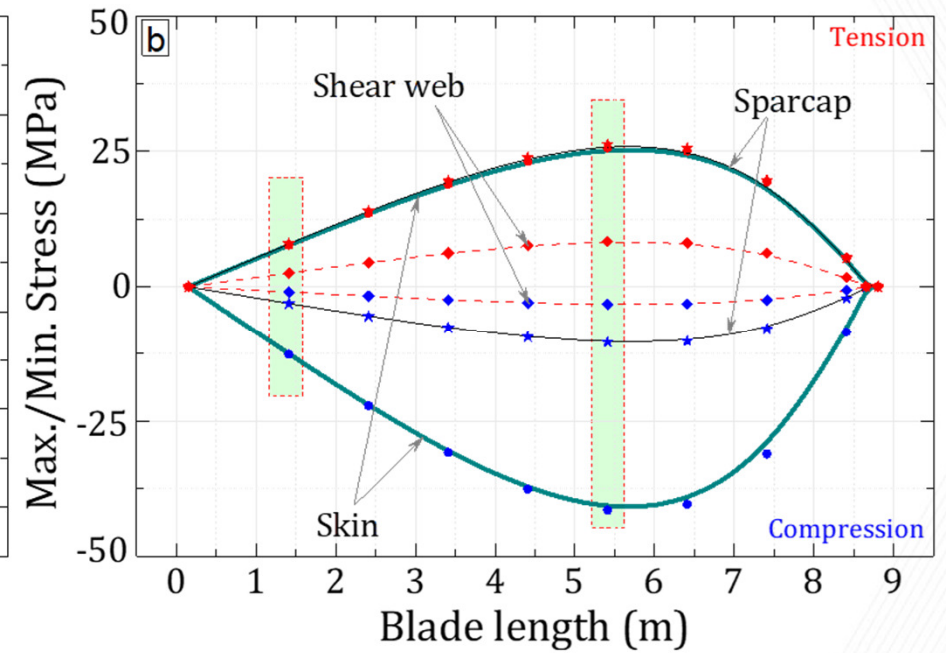
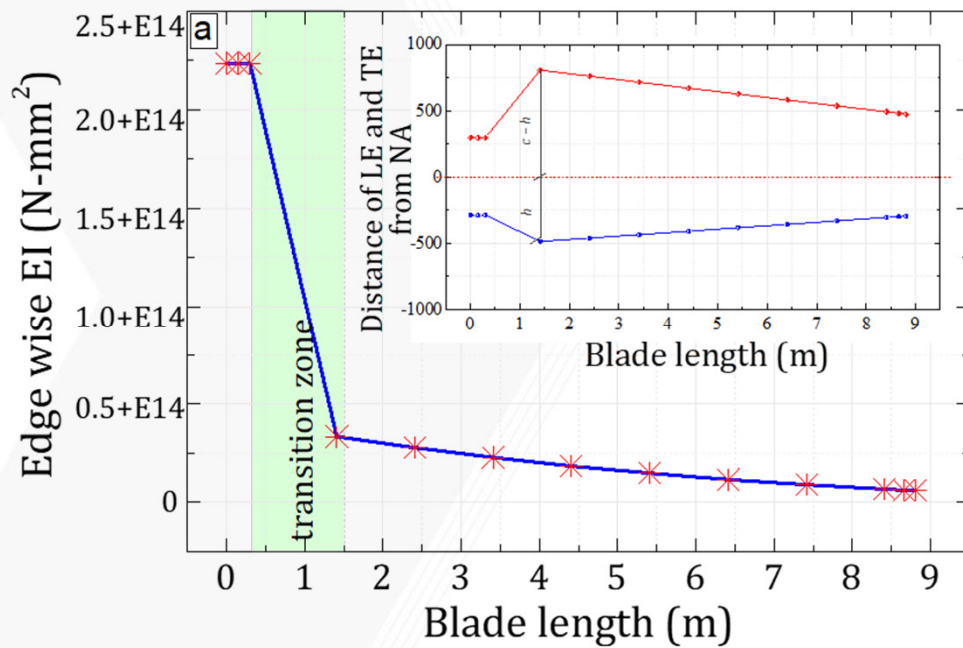


Why this “simple” design?

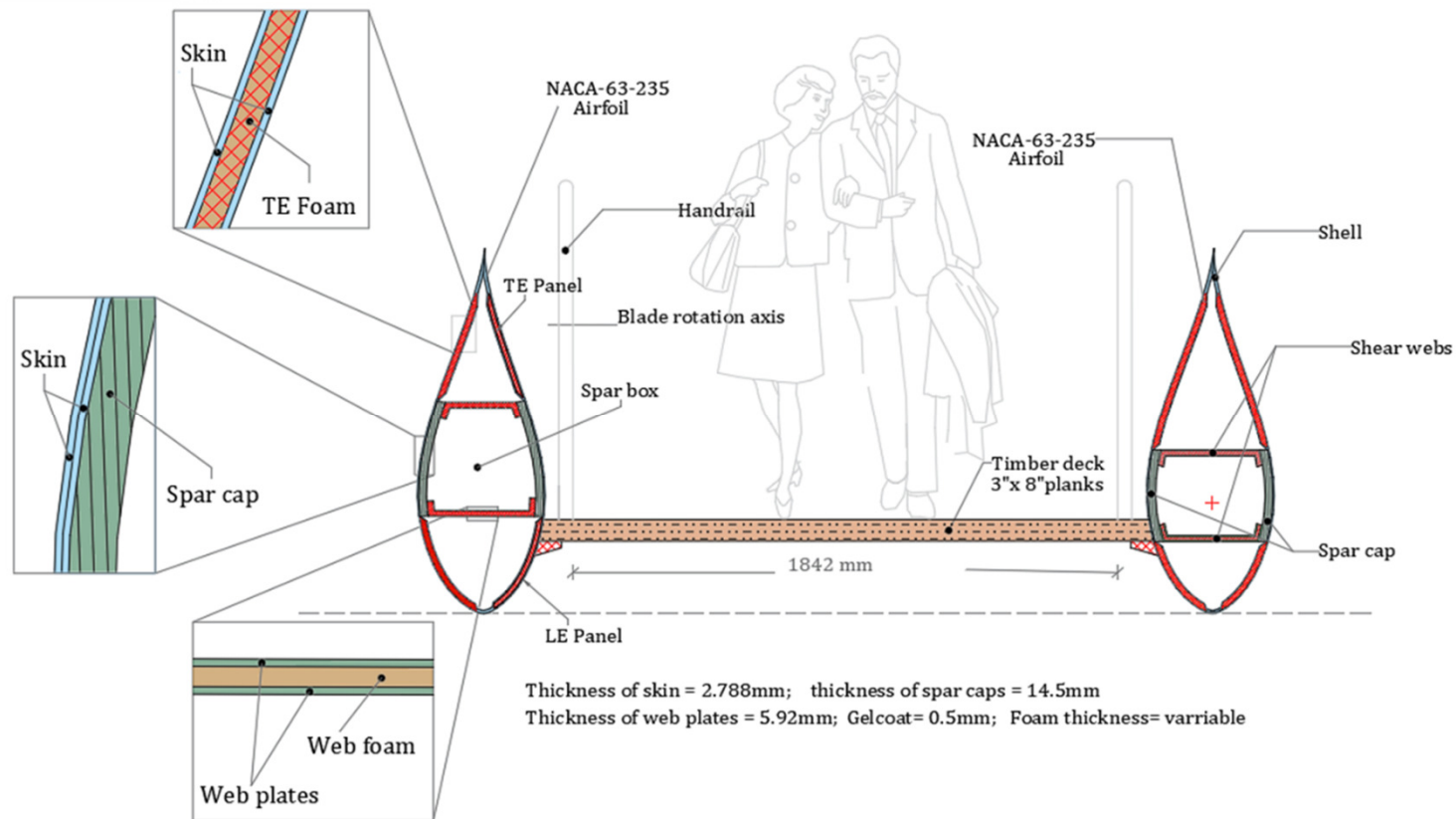
- Mass market not bespoke
- It is “simple” for structural analysis, design and construction
- Fits all size blades



2018-2019 – Preliminary Structural Analysis



2018-2019 – Preliminary BladeBridge design



BladeBridges – various length designs



Nordex N29 (~13 m)
Vestas V29/A29
5-8 m BladeBridge



Vestas V44 (~21 m)
12-15 m BladeBridge

BladeBridges – various length designs

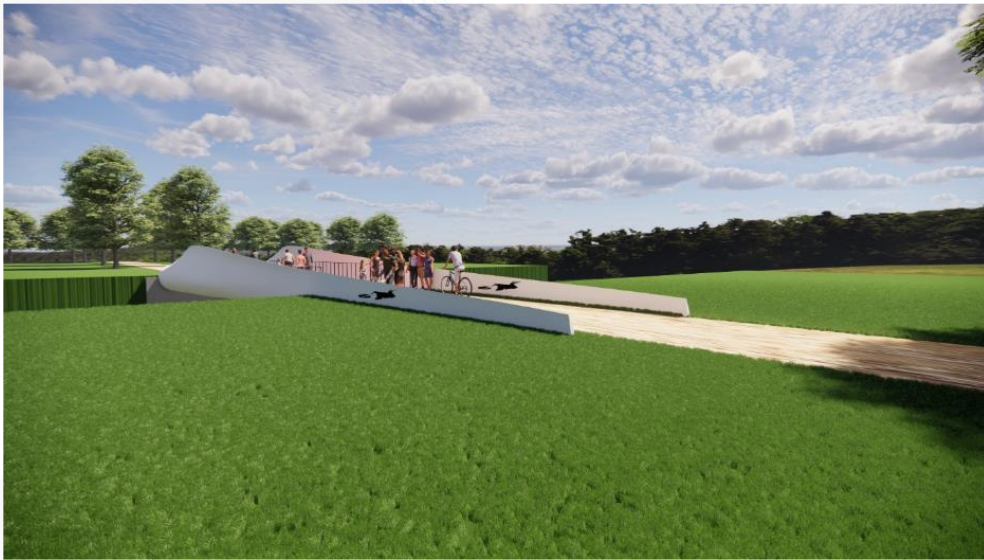


**GE 37 (~37m
15-25m BladeBridge**

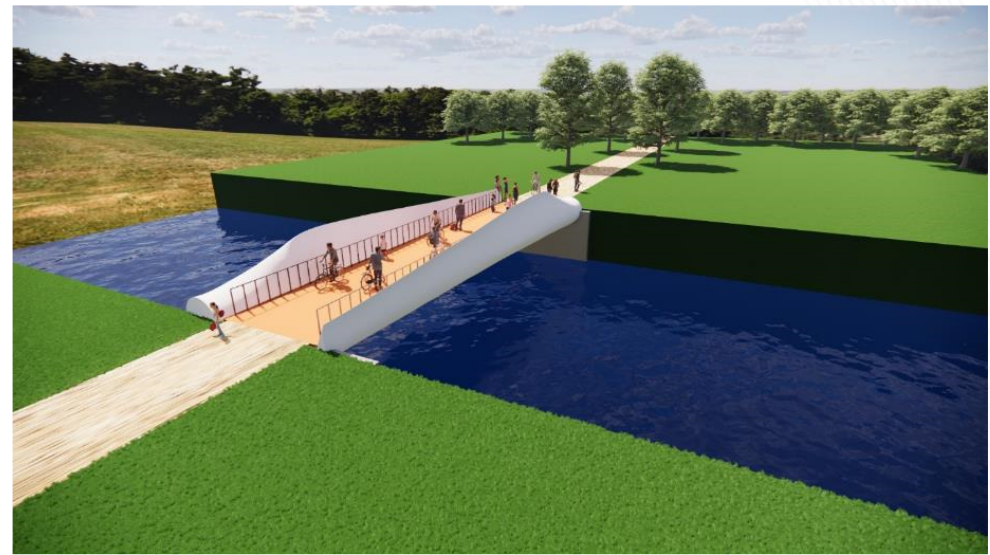


**Clipper C96 (~46m
25-35m BladeBridge**

BladeBridges – other simple options

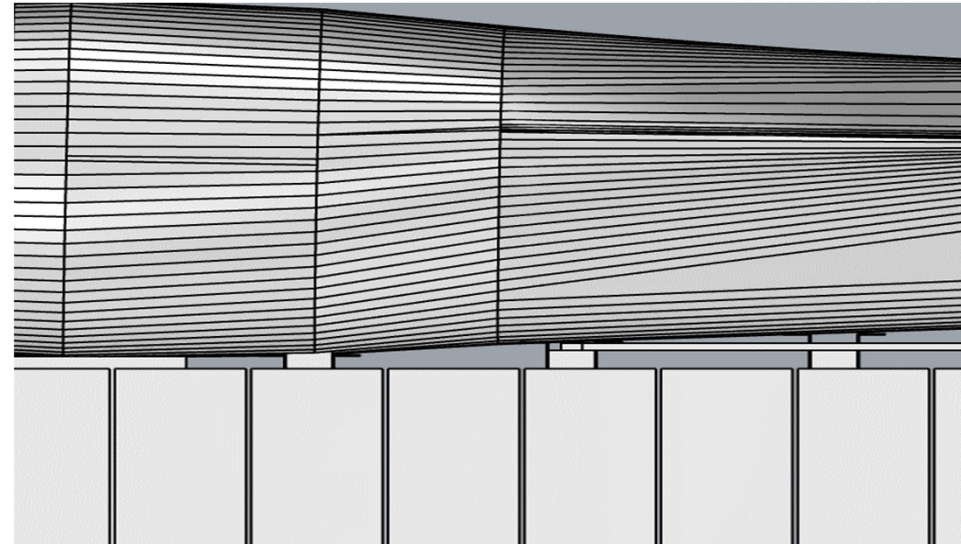
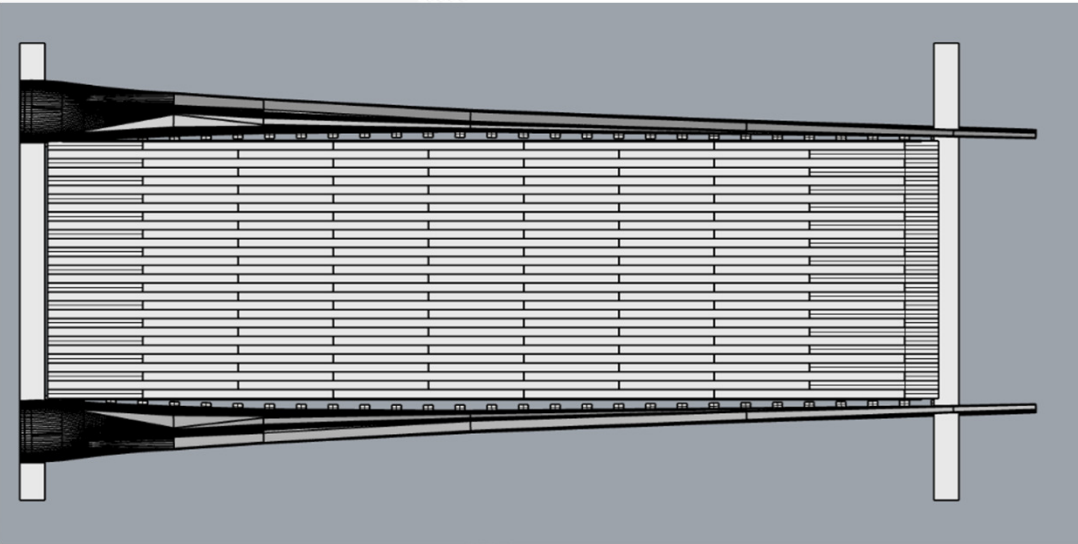


Extensions



Asymmetrical

Windblade Alignment



Complexity of Geometry must be accounted for in actual designs:
Pitch of blades, straightness of blades, spacing between blades

County Cork BladeBridge – Midleton to Youghal Greenway

earth.google.com/web/@51.88547074,-8.11575666,69.17183928a,47154.15170744d,30.00001373y,0.00007467h,0t,0r/data=MickJQojCiExU2Nyd1NTOX...

VIEW ONLY

Youghal Cycleway

Angela Nagle

New feature Present

- A. Midleton - Start Greenway
- 1. Road 5m
- 2. Driveway 4m
- 3. driveway 4.5m
- 4. Mogeely Road 8m
- 5. Ditch 7m
- 6. driveway 3.5m
- 7. Small Road 6m
- 8. Road 7m
- 9. Road 7m
- 10. Road Killeagh 11m
- 11. Road 8m
- 12. Road 8m
- 13. Culvert 4m
- 14. driveway 5m
- 15. road 8m
- 16. Road 8m
- 17. Road 8m
- 18. sma
- 19.

Approximate location of pedestrian bridge chosen site

Map labels: Ballincurrag, Walshtown, Clonmult, Mount Uniacke, Inch, Newtown, Leamlara, Tattens Glen, Dungourney, Dangan, Leamlara, Tattens Glen, 10. Road Killeagh 11m, 9. Road 7m, 15. road 8m, 19., 3. driveway 4.5m, 2. Driveway 4m, 1. Road 5m, 4. Mogeely Road 8m, 13. Culvert 4m, 18. sma, A. Midleton - Start Greenway, Carrigwohill, Castlemaryr, Ladysbridge, Pilmore, Ballinacurra West, Ballymacoda, Island, Fota Wildlife Park, Passage West, Garryvoe, Cobh, Shanagarry, Ringaskiddy, Aghada-Farsid-Rostellan, Carrigalusk, Whitegate, Churchtown South, Ballycotton, Ballycreeen, Arch Bay.

Google 100% CNES / Airbus Data SIO, NOAA, U... 7,000 m Camera: 47 km 51°51'44"N 8°06'22"W 23 m

County Cork BladeBridge – Midleton to Youghal Greenway



2020 - BladeBridge – Testing, Detailed Design



BladeBridge - Environmental Analysis (LCA)

Functional Unit: Delayed disposal of 4500 kg 22m long blade (Vestas V44) over 60 years (Cradle to Grave)


- Blades transportation 500 km Belfast to Cork
- Lower 2/3 blade replaces steel girders made with partially recycled material
- Top 1/3 blade sent to landfill
- Blades coated in epoxy protective layer
- End of Life Plan: Co-processing of GFRP girders, recycling of hardware

Wooden decking material, abutments, and maintenance schedule assumed equal to bridge made with steel girders

Thanks for listening

larry.bank@design.gatech.edu

www.re-wind.info



Re-Wind team article featured in CompositesWorld: "Defining the landscape for wind blades at the end of service life"
May 17, 2021

New journal paper accepted - "End-of-Life Alternatives for Wind Turbine Blades: Sustainability Indices Based on the UN Sustainable Development"
April 16, 2021

Yale Climate Connections radio story about Re-Wind airs on April 14, 2021
April 16, 2021

Georgia Tech Re-Wind Team visits ENEL's Smoky Hills wind farm in Kansas
April 2, 2021

Re-Wind featured at New York City's Town+Gown webevent "New Frontier for Construction Materials - Decommissioned Wind Blades"
March 25, 2021

Re-Wind is a Holistic R&D Program

- EOL Repurposing of wind turbine blades
- Architecture and Industrial Design
- Structural Engineering and Construction
- Composite Material Mechanics
- Geographic Information Science and logistics
- Life–Cycle Assessments
- Business Models