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Potential benefits of replacing aluminum with (GFRP) in the installation of evacuation guidance lighting

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Introduction.

- Role of Evacuation Lighting.
- E4 Stockholm Bypass Project.
- Material Selection for Guiding Evacuation Lighting.
- Objective: Co2e, cost and weight reduction?
- Technical Questions to consider.

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Role of Evacuation Lighting

- Provide orientation, comfort, and directional guidance
- Must function during power failure and smoke-filled conditions
- Should guide towards emergency exits – not confuse

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Evacuation Strategies from research.

- Use of wall or handrail for orientation
- Tactile navigation with hands and feet
- Follow the light!

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Types of Evacuation Lighting

- Point lighting (LED or spot): 8–25 m spacing
- Continuous lighting (LED strips along walls)

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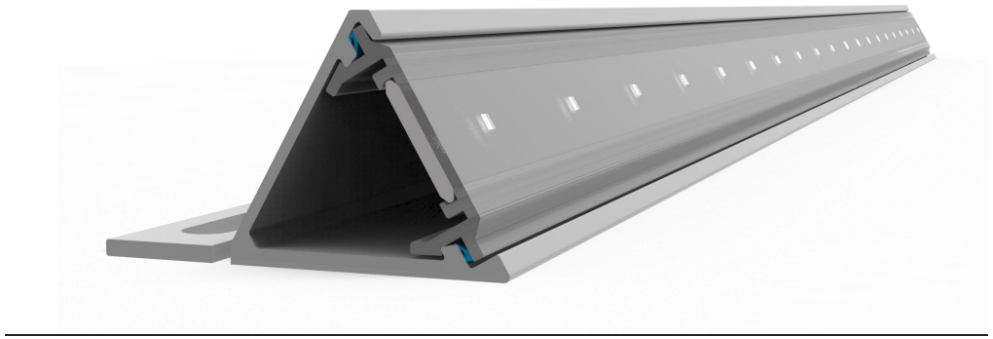
E4 Stockholm Bypass

- **From idea to implementation:**
- Continuous LED strips in GFRP housing
- Supplemented with strobe lights, acoustic beacons, and dynamic lighting



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Material Exchange – Light Strip

- 55,000 m of light strip installed in E4 Bypass
- Material and corrosion demands high i tunnels (C5)
- CO_2e, cost and savings (stainless to aluminum to GFRP)
- Transport and installation savings
- GFPR can be done with flame retardent and UV additions

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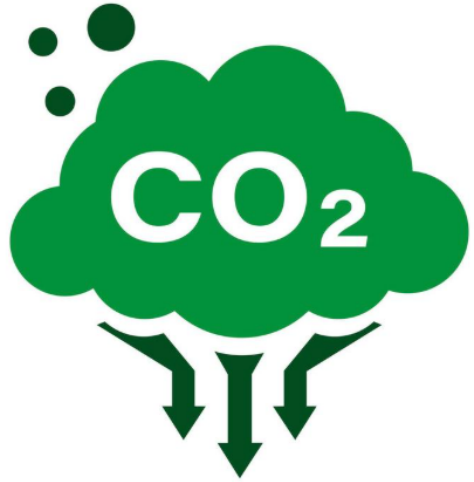
CO_2e savings

- Saving at 55,000 meters installation: 473,000–819,500 kg CO_2e (≈ 473–819 tons CO_2e) The CO_2e for GFRP typically ranges between 3–6 kg per kg, depending on resin, manufacturing process, and glass fiber ratio [1].
- This is significantly lower than primary aluminium (~14 kg CO_2e/kg) [2]

[1] *Comparative Life-Cycle Assessment of Steel and GFRP Rebars for Procurement Sustainability in the Construction Industry*, Saad Al Omar, Abdelhakim Abdelhadi, 2024.
[2] *International Aluminium Institute: Primary Aluminium Greenhouse Gas Emission Intensity.*



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Economic Aspects

- Raw material costs: Total costs in E4FS: Similar range aluminum and GFRP
- Easy to produce complex shapes in large series, but more costly the more complex the shape.
- Transport and installation: Easier with GFRP
- Weight reduction: ~16 tons total (aluminum 1,15kg/m – GFRP 0,86kg/m) in E4 Bypass
- End-of-life: Recycling disadvantage for GFRP

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Key Technical Questions

- Fire classification of GFRP components
- Long-term resistance in tunnel environment
- Mounting system adaptation
- Maintenance and inspection procedures
- Mechanical strength must be verified by future tests

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Potential Applications Beyond Lighting

- Cable trays
- Support brackets
- Profiles for ventilation
- Handrails in escape route or stairs.

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Approved Light handrail in railroad tunnels.

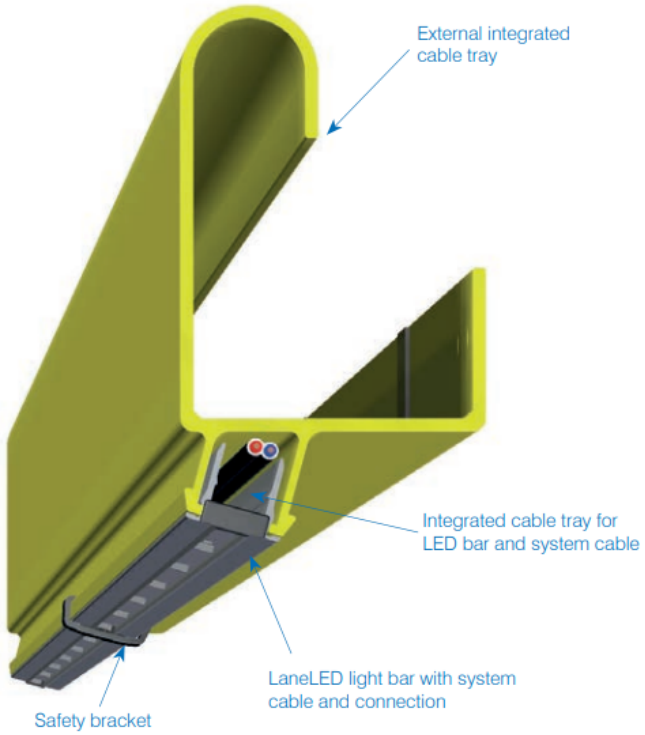
Eco Report

Product: 20250424MC50LED

Date: 24-4-2025

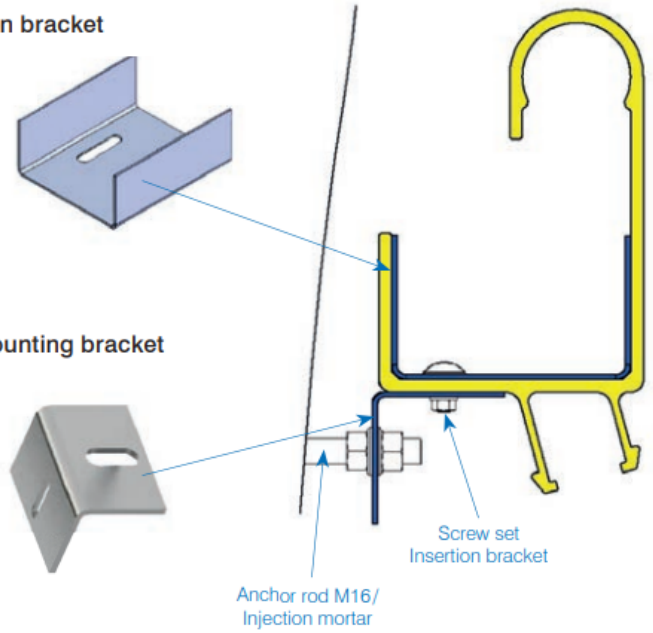
EuCIA
The European Voice of Composites

Handrail MC50



Insertion bracket

Wall mounting bracket



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Thank you!

- Questions?