



The project is supported by the Europe's Rail and its members. Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or Europe's Rail Joint Undertaking. Neither the European Union nor the granting authority can be held responsible for them.



Co-funded by
the European Union



Europe's Rail



MIDTERM EVENT PARIS

WP5: Development of 3D printed profile visualisation tools

Xabier Pérez Ferrero (AIMEN)

Additive Manufacturing researcher

5/02/26

Railway crossing verification tooling advantages

- **Quick indicator of profile shape:** 3D printed verification gauges to ensure correctness of maintenance operation per optimized rail shape models developed within XCROSS project.
- **Quick production:** Rail verification tooling can be printed on demand from one day prior to the maintenance operations.
- **Versatile tooling:** Handheld portable frame can be fitted with different tooling very quickly. Maintenance team can carry different sets of 3D printed gauges and customize the verification tool on the spot according to the crossing.
- **Database of 3D models:** 3D scanned crossings database together with tool models to manufacture on demand required tooling.



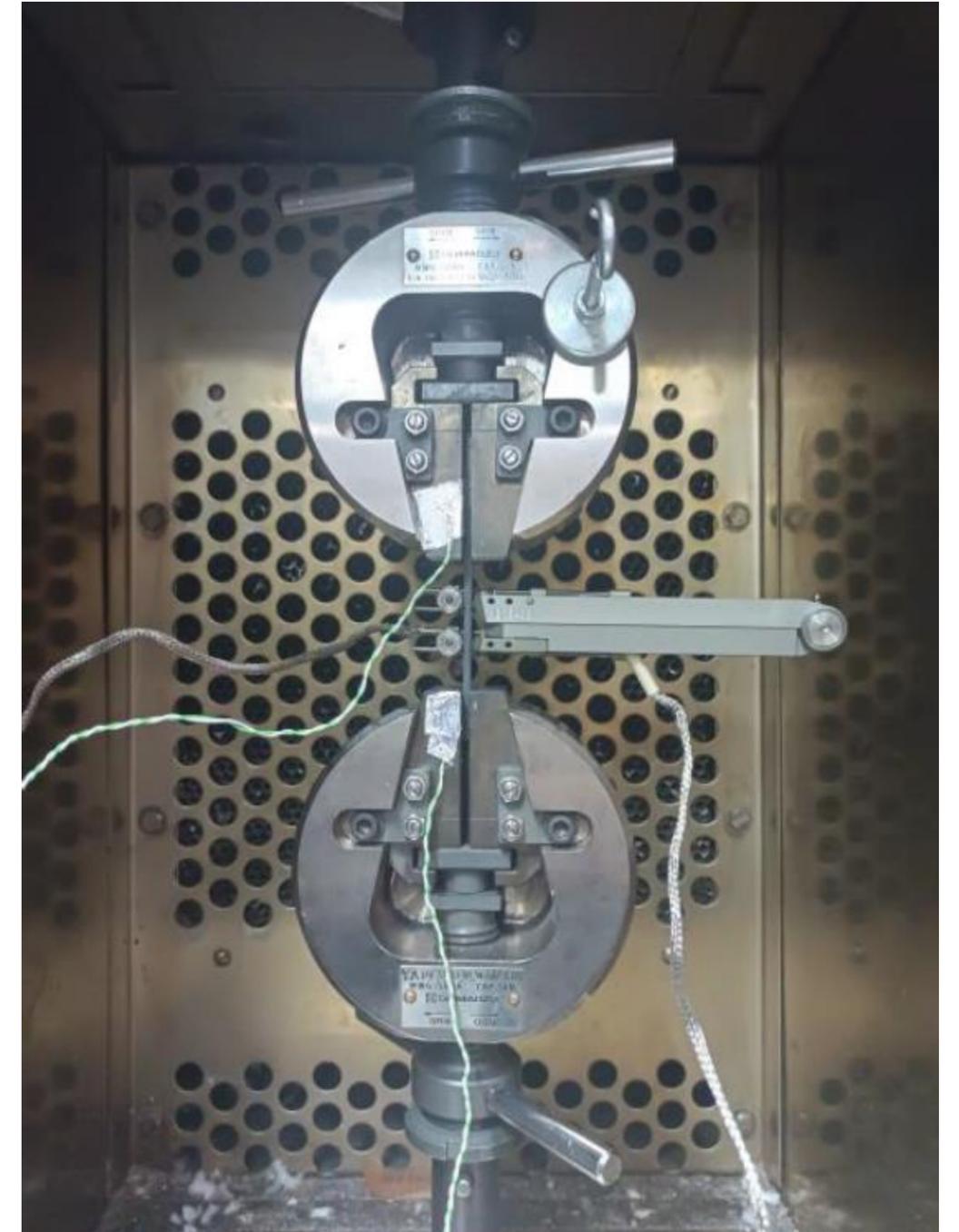
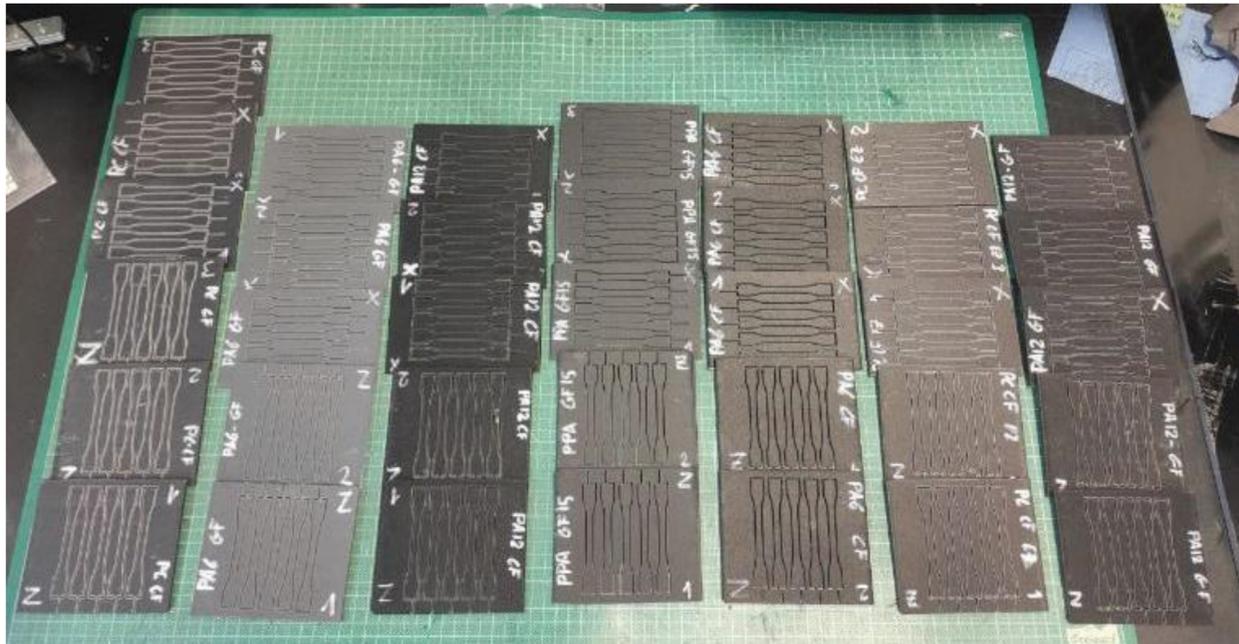
Measuring tool prototype status

- Railway profile gauge tool for quick assessment of shape deviations after maintenance operation.
- First prototype design completed and tested
- Upcoming design iteration:
 - Shorter templates
 - Cutaways mid-body to reduce print time and increase operator visibility
 - Tool frame handle with moving templates to accommodate rail imperfections.



Material selection: characterization status

- 8 candidate materials characterised
- 350 coupons tested and more than 400 printed
- Testing campaign completed early January:
 - RT tensile and flexural testing (X-Z)
 - HT tensile testing (X)
 - Aging testing (4 weeks on climatic chamber)
 - RT-Aged tensile and flexural testing (X-Z)



Material characterization results

TENSILE TESTING ISO 527-2				X DIRECTION						Z DIRECTION					
				Tensile strenght (MPa)			Tensile Modulus (Mpa)			Tensile strenght (MPa)			Tensile Modulus (Mpa)		
Fabricante	Material	Matrix	Reinforcement fibre	RT	Aged RT	HT	RT	Aged RT	HT	RT	Aged RT	HT	RT	Aged RT	HT
3DXTECH	CarbonX PC-CF	PC	Carbon (15-20%)	60,8	56,1	24,9	4196	3482	2488	24,65	26,2		1513	1413	
3DXTECH	CarbonX ezPC-CF	ezPC	Carbon (15-20%)	93,6	94	20,7	7029	6290	3784	49,7	49,1		3040	2815	
3DXTECH	CarbonX PA6-CF	PA6	Carbon (15-20%)	112,1	91,2	44,2	8774	5091	2426	36,2	31,9		2603	992	
3DXTECH	CarbonX PA12-CF	PA12	Carbon (15-20%)	127,5	122,2	51,4	10232	9119	3970	41	43		1696	1474	
3DXTECH	Fibrex PA6-GF30	PA6	Glass (30%)	74	54,3	23,4	6573	3405	1385	38,1	26,6		2569	1036	
3DXTECH	Fibrex PA12-GF30	PA12	Glass (30%)	72,4	69,2	20,9	6252	5722	1006	41,1	47,8		2180	2193	
3DXTECH	Fibrex HTN-GF15	PPA	Glass (15%)	56,3	54,6	12,7	3984	3524	353	9,8	9,4		717	635	
PRUSA	Prusament PA11CF	PA11	Carbon (15%)	95,5	93,5	37,2	11387	8235	1697	39,4			2198		

FLEXURAL TESTING ISO 178				X DIRECTION						Z DIRECTION					
				Flexural Strenght (Mpa)			Flexural Modulus (Mpa)			Flexural Strenght (Mpa)			Flexural Modulus (Mpa)		
Fabricante	Material	Matrix	Reinforcement fibre	RT	Aged RT	HT	RT	Aged RT	HT	RT	Aged RT	HT	RT	Aged RT	HT
3DXTECH	CarbonX PC-CF	PC	Carbon (15-20%)	92,4	80,5		4196	3028		48	46,1		1598	1533	
3DXTECH	CarbonX ezPC-CF	ezPC	Carbon (15-20%)	150,4	144,4		7029	6333		92,6	77,9		2909	2949	
3DXTECH	CarbonX PA6-CF	PA6	Carbon (15-20%)	83,8	70,7		3158	2586		36	17,4		1134	589	
3DXTECH	CarbonX PA12-CF	PA12	Carbon (15-20%)	188,4	166,7		10232	7768		57	46,3		1642	1330	
3DXTECH	Fibrex PA6-GF30	PA6	Glass (30%)	136,5	83		6573	3436		48	30,1		1648	1021	
3DXTECH	Fibrex PA12-GF30	PA12	Glass (30%)	137	130,2		6252	5489		67	68,8		2121	2142	
3DXTECH	Fibrex HTN-GF15	PPA	Glass (15%)				3984								
PRUSA	Prusament PA11CF	PA11	Carbon (15%)	162,6	144,1		11387	9299		60,2	53,7		2207	1934	

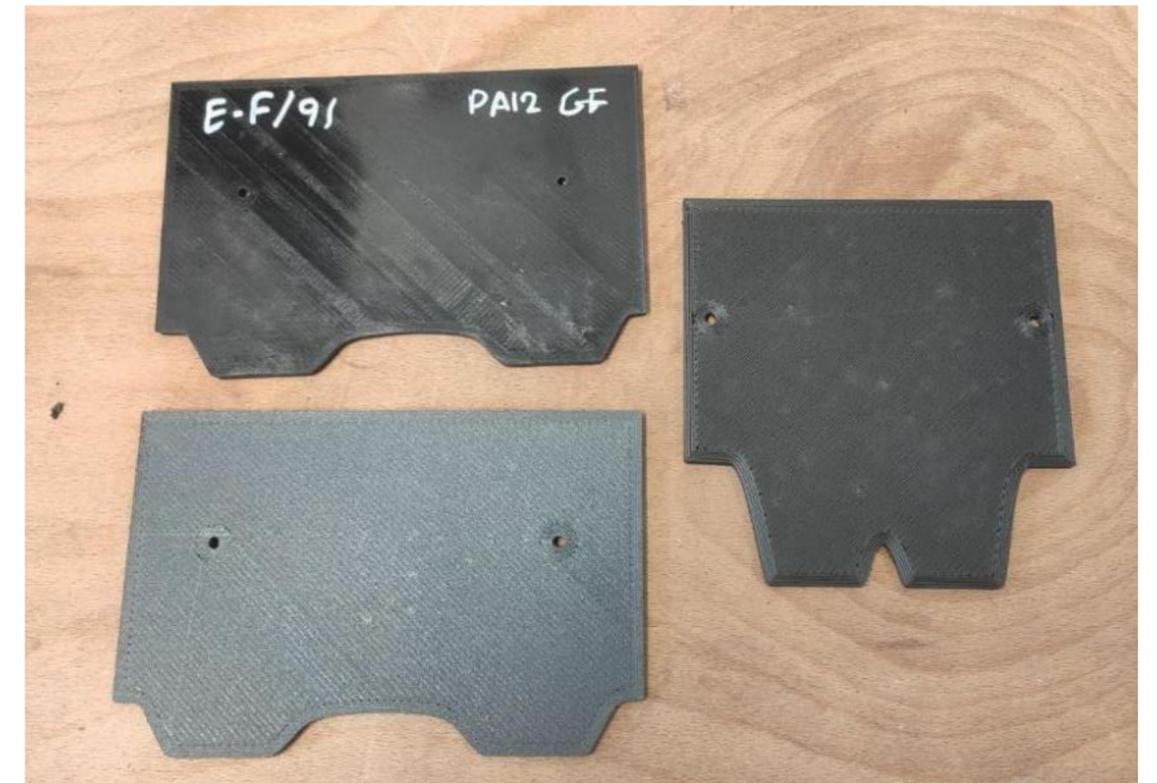
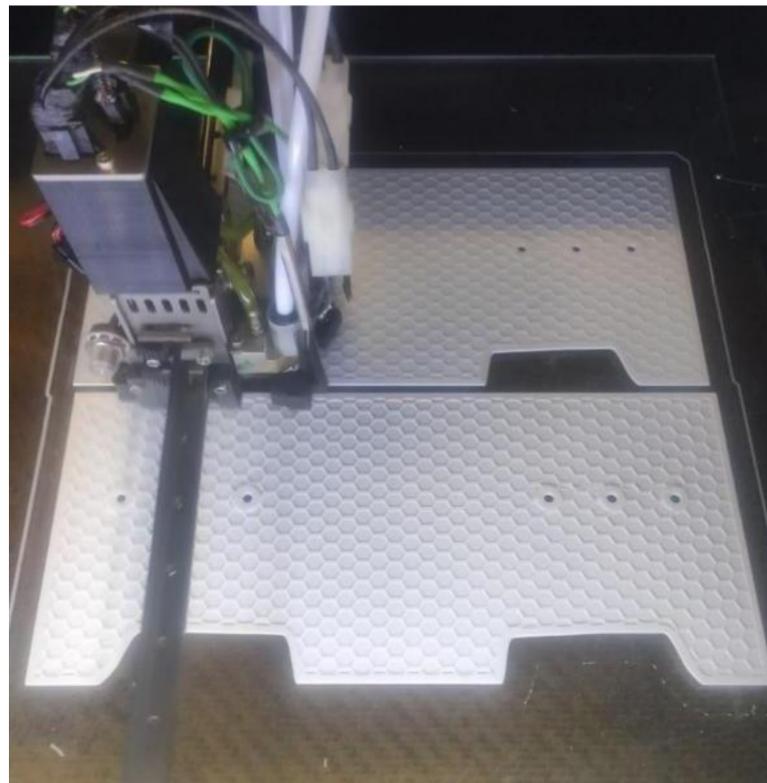
Material characterization results

Testing conclusions:

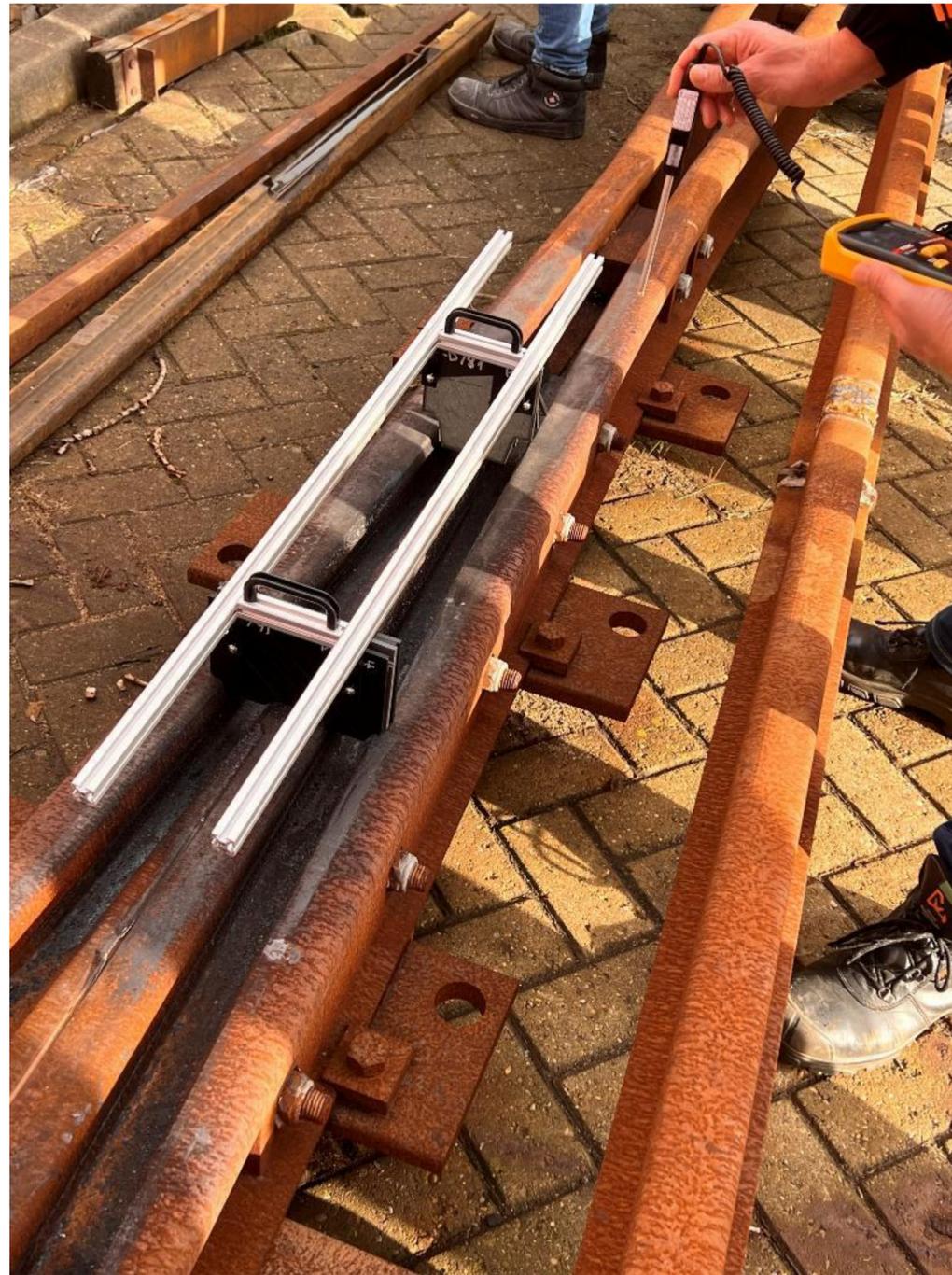
- **PA11-CF and PA12-CF** present so far the best mechanical properties in combination of tensile and flexural test at RT
- **PA11-CF and PA12-CF** mechanical properties drop after climatic chamber negligible
- **PA11-CF and PA12-CF** best performing materials under temperature testing
- **PA11-CF** average price **PA12-CF** higher price range .
- **PA11-CF and PA12-CF** were found among materials with best processability
- Overall very good results after the climatic chamber aging test, good initial selection.

Measuring tool prototype manufacturing

- 1st stage: PLA prototypes to evaluate initial design
- 2nd stage: Technical material prototypes to assess material properties
- 3rd stage: Selected material prototype with optimized manufacturing process and matured designs



RET workshop November 2026





Thank you
for your attention

The project is supported by the Europe's Rail and its members. Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or Europe's Rail Joint Undertaking. Neither the European Union nor the granting authority can be held responsible for them.



Co-funded by
the European Union



Europe's Rail