



Precast Advanced Track

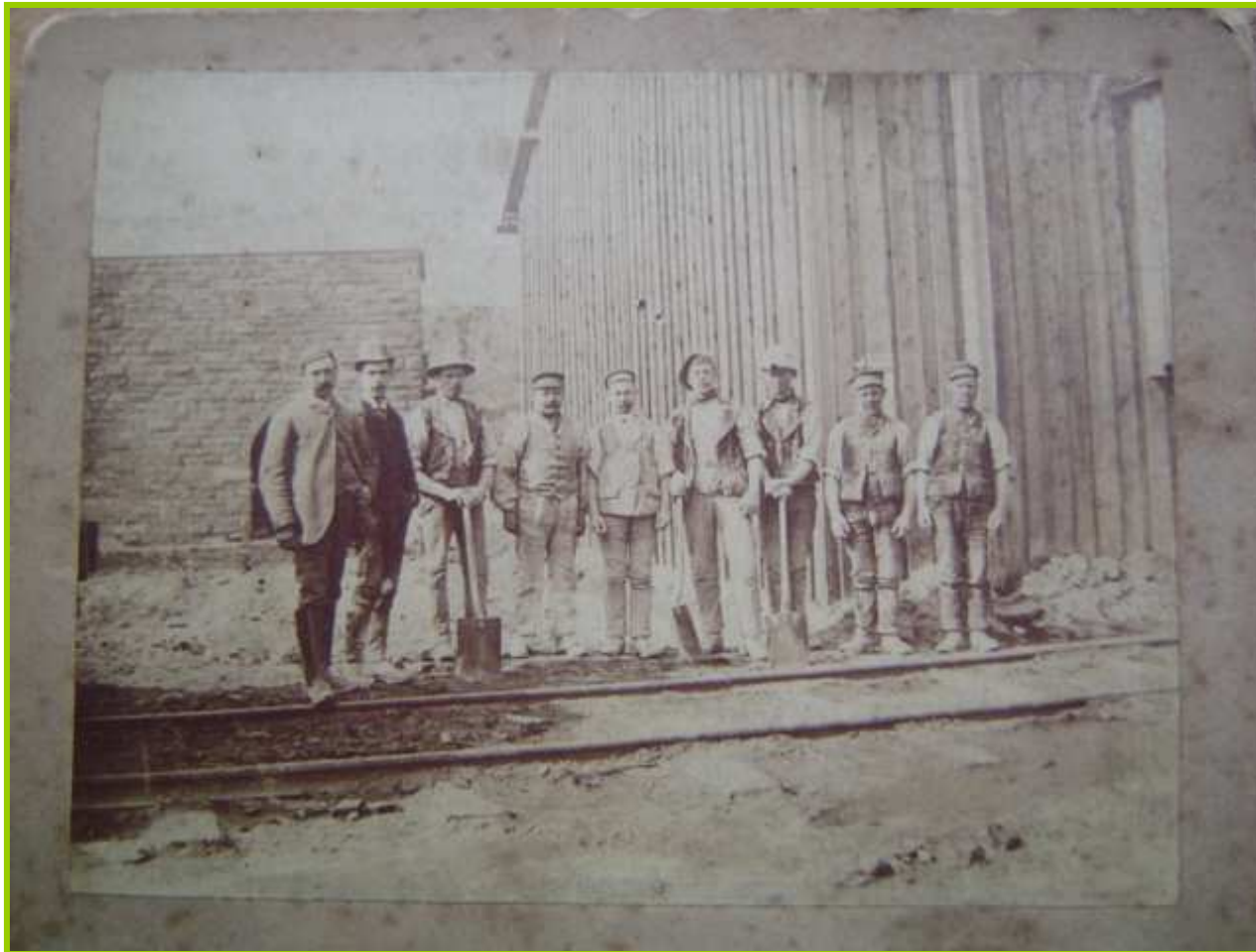
Smart metro slab systems

Leeds December 2016

www.precastadvancedtrack.com



My background



Presentation overview

- Existing light track forms (Light rail)
- PCAT concept
- Desk studies UKTram
- AECOM Laboratory deflection testing
- Test results conclusions and FEM calibration
- Launch at Rail Live 2016
- Ongoing development plan
- Why PCAT - benefits and opportunities,

Light rail track forms



Typically majority are insitu slab systems these suit variable alignments however these are time consuming to build and are expensive and cause major disruption

Existing precast systems need a strong concrete base are Reinforced with steel rebar and insitu concrete are not easily removed in future

The PCAT concept

- (1) ADVANCED long life MSFR precast structure
- (2) STRONG channel beam monocoque profile
- (3) INBUILT ducts for drainage and services
- (4) UNIQUE joint - dry self aligning joint
- (5) BASE road recycle foundation options
- (6) EASY rapid build – replacement process
- (7) NOISE off street - noise reduction
- (8) SAFETY edge beam – train containment
- (9) SMART inbuilt tram detection technology
- (10) PCAT Many overall benefits

PCAT-HSR concept (model) 2012 Berlin

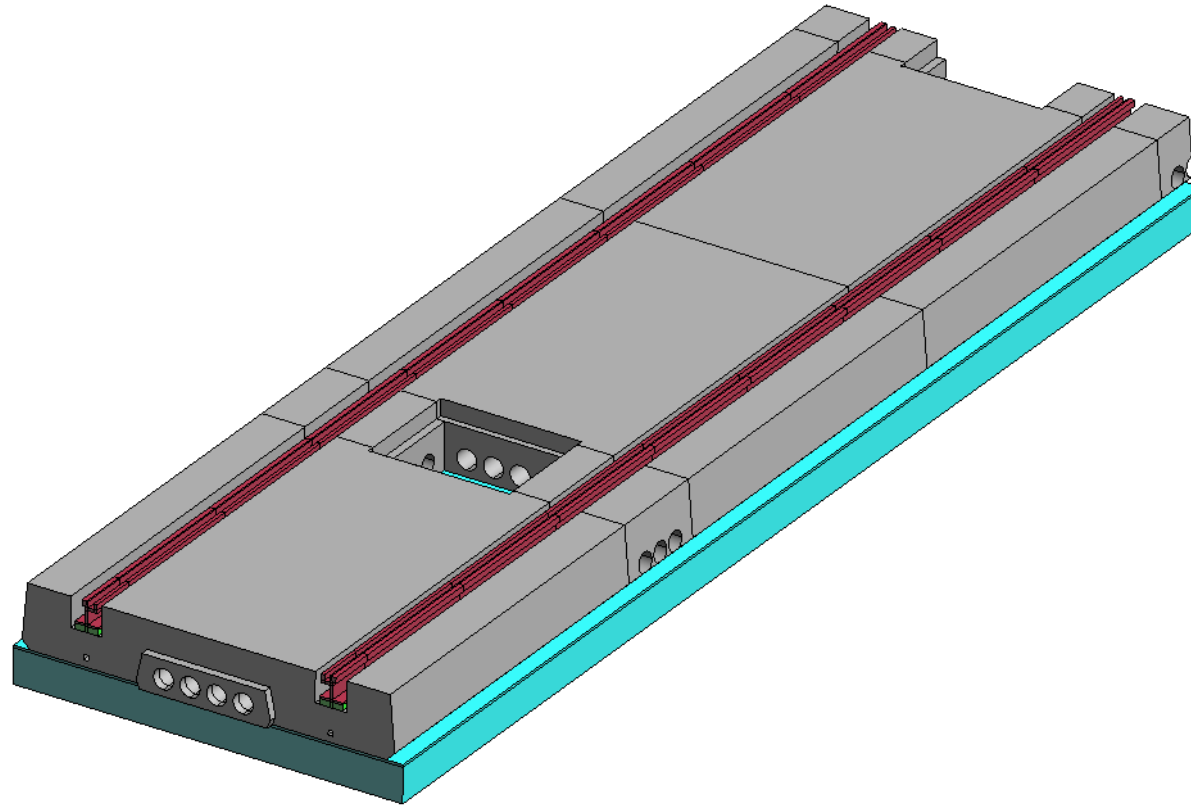


PCAT – LRT generic design

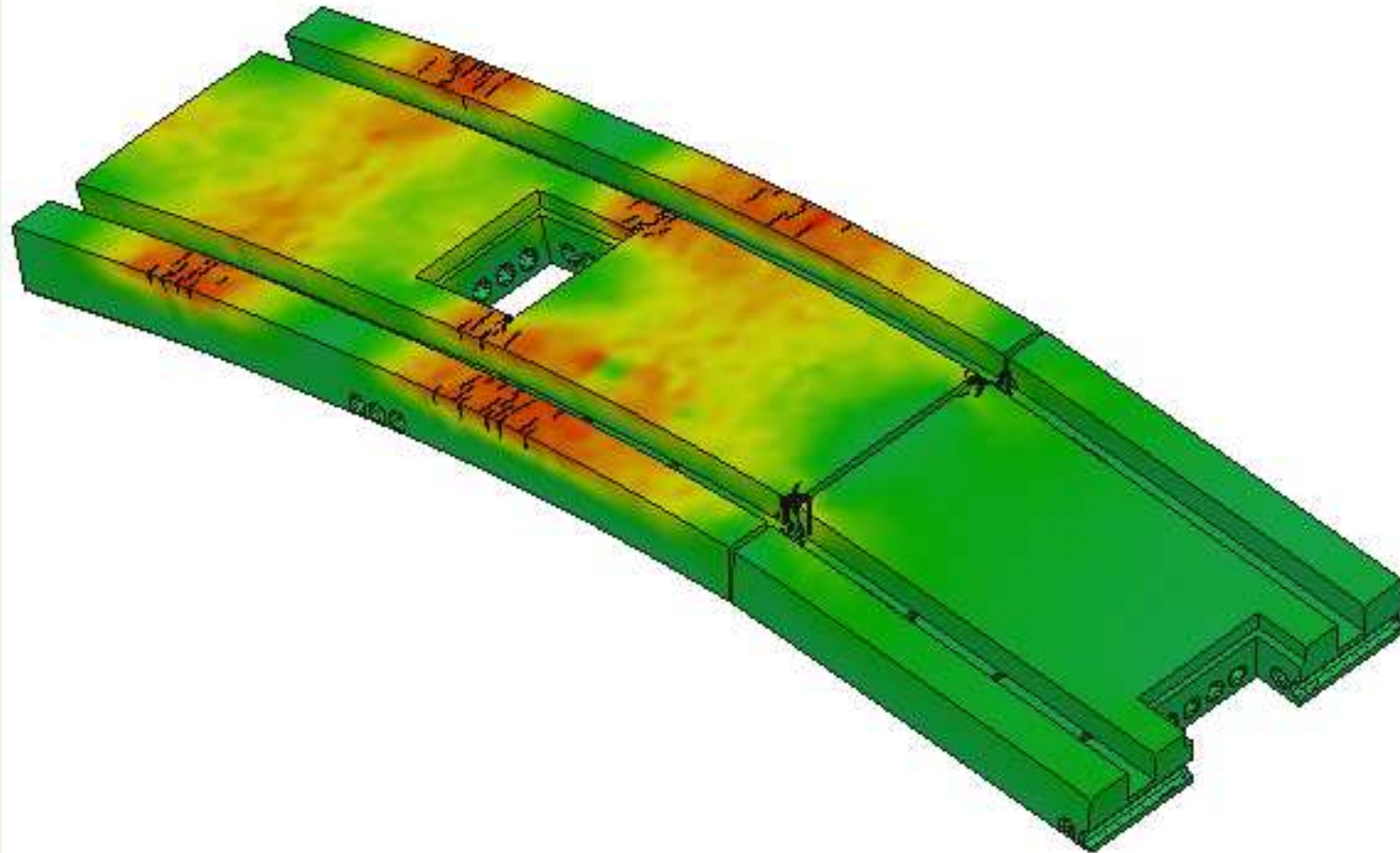
- Design load for LRT 12t axle off street and on street designs
- Off Street Slab 2.6m x 5m x 225mm deep at fixing weight 6.25t
- On Street slab 2.2m x 5m x 380mm overall depth weight 8.3t
- Integral longitudinal / transverse ducts for services and drainage
- High edge upstand increases strength of the slab (off Street)
- Inbuilt ducts did not compromise strength

- FEM of full slab width and jointed full slab / half slab structure analysed using Atena for both systems
- Complied fully with Eurocodes design codes

PCAT – metro slab



Principle stresses and cracks

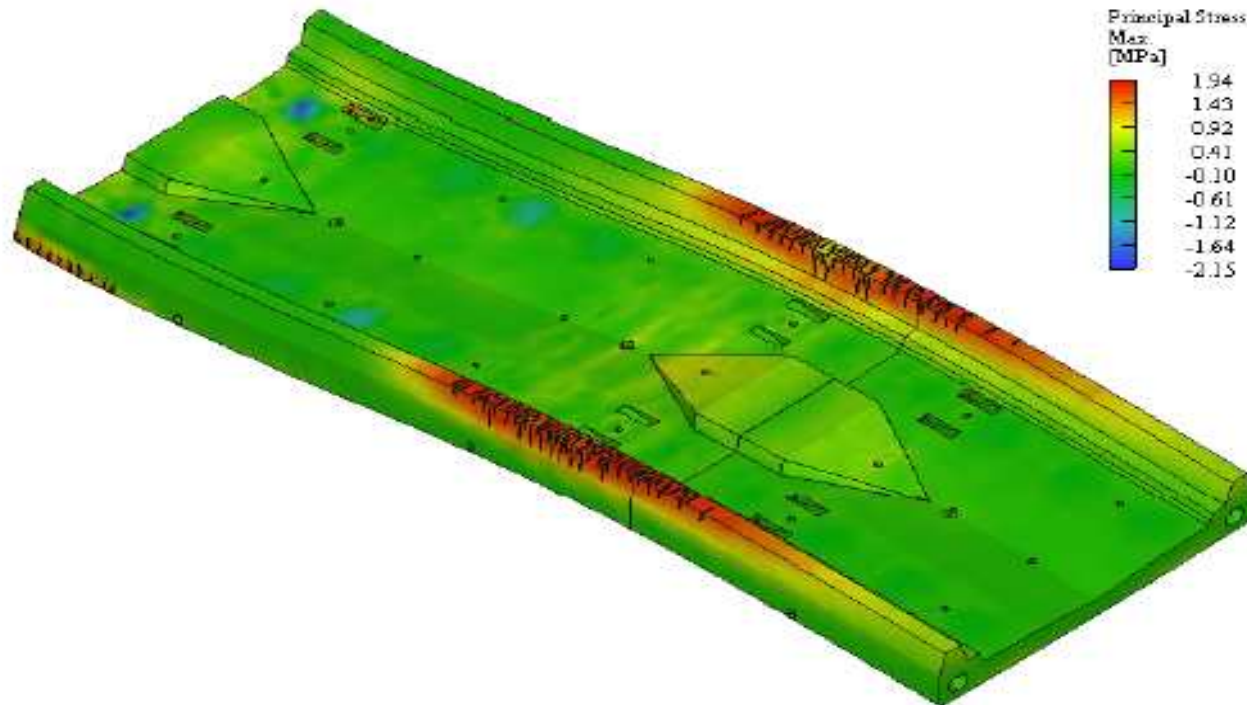


PCAT - HR slab



Principle stresses and cracks

Principal stress and cracks in deformed Atena model
with only fibre reinforced slab visualization (upper surface)



UKTram Desk study findings

- PCAT-LRT rapid mechanised construction saved **70% in construction time** easier access for businesses and improved site safety
- PCAT gave a **52% saving in capital cost** compared with traditional slab construction and a **38% saving in future** operating / maintenance costs
- The PCAT shallow construction depth and recycling method reduces the need for deep excavations to be undertaken has a **low environmental impact / carbon footprint**
- The integral ducting for cables and drainage **increases security** and **minimises** the need to divert underground services
- Individual slabs can be **easily replaced or adjusted** if needed and **easy to remove** to access services if needed

PCAT modular slab production

- Laing O'Rourke appointed suppliers manufactured slabs at Swadlincote / Bison Works
 - Timber moulds used
 - Slabs cast upside down
 - Standard factory SCC mix C60/70N in 28 days
 - BarChip MSF 5kg/cum
 - No steel bar or mesh used
 - Mould struck / slab removed and turned after 24 hours
 - Excellent finish
 - Trial assembly in yard carried out with connectors

PCAT On street slab de-moulded



Pandrol rail fixings installed



AECOM Laboratory testing

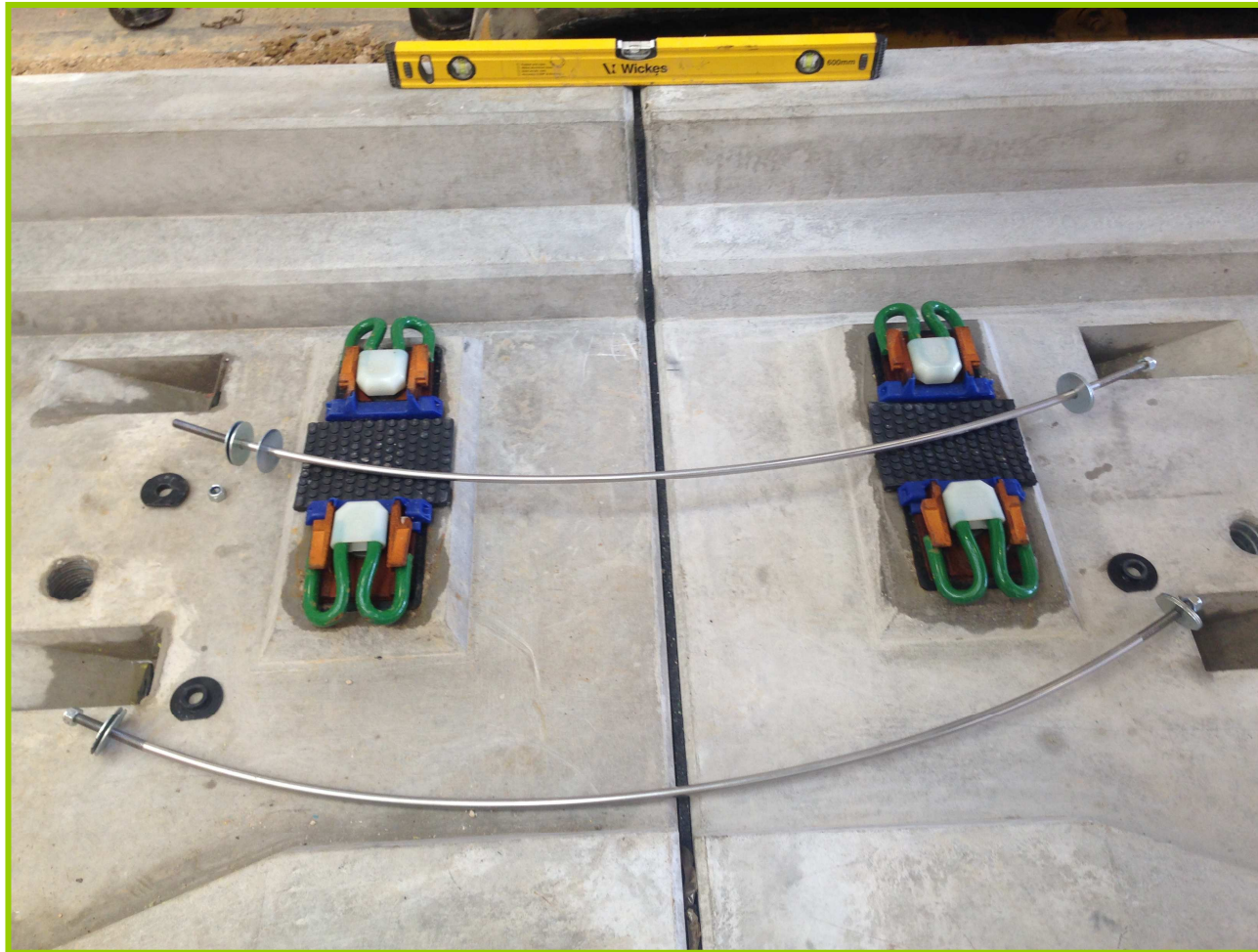
- **Objective**
 - To calibrate the Finite Element Model (FEM) by deflection testing
- **Design Parameters**
 - The laboratory testing of the PCAT LRT - OFF-STREET 225 slab
 - Two inter connected slabs were tensioned together, each slab measuring 5m long by 2.6m wide and 225mm deep
 - The PCAT slab has been designed considering a low strength "Foundation Class 2" with surface modulus $\geq 100\text{MPa}$
- **Deflection testing using AECOM's Rail Trackform Stiffness Tester (RTST)**
 - RTST test range **8t -24t** applied to the 12t designed slab no defects observed



Erection in test pit at Nottingham



Curved SS M16 bolts



RAIL LIVE 2016 - PCAT launched



PCAT innovation winners

RAIL LIVE June 2016



Ongoing development - UKTram

- Design review / calibration of FEM
- March 2017-100m test installation at QRTC Long Marston in Warwickshire
- 4 months Trafficking and monitoring
- MM Category 3 design review
- Standards and Specifications
- Report and dissemination
- Approval expected summer 2017

Slabs ready for site



PCAT generic track structures

TRACK TYPE	Ultra	VLR	LRT	ML	HSR	HR
AXLE LOAD	<4	8-12	12-20	20-25	25-30	30+
GAUGE	<1.000	1.435	1.435	1.435	1.435	1.435
DEPTH ON STREET mm	200	275	380	NA	NA	NA
Foundation mm	250	175	70	0	0	0
Foundation material	Class 1	Class 2	Class 2	0	0	0
DEPTH OFF STREET mm	150	200	225	250	275	300
Foundation mm	300	250	225	300	300	300
Foundation material	Class 1	Class 2	Class 2	Class 3	Class 3	Class 3

Recent interest in PCAT

- WMG VLR test track at Dudley Port in progress
- Colas Rugby Depot train wash facility
- MMA Value engineering options
- Smart Town infrastructure potential application
- Other LRT projects
- Overseas LRT projects
- Track lowering for OLE installation at structures
- HS2 enquiries following Rail Live

PCAT Smart ***next generation slab track***

Uniquely PCAT offers public utilities the ability to leave services in the road and for metro's to operate without interfering to services if plant needs to be repaired

PCAT's innovative technology is expected to provide economic slab track solutions for all rail projects

PCAT slabs can easily accommodate inbuilt sensors for autonomous vehicle location, speed control

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