

PANDA: a tool for lightweighting structures

Cyrille Dunant

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Material utilisation

Substitution with low CO₂ materials

Better design

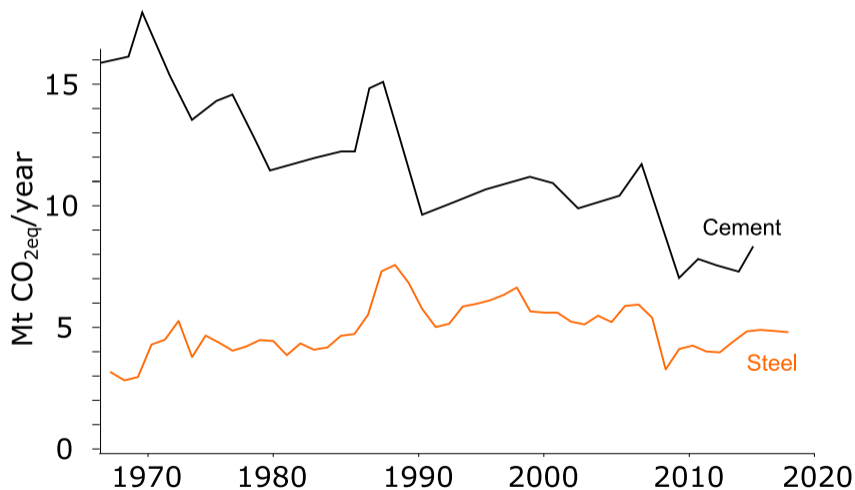
PANDA

Demo

Material utilisation

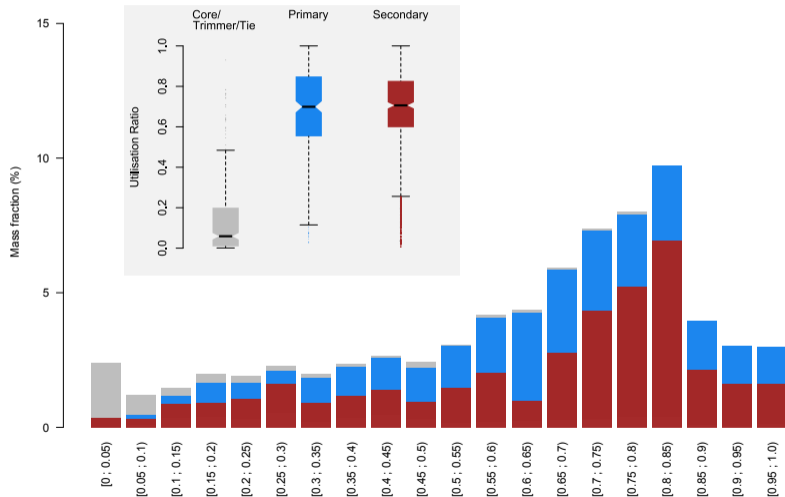
1. MC Moynihan, JM Allwood — Proceedings of the Royal Society A, 2014
2. CF Dunant et al — Resources Conservation and Recycling, 2018
3. W Shanks *et al.* — Resources Conservation and Recycling, 2019

Process emissions — steel and cement scaled by CO₂

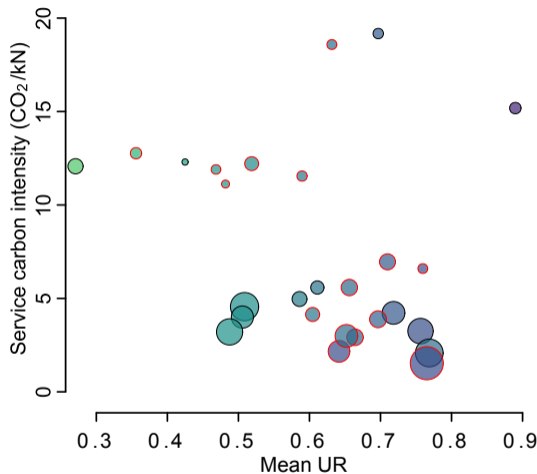
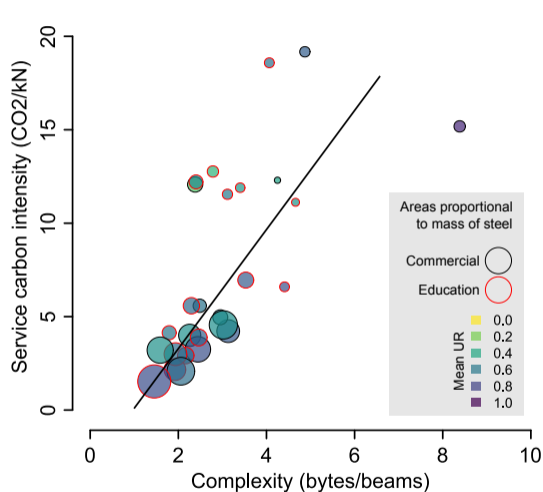


Steel Utilisation

- Drop-off for $UR > 0.8$
- Complex layouts?
- Cores/Trimmers?

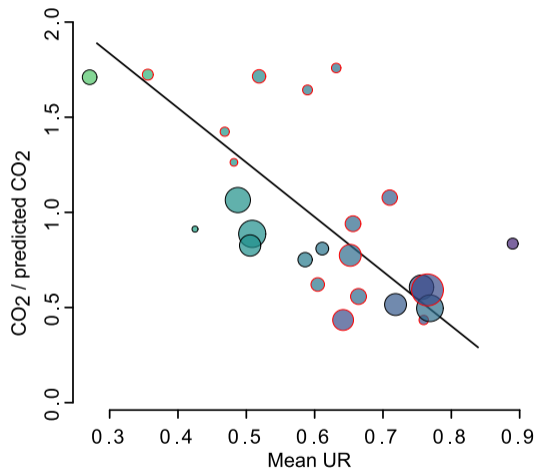
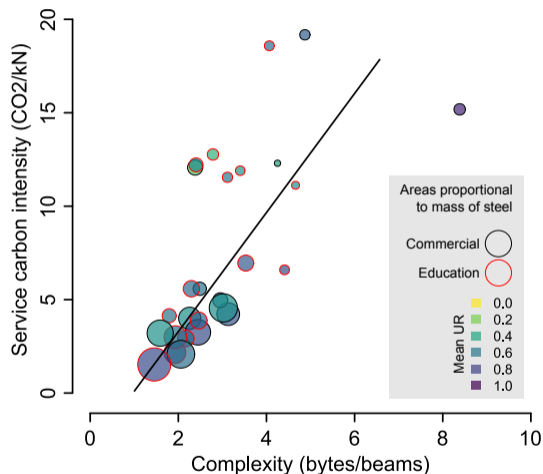


Optimisation is only half as important as layout



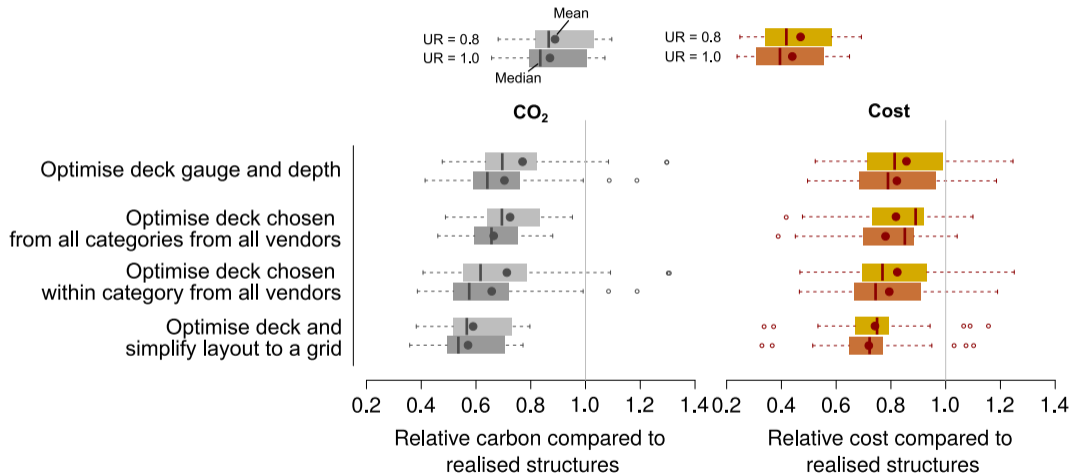
Extra CO₂: optimisation $\frac{1}{3}$, design $\frac{2}{3}$

Optimisation is only half as important as layout



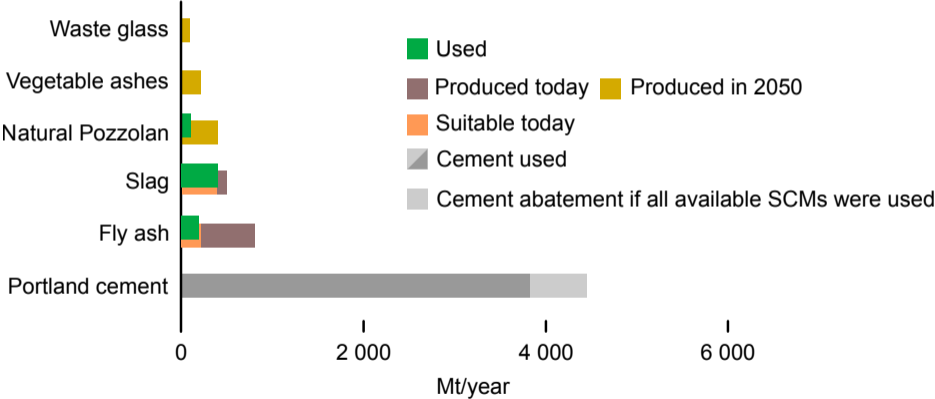
Extra CO₂: optimisation $\frac{1}{3}$, design $\frac{2}{3}$

Decking choice is frequently suboptimal

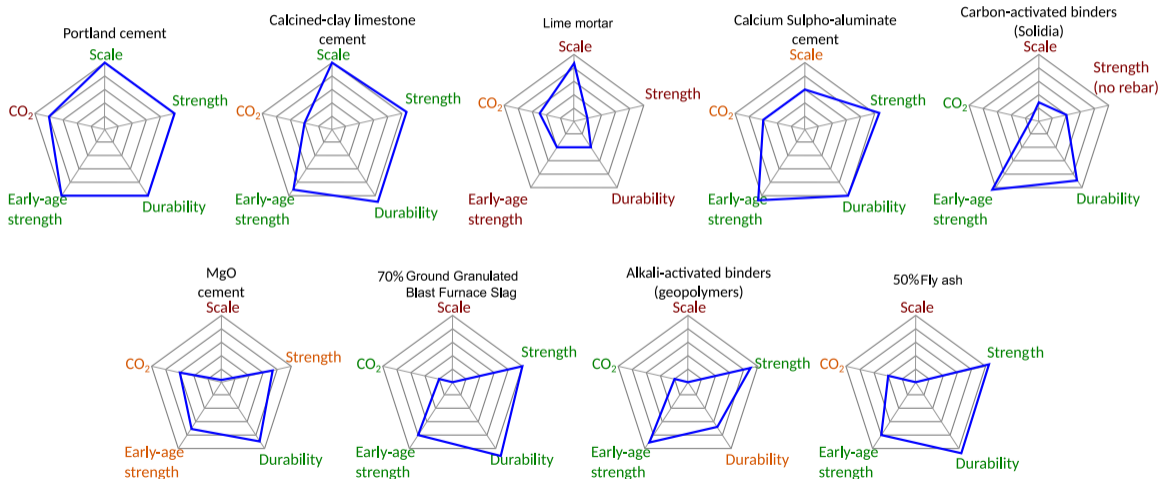


Substitution with low CO₂
materials?

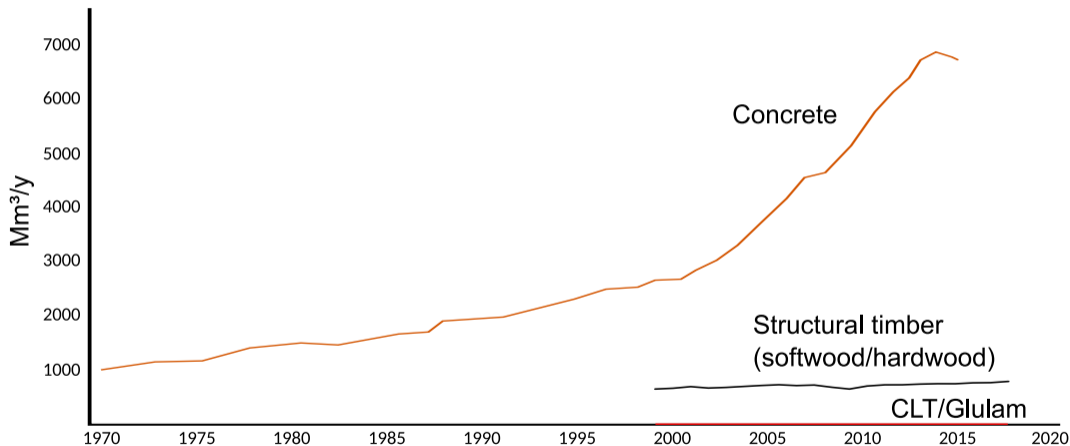
No Substitution at Scale



Substitution is limited by a number of factors



Scale makes (large) substitution impossible

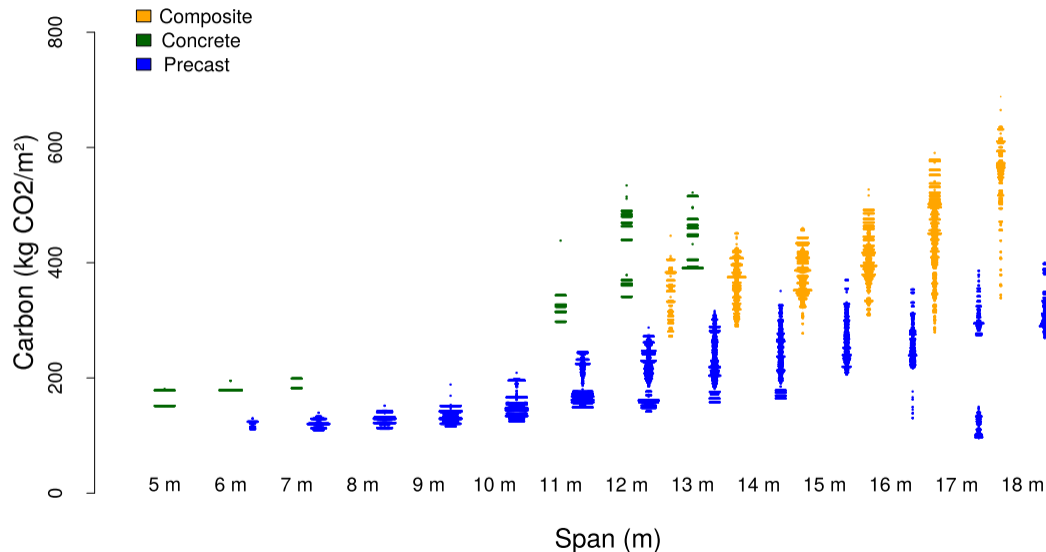


Design is *the* thing to improve

- Cement is not used optimally
- Steel is not used optimally
- Substitution on a large scale is impossible today
- But optimisation is not where most CO₂ is lost
- Better design can bring gains immediately
 - Better layout choice
 - Better frame choice
 - Better decking choice
 - better foundation choice
- Design is where the largest gains are to be made

PANDA

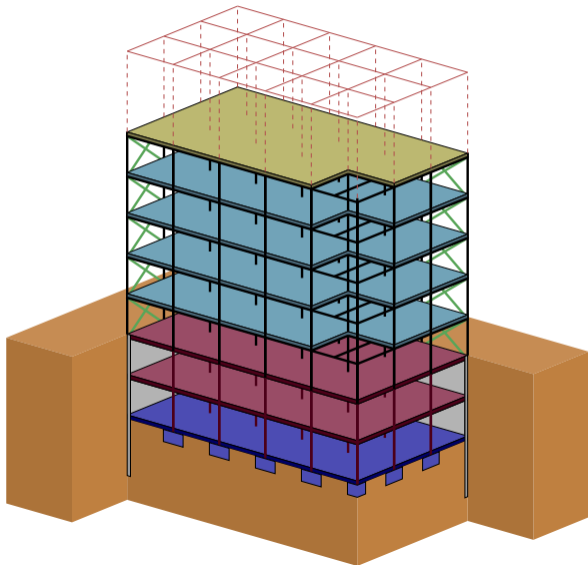
matching grid and frame is complex



Max column spacing, cheapest option as a function of span, wide range of loads and SLS conditions

Early stage decisions are crucial

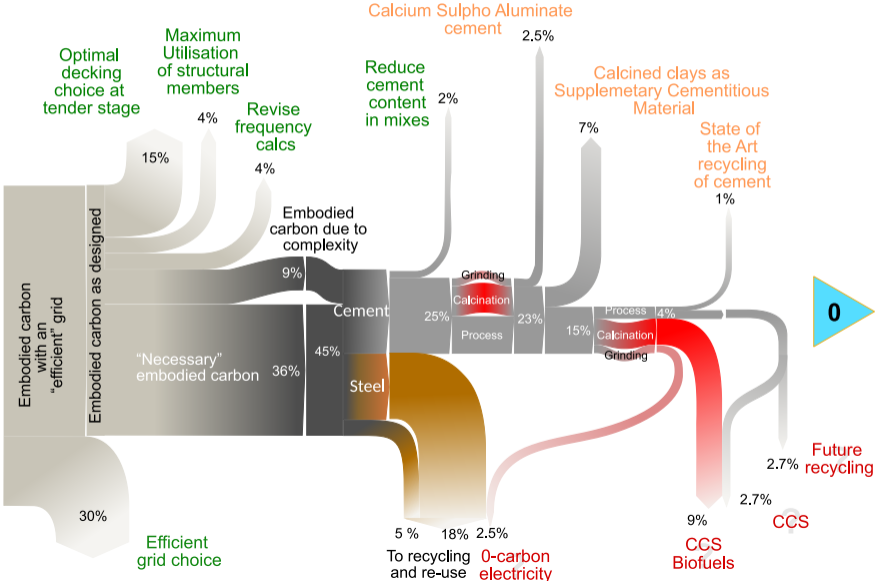
- Overall layout
- Grid spacing
- floor heights
- Serviceability
- Loads
- Type of frame
- Type of decking
- ...



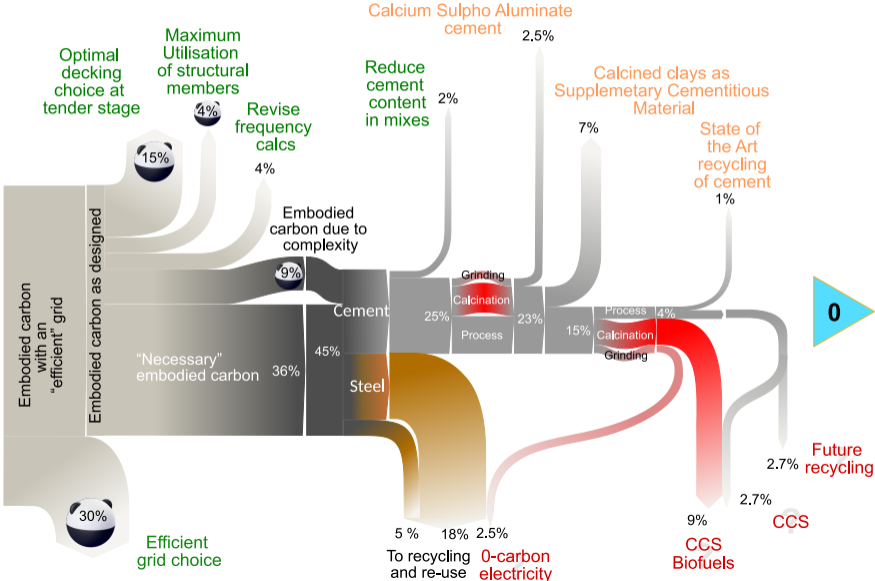
- Developers value flexible space
- Architects look at function and aesthetics
- General contractors will take the project and coordinate actors to make it real
- Structural designers look at structural solutions and construction details
- Other contractors will finish the details and do the actual construction

As you go down that list, consideration of value gives place to consideration of costs

PANDA on the road to zero



PANDA on the road to zero



Demo

Special thanks to

PRICE & MYERS

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