

# Calculating Carbon: Understanding the Impact of Interior Materials Selection

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Joon Ta, Amy Douma, Shawn Sullivan, Jim Moore, Meghan Hendrickson, Malini Srivastava

Collaborators: HGA

*Master of Science in Architecture - Applied Research in Practice*

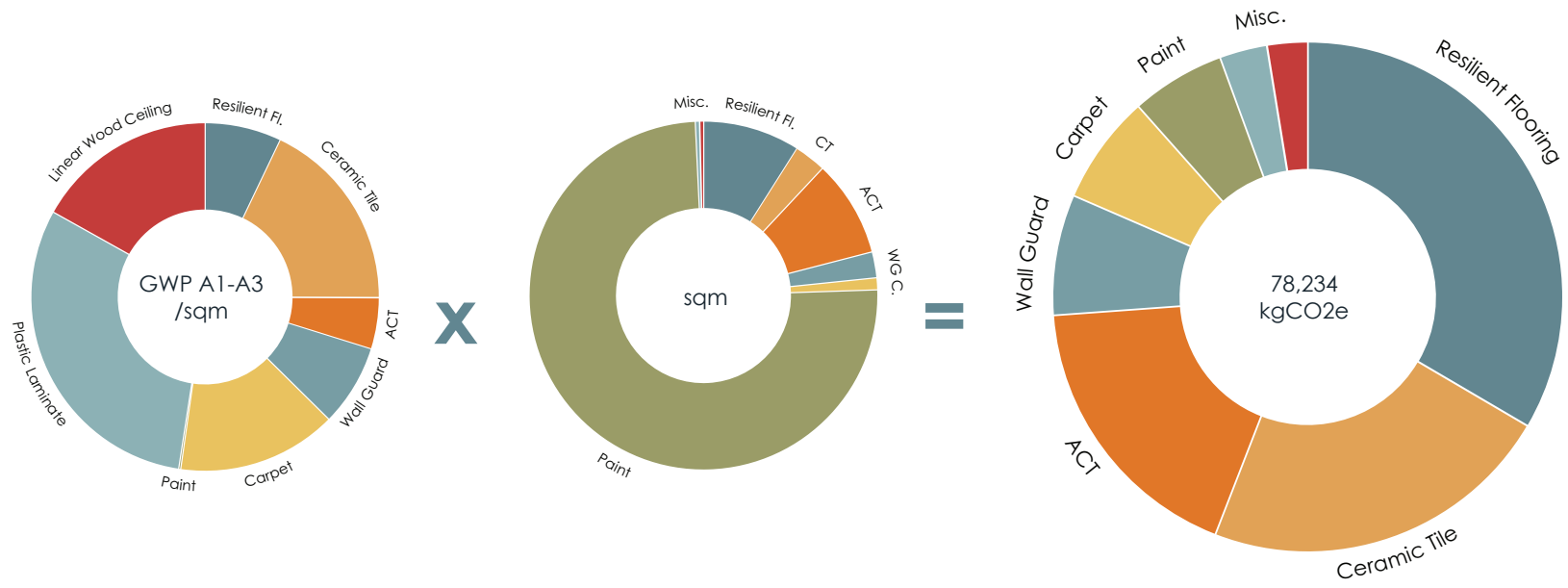
*Keywords: embodied carbon, interior finishes, sustainability*

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Designers and architects have the power to create a healthier and more sustainable future for the built environment. Understanding the impact of design practices is an imperative step toward making actionable changes within the industry.

The built environment contributes approximately 40% of global carbon emissions annually including 27% of operational carbon and 13% of embodied carbon (Architecture 2030, 2023). Embodied carbon is the sum of greenhouse gas emissions associated with material manufacturing, transportation, construction, and maintenance processes throughout the whole life cycle of a building. While operational carbon can be reduced over time by different strategies such as using renewable energy or upgrading the building energy, embodied carbon is embedded in materials and thus remains constant throughout the building's lifespan (Architecture 2030, 2023). According to research compiled by LMN Architects over 60 years, the cumulative contribution of embodied carbon from interior materials is more detrimental to the environment than that of structure and envelope components combined (2022).

While resources on the embodied carbon of structural and envelope components are quite developed, there is limited research on interior materials. Published case studies on the embodied carbon of interiors only focus on corporate offices. To fill this knowledge gap, this collaborative research between the University of Minnesota and HGA analyzed the embodied carbon impacts of healthcare and performing arts projects.



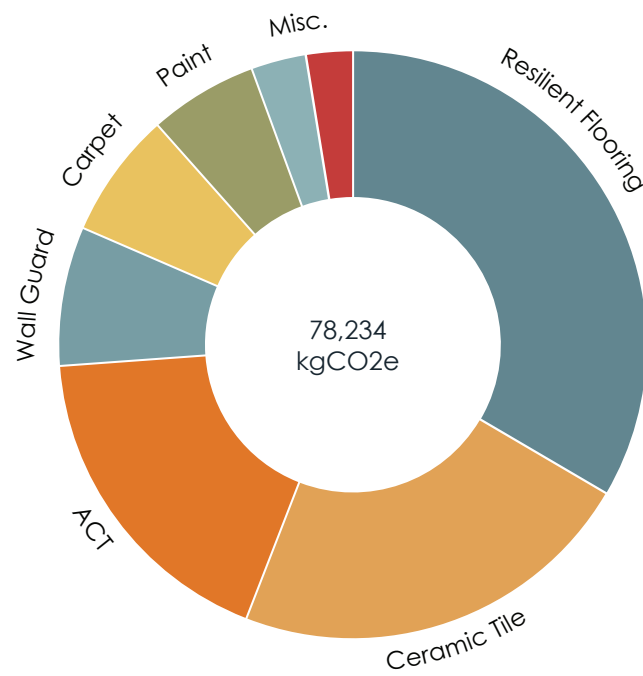
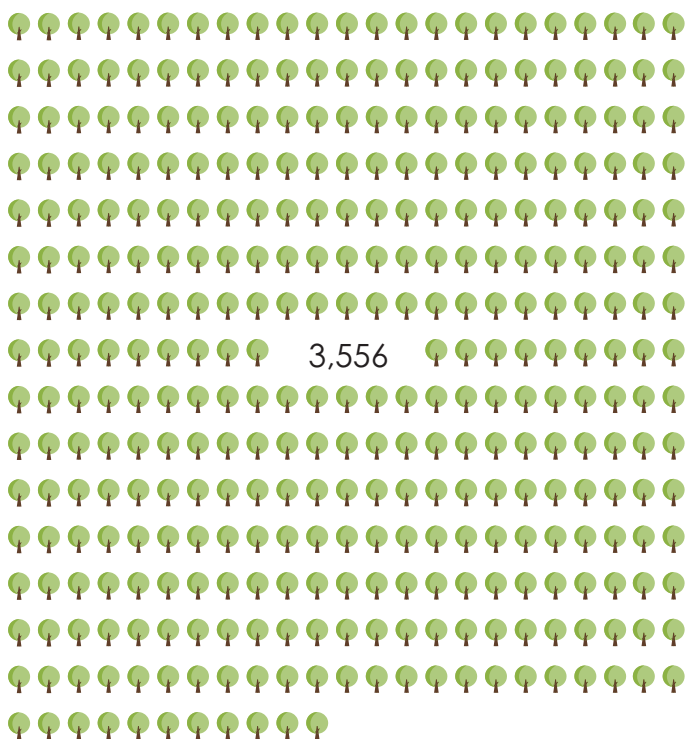
Initial A1-A3 Global Warming Potential

GWP = Global Warming Potential  
 sqm = square meter  
 ACT = Acoustic Ceiling Tile  
 Resilient Fl. = Resilient Flooring  
 CT = Ceramic Tile  
 WG = Wall Guard  
 C. = Carpet

Case Study 1. Data Result

Image 1. Case Study 1 Findings.

🌳 = 10 trees



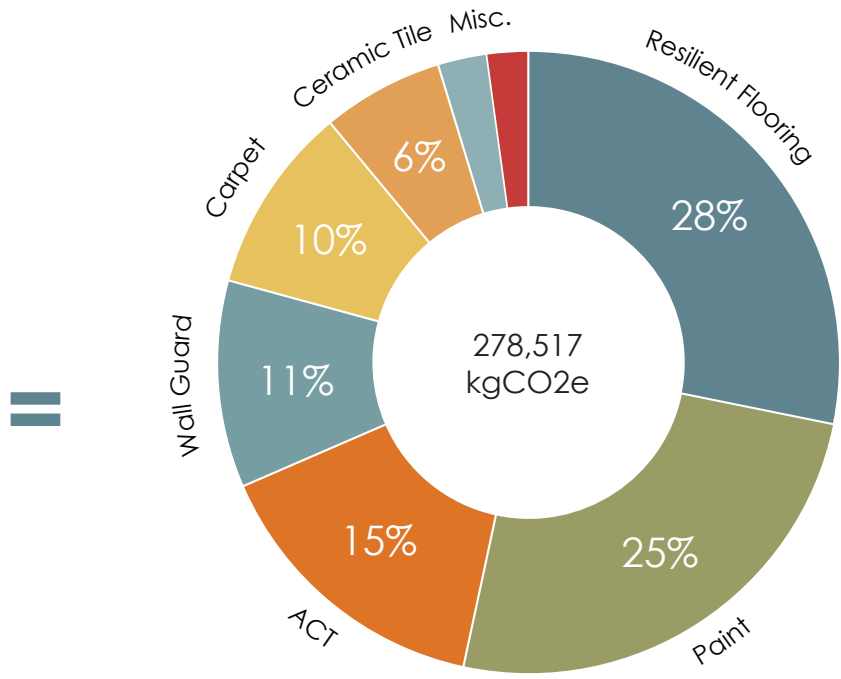
Initial GWP A1-A3

Case Study 1. Data Result

Image 2. Case Study 1 Findings.



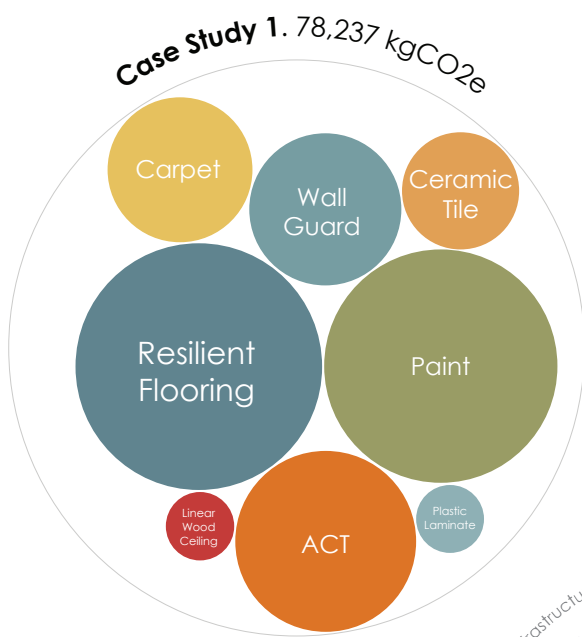
Total GWP A1-A3 after 75 Years with Replacements



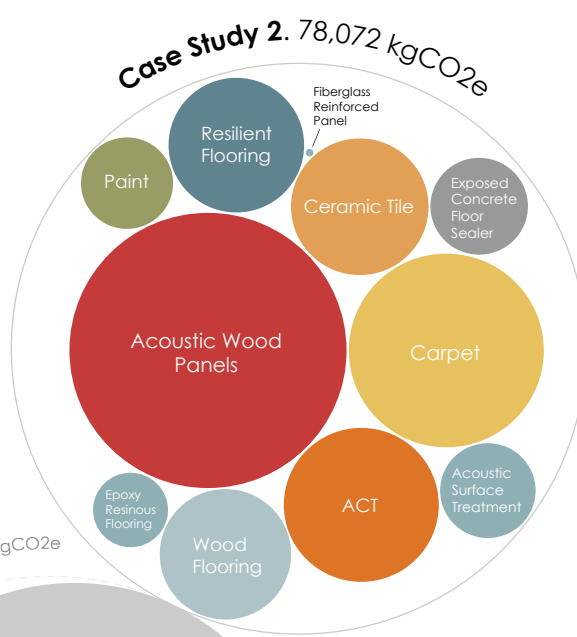
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Case Study 1. Data Result

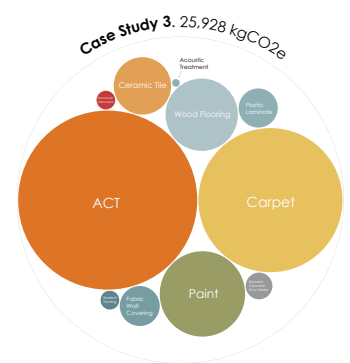
Image 3. Case Study 1 Findings.



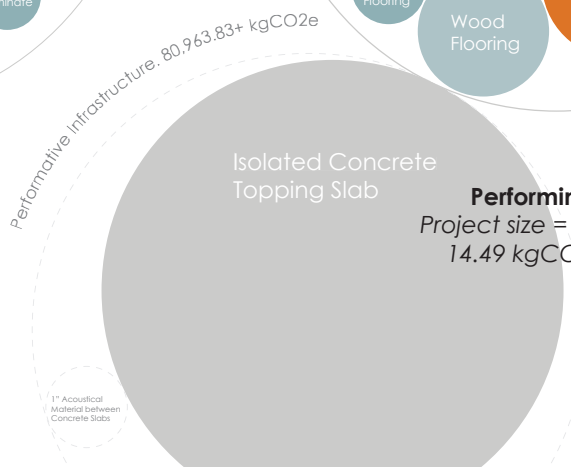
**Healthcare**  
Project size = 55,000 sqft  
15.31 kgCO2e/sqm



**Performing Arts**  
Project size = 58,000 sqft  
14.49 kgCO2e/sqm

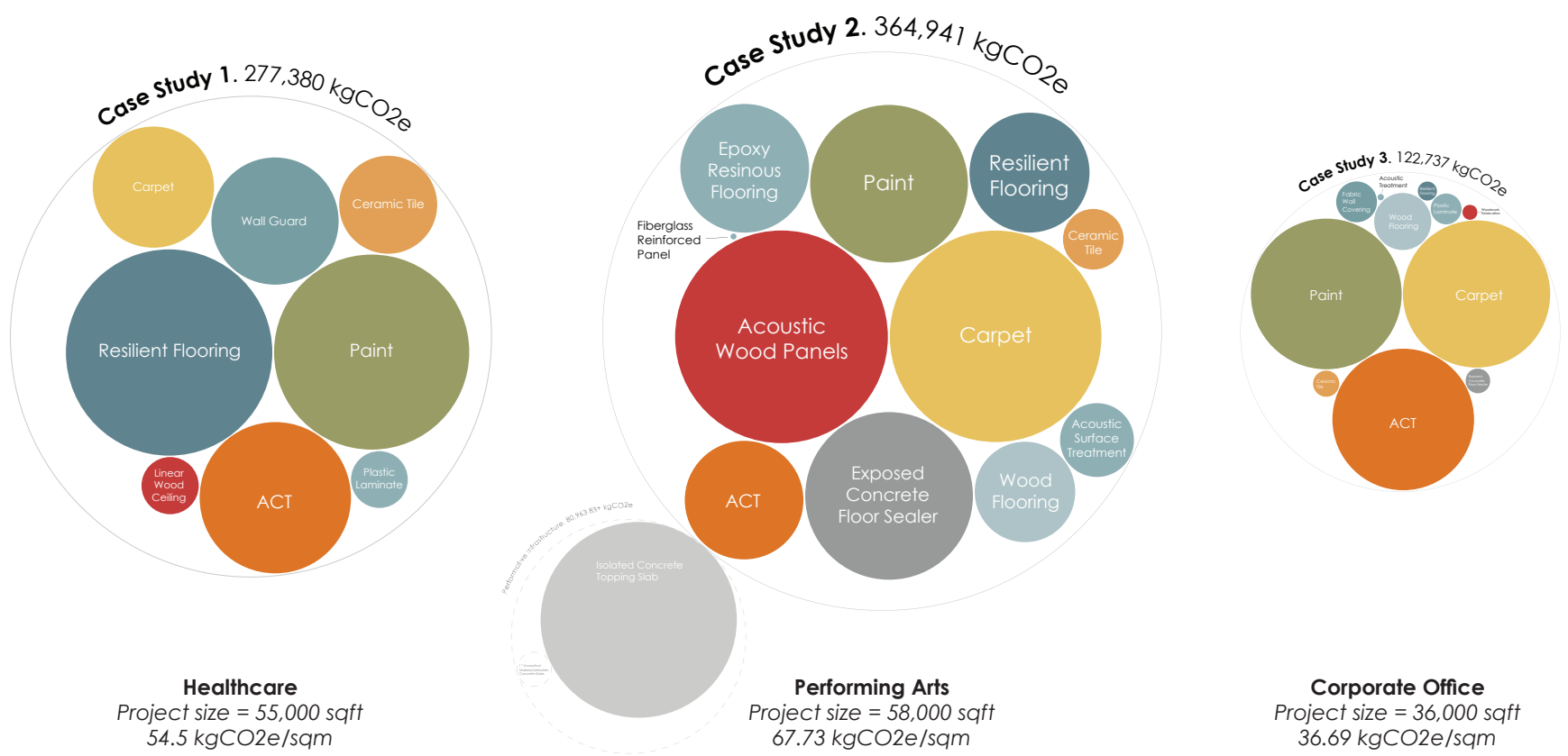


**Corporate Office**  
Project size = 36,000 sqft  
7.5 kgCO2e/sqm



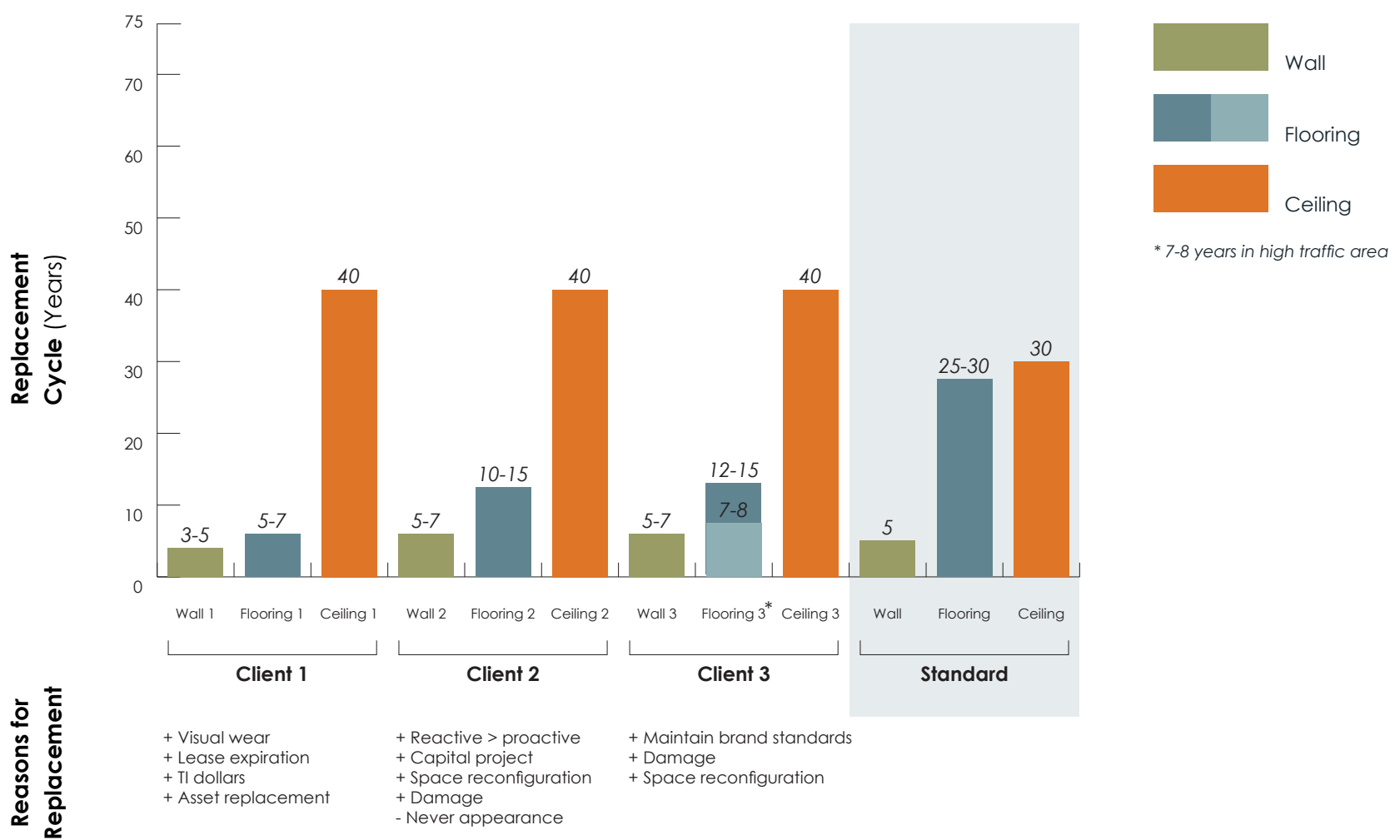
Case Studies Comparison. Initial GWP

Image 4. Three Case Studies Initial Global Warming Potential Comparison.



Case Studies Comparison. 75-Year GWP

Image 5. Three Case Studies 75-Year Global Warming Potential Comparison.



## Healthcare Client Interviews. Materials Replacement Practices

Image 6. Healthcare Client Interviews Findings.