

# Computer-aided insole manufacture: Stepping towards best practice

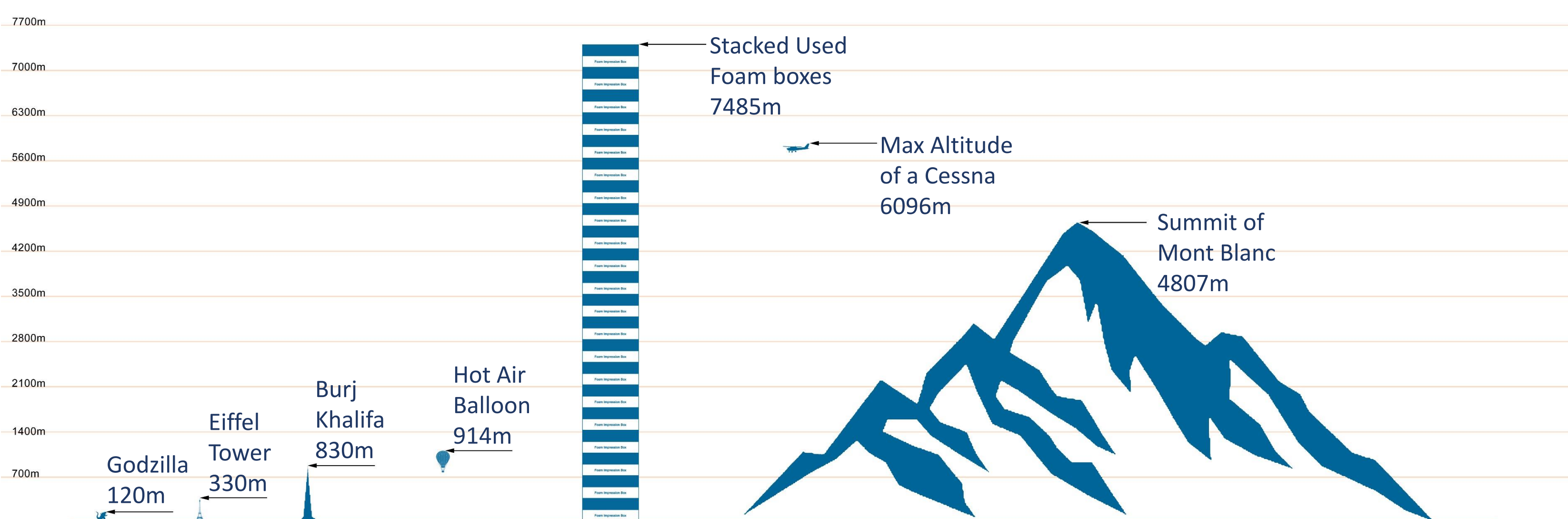
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## Rationale and Background

Insole provision is one of the largest single areas of orthotic intervention in the UK. In NHS GG&C, custom insoles produced by computer-aided-design and manufacture processes (CAD/CAM) represent 14% (n=2739, per annum 2020) of all orthotic provision. In NHS GG&C, service users receive their insoles through a fully digital design and manufacture process, utilising direct foot scanning. Other orthotic services across the UK have adopted a partially digitised approach, whereby shape-capture is achieved with a traditional foam-box casting method. To date, no work has been undertaken to determine the clinical outcomes and economic impact relating to these different treatment approaches. Digitisation in the orthotic industry conceptualised gains in production speed and reduction in waste materials when compared to traditional manufacture utilising physical shape capture<sup>1</sup>. Yet the continued interim stages of foam impression casts and physical transportation sacrifices these benefits, despite the increased accessibility to mobile direct scanners over the past 10 years<sup>2</sup>.

## Aim and methods

In order to understand the true variability in orthotic practice across the UK, freedom of information requests were sent to 222 Health Boards and Trusts across Scotland, England, Northern Ireland and Wales. Detail about the number of insoles delivered per year using any CAD/CAM process was requested, as well as specifics relating to the full manufacture process from foot-shape-capture, to final insole production. Further questions including barriers and motivators to the use of CAD/CAM were included. The purpose of this scoping service review was to understand the potential impact of any further work in this area, with an overarching goal of identifying best practice in relation to patient care. Discover more about how the freedom of information process was used in this project by scanning this QR code.



## Responses and Results

198 responses were received from the 222 Freedom of Information Requests sent to Health Boards and Trusts across the UK. Of those respondents, 97 were able to provide full data in relation to the manufacture processes for CAD/CAM insoles used within their Orthotic services. 76 services reported that they did use CAD/CAM in the manufacture of their bespoke insoles in the 2021/22 financial year, and on average 76.44% of all their bespoke insoles were manufactured using CAD/CAM processes. Therefore a total 90222.74 pairs of CAD/CAM insoles were produced by 76 orthotic services in the UK in 2021/22.

A comparison was then made between services who used direct foot scanning as their primary shape capture method vs those who used foam impression boxes; which are then scanned into the CAD system at a later date. 70 services reported using foam impression boxes as their **primary method** of shape capture, meaning that **up to 83167.6** foam impression boxes were used in the 2021/22 financial year to produce CAD/CAM insoles. The true number is likely to differ due to repeat / duplicate insoles not requiring new shape-capture, and the possibility that not all insoles were produced by foam box within services who used this as their primary shape capture method. The graphic above provides a visual representation of these foam impression boxes.

## Sustainability?

The manufacture of phenolic foam alone, without even considering the environmental impact of international and trans-UK shipping, is significant<sup>3</sup>. Particularly given the single-use status of these boxes within the Orthotic industry, and the high likelihood of being sent to landfill following one-time use. If direct digital scanning can be shown as an equitable or superior method of shape-capture, with regard to treatment outcomes, then this could be considered as an area of potential change for orthotic services to meet NHS Net Zero targets in the coming years<sup>4</sup>.

## Conclusions and Next Steps

Mapping the current landscape of clinical practice across the UK is one of two aspects combined to form a larger project. A parallel project area is currently being undertaken in the form of a double blinded randomised controlled trial, investigating the effectiveness of both shape capture methods relating to service-user outcomes. The combination of these two project areas is ultimately intended to form the basis of a best practice guideline for Orthotists prescribing CAD/CAM insoles.

### References

- <sup>1</sup> Parker, D.J., Nuttall, G.H., Bray, N., Huggill, T., Martinez-Santos, A., Edwards, R.T. and Nester, C., 2019. A randomised controlled trial and cost-consequence analysis of traditional and digital foot orthoses supply chains in a National Health Service setting: application to feet at risk of diabetic plantar ulceration. *Journal of foot and ankle research*, 12(1), pp.1-13.
- <sup>2</sup> Barrios-Murriel, J., Romero-Sánchez, F., Alonso-Sánchez, F.J. and Rodríguez Salgado, D., 2020. Advances in orthotic and prosthetic manufacturing: A technology review. *Materials*, 13(2), p.295.
- <sup>3</sup> Tingley, D.D., Hathway, A., Davison, B. and Allwood, D., 2017. The environmental impact of phenolic foam insulation boards. *Proceedings of the Institution of Civil Engineers-Construction Materials*, 170(2), pp.91-103.
- <sup>4</sup> Torjesen, I., 2020. NHS aims to become world's first "net zero" health service by 2040. *BMJ (Clinical Research ed.)*, 371, pp.m3856-m3856.