

Problem Statement and Goals

BeamBending

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Table 1: Revision History

Date	Developer(s)	Change
Jan. 20, 2023	Jason	Template created & committed to git.
Jan. 20, 2023	Jason	Template filled in.

1 Problem Statement

Beams safely support many constructions under load. Everything from bridges and skyscrapers to commercial and residential properties use beams to safely carry load by distributing the stress into their foundations and the ground [1]. Beams are flat, horizontal structural elements. They bear load perpendicular to their horizon [1].

Typically, inhabitants of residential constructions expect their floors to be flat, balanced, and rigidly unmoving, or else they might feel uncomfortable in their space. As such, beams must be rigidly fixed in place and be capable of transferring all imposed loads down to the foundations of the buildings and the ground. However, for other applications, such as bridges and beds of machine tools, beams are free, within reason, to move horizontally [2]. *Simply-supported* beams are one kind of beams that are commonly found in these other applications.

Simply-supported beams use only two supports: a *pinned* support and a *roller* support [3]. The pinned support is fixed and unmoving, while the roller support allows the beam to expand or contract axially [3].

1.1 Problem

Under simplified assumptions (i.e., Euler-Bernoulli beam theory [4]), to understand how various simply-supported beams can safely carry uniformly distributed loads, engineers must understand how beams deflect and how the ends react.

1.2 Inputs and Outputs

[Characterize the problem in terms of “high level” inputs and outputs. Use abstraction so that you can avoid details. —SS]

1.3 Stakeholders

1.4 Environment

[Hardware and software —SS]

2 Goals

3 Stretch Goals

4 Potential Changes

References

- [1] Noah Moscovitch. *What are beams & columns in structures?* 2020-12. URL: <https://structuralengineeringbasics.com/what-are-beams-and-columns-building-construction/> (cit. on p. 1).
- [2] J. O. Bird and P. J. Chivers. “36 - Simply supported beams”. In: *Newnes Engineering and Physical Science Pocket Book*. Newnes, 1993, pp. 278–286. ISBN: 978-0-7506-1683-6. DOI: <https://doi.org/10.1016/B978-0-7506-1683-6.50039-4>. URL: <https://www.sciencedirect.com/science/article/pii/B9780750616836500394> (cit. on p. 1).
- [3] Minas Lemonis. *Simply Supported Beam Calculator*. 2020-05. URL: <https://calcresource.com/statics-simple-beam.html> (cit. on p. 1).
- [4] Wikipedia contributors. *Euler-Bernoulli beam theory* — *Wikipedia, The Free Encyclopedia*. [Online; accessed 20-January-2023]. 2022. URL: <https://en.wikipedia.org/w/index.php?oldid=1125198888> (cit. on p. 1).