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Loading Rates and Compaction Factors for Woodchip Vessels Visiting Australian Ports

Glen Murphy, Mauricio Acuna, Michael Berry, Rick Mitchell

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Introduction

- Forest and Wood Products Australia funded USC to investigate opportunities for improving the economics of log and woodchip export supply chains
- Australia is the world's 4th largest exporter of woodchips
- Approximately 60% of the cost of sales of woodchips to Asian markets is accounted for by shipping and port costs
- Past studies have found that terminal loading/unloading rates and the amount of material that can be loaded are two of the four most decisive factors affecting shipping costs

Research Methods

- Interviews with woodchip exporting companies
- Literature and internet review
- Analysis of detailed ship loading data provided by one company.
  - Data gathered over a 17 year period
  - Over 500 observations on loading rates and compaction factors
  - Different loading and compaction methods tried over this period

Woodchip Handling Methods

Grab bucket for loading and unloading of woodchip vessels

Woodchip Handling Methods

Mobile woodchip conveyors

Woodchip Handling Methods

Woodchip storage areas, reclaim units, and fixed conveyor systems

Woodchip Handling Methods

Gravity feed with chip distribution by dozers

Woodchip Handling Methods

Jet slinger (aka Chip flinger) distribution of chips within a vessel's hold

Woodchip Handling Methods

Jet slinger with deflector plate used to distribute and compact wood chips

Woodchip Handling Methods

Gravity fed chips are loosely aligned (top left). Jet slingers with deflector plates are claimed to better align chips (bottom left) resulting in better compaction rates.

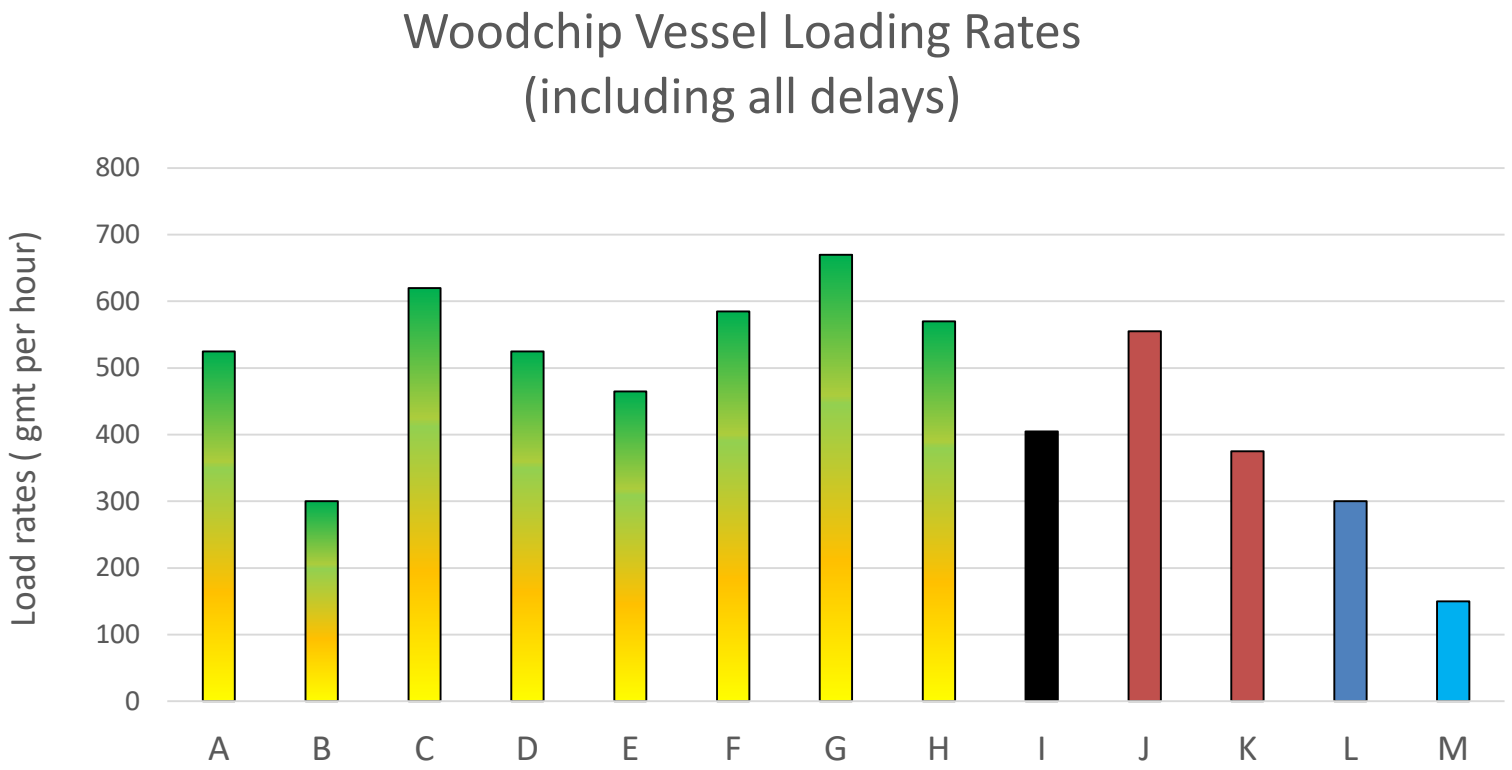
Definitions

Maximum Design Loading Rate

Net Loading Rate *(includes some loading delays)* ~ 85% of Max

Gross Loading Rate *(includes all delays)* ~ 70% of Net

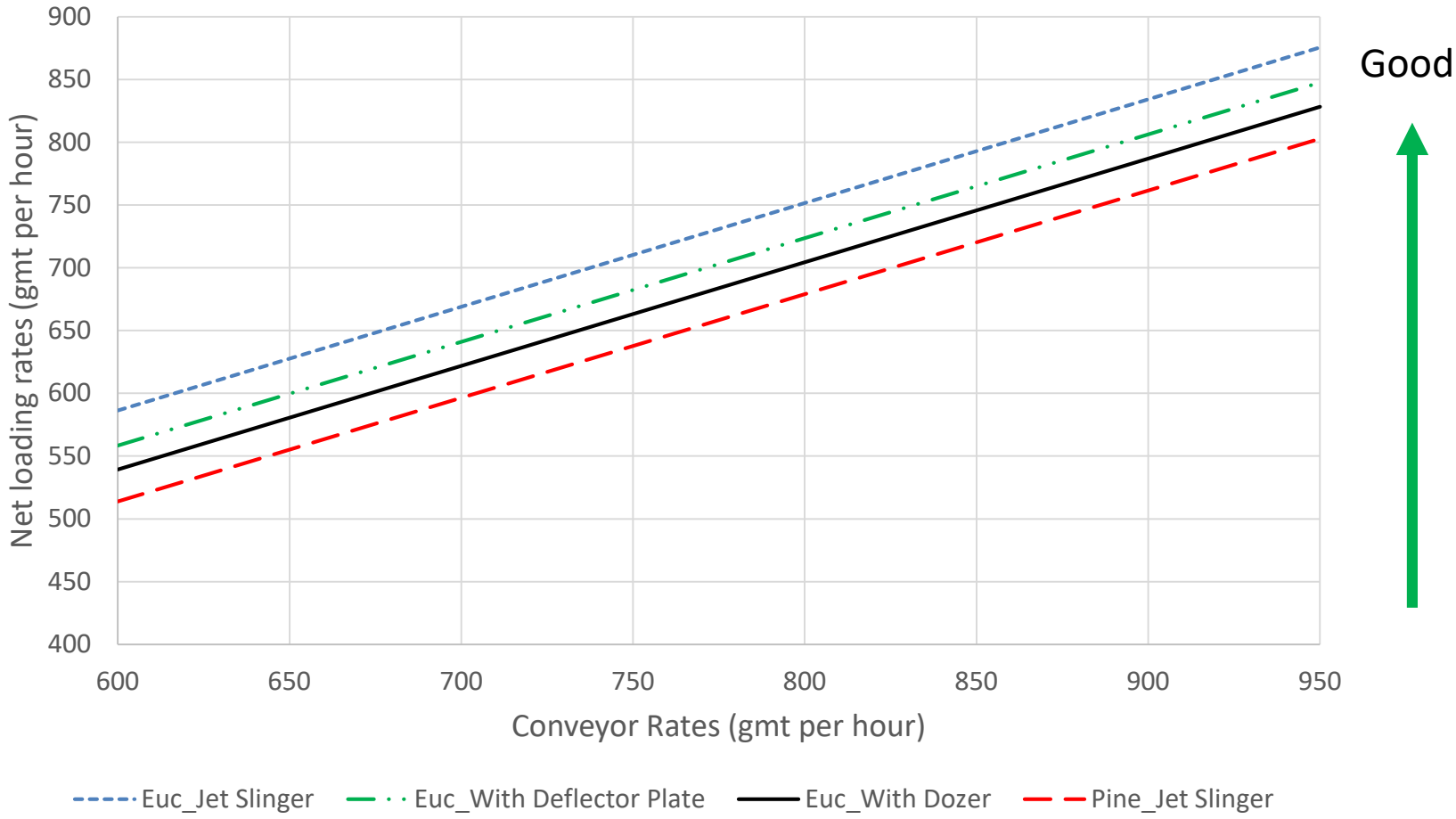
Results: Interviews – Loading Rates



A to H = Australian ports, I = New Zealand, J to K = South Africa, L = Uruguay, M = Finland (barge loading only)

Delays often account for 40% of loading time

Results: Analyses – Loading Rates



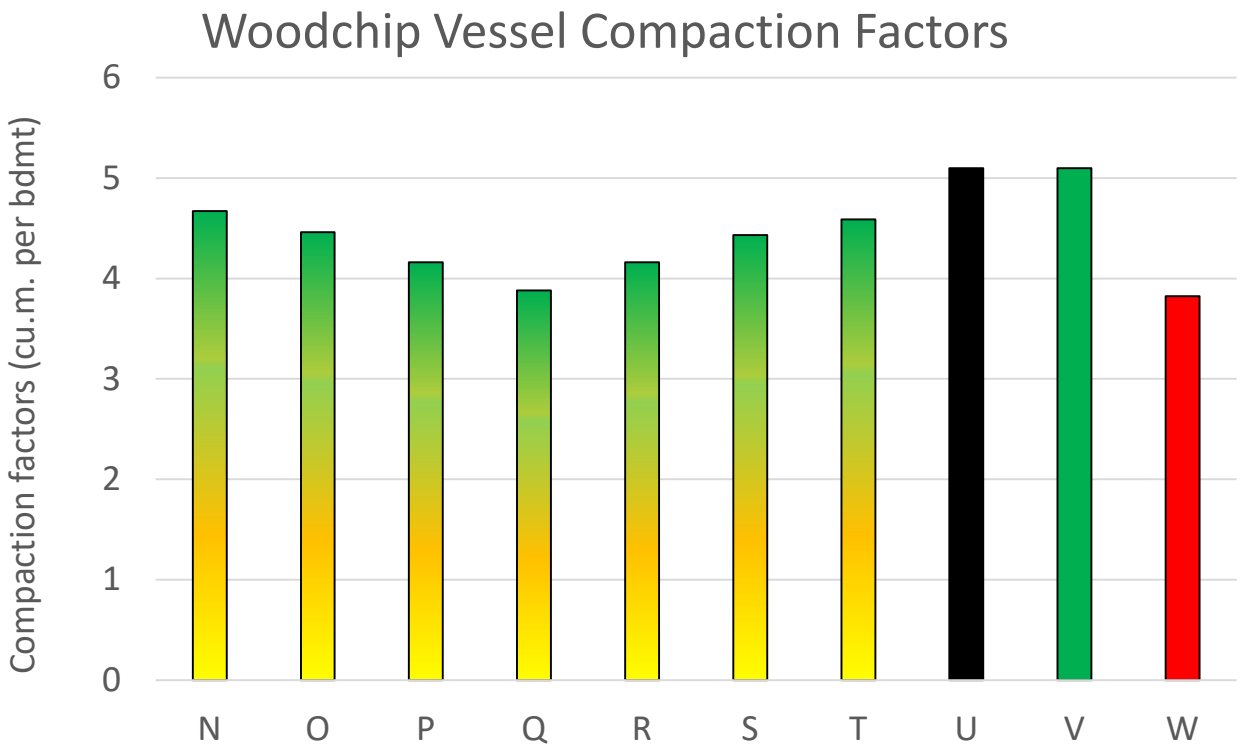
Definitions

$$Stowage\ Factor = \frac{Available\ Space}{Green\ Metric\ Tonnes}$$

$$Compaction\ Factor = \frac{Available\ Space}{Bone\ Dry\ Metric\ Tonnes}$$

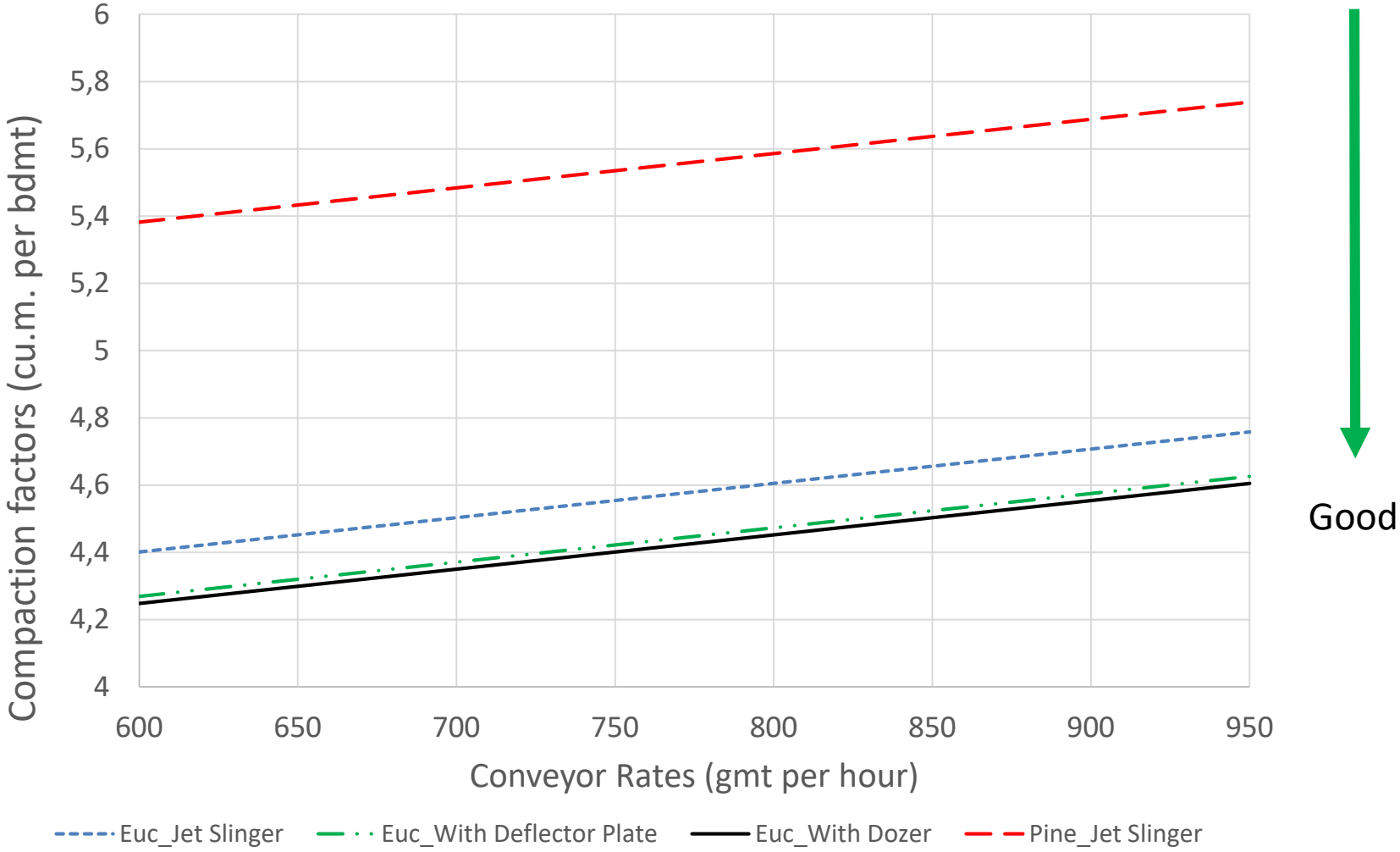
Each 1% improvement in compaction is worth US$20,000 to US$35,000 in additional income per vessel for the exporter.

Results: Interviews – Compaction Factors

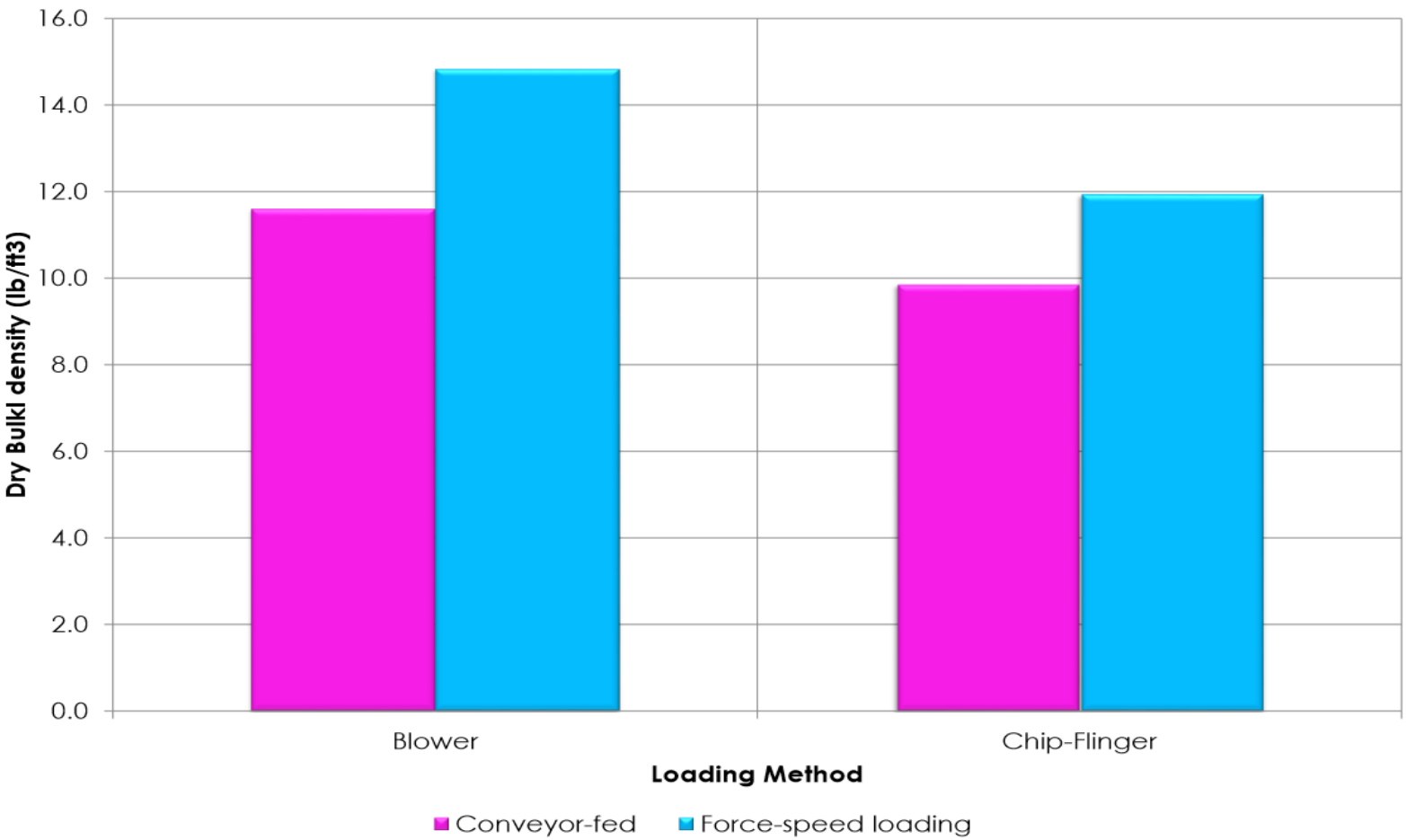


N to T = Australian ports, U = New Zealand, V = Brazil, W = Indonesia

Results: Analyses – Compaction Factors

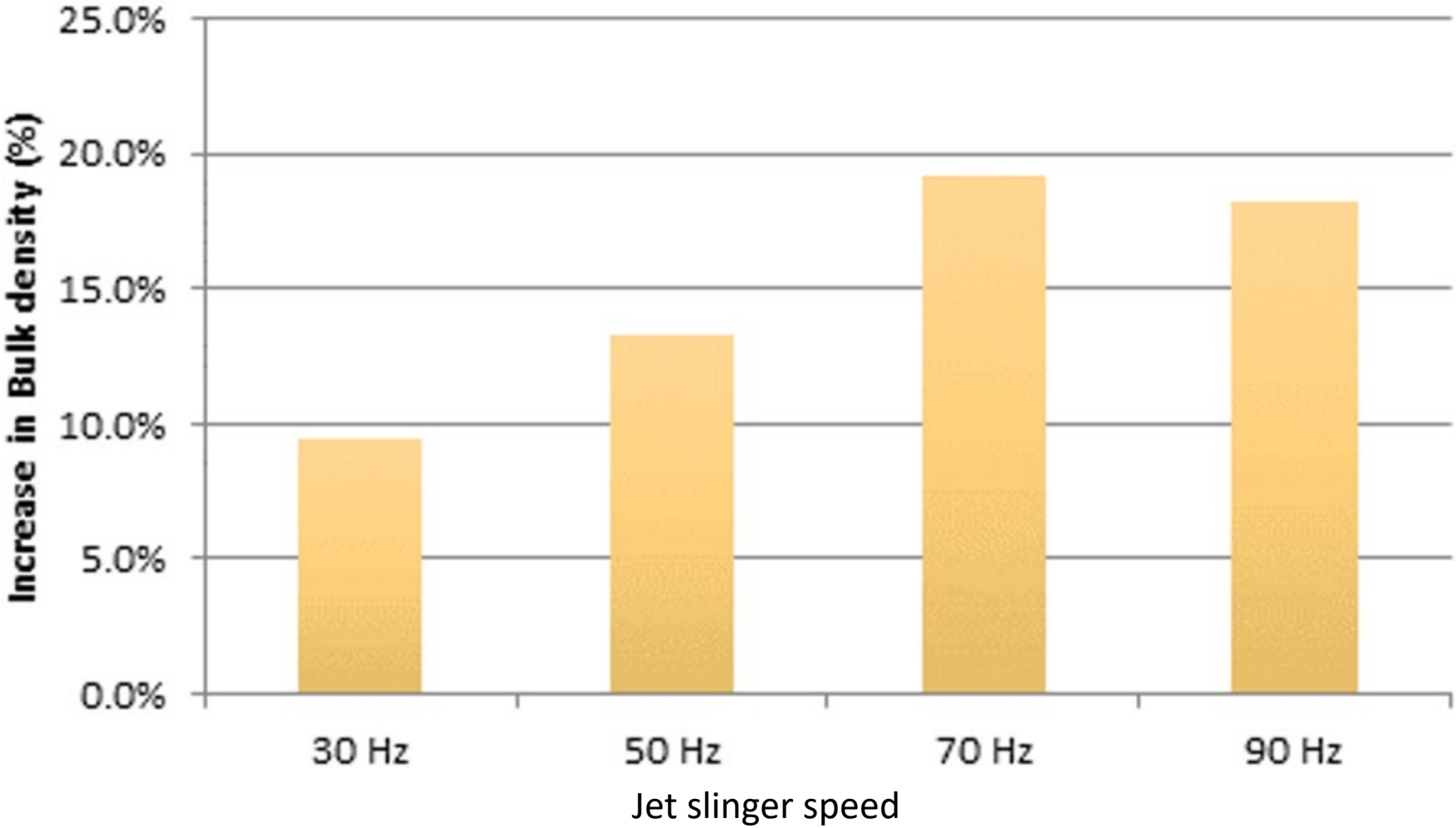


Improving Compaction: Other Research



Zamora and Sessions 2016

Improving Compaction: Other Research



Zamora and Sessions 2016

Conclusions

- Maximising net returns can result in a trade-off between loading rates and compaction factors.
- Maximum load rates ranged between 670 and 1200 gmt/hr
- Load rates were highly variable and affected by
  - shore-to-ship delivery systems
  - conveyor rates
  - species being loaded
  - use of deflection plates on jet slingers
  - use of dozers in the hold to redistribute chips

Conclusions

- Compaction factors ranged between 3.90 and 5.75 m^3/bdmt
- Compaction factors were affected by
  - species being loaded
  - use of deflector plates on jet slingers
  - use of dozers in the hold to redistribute chips
  - order in which holds were loaded
  - loading pattern
  - loader operator skill

Contact

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