Research and Development of a Model to Establish an Equitable Disposal Fee for Landfilling Bulk Loads of Mattresses

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The Purpose of This Study

- **Provide A Model that Explains Mattress Compression within a Landfill**

- **Define the Potential Revenue Loss as a Result of Diminished Available Air Space**

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Background

- Bulk loads of mattresses entering the Warren County District Landfill (WCDL) were used in developing our model.
- WCDL receives at least two tractor loads of mattresses per week.
- How much should the mattress supplier be charged?

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Warren County District Landfill

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Compaction vs. Compression

- **Compaction is defined as the act of crushing an object in order to increase its density.**
  - *WordNet ® 2.0, © 2003 Princeton University*
- **Compression is defined as the act of reducing in size or volume as if by squeezing.**
  - *Merriam-Webster Online Dictionary. March 2006.*

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Mattress Compression

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Mattress Compression

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Literature Review

- **"On average, taking into account both garbage and cover soil, every vertical foot of filled landfill exerts approximately 0.4 psi of ground pressure."** – Neal Bolton. *MSW Management*. "Landfill Airspace and Waste Density"

- **"When it is placed in a landfill, solid waste has a density of 1,200 to 1,400 pounds per cubic yard."** – Wastec Group. http://wastec.isproductions.net

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Literature Review

- Study performed by Gregory Conigliaro and Paul Careau on behalf of Conigliaro Industries, Inc. (A mattress recycling company)
  - Achieved a maximum compression of 66% for a 12” thick mattress
  - The original density of the 12” mattress was calculated to be 83 lbs/CY. The density of the compressed mattress was 250 lbs/CY
  - Testing methods and verification of data were not provided

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Experimental Methods

- Mobile Car Crusher
- Concrete Testing Facility
- Landfill Scale and Bucket Loader
- Testing of 5” x 5” Mattress Samples

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Mobile Car Crusher

- Uniform Application of Pressure
- Could not detect actual force being applied to mattresses

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Concrete Testing Facility

- Key Tech Laboratories
- Testing Equipment Could Not Compress Beyond 3 inches

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Landfill Scale and Bucket Loader

- A front end bucket loader was used to apply pressure to mattresses that were resting atop a landfill truck scale.
- Bucket loader was unable to apply uniform pressure.

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Testing of 5” x 5” Mattress Samples

- Mattress samples were cut into 5” x 5” pieces and weights of known mass were placed atop the pieces.

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Testing of 5” x 5” Mattress Samples

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There was only one injury during the experiment…

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But after a few minutes he proved to be just fine.

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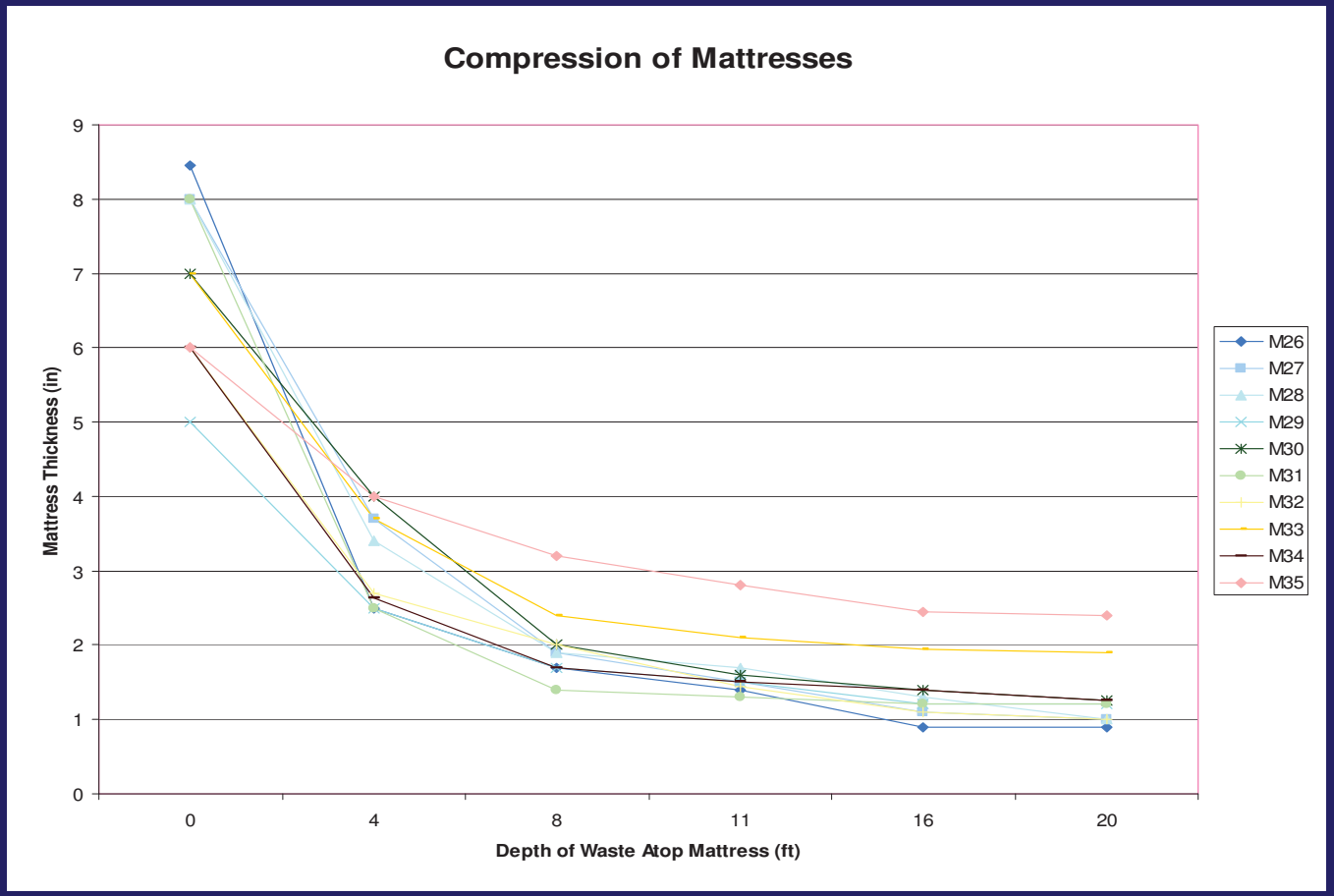
Results



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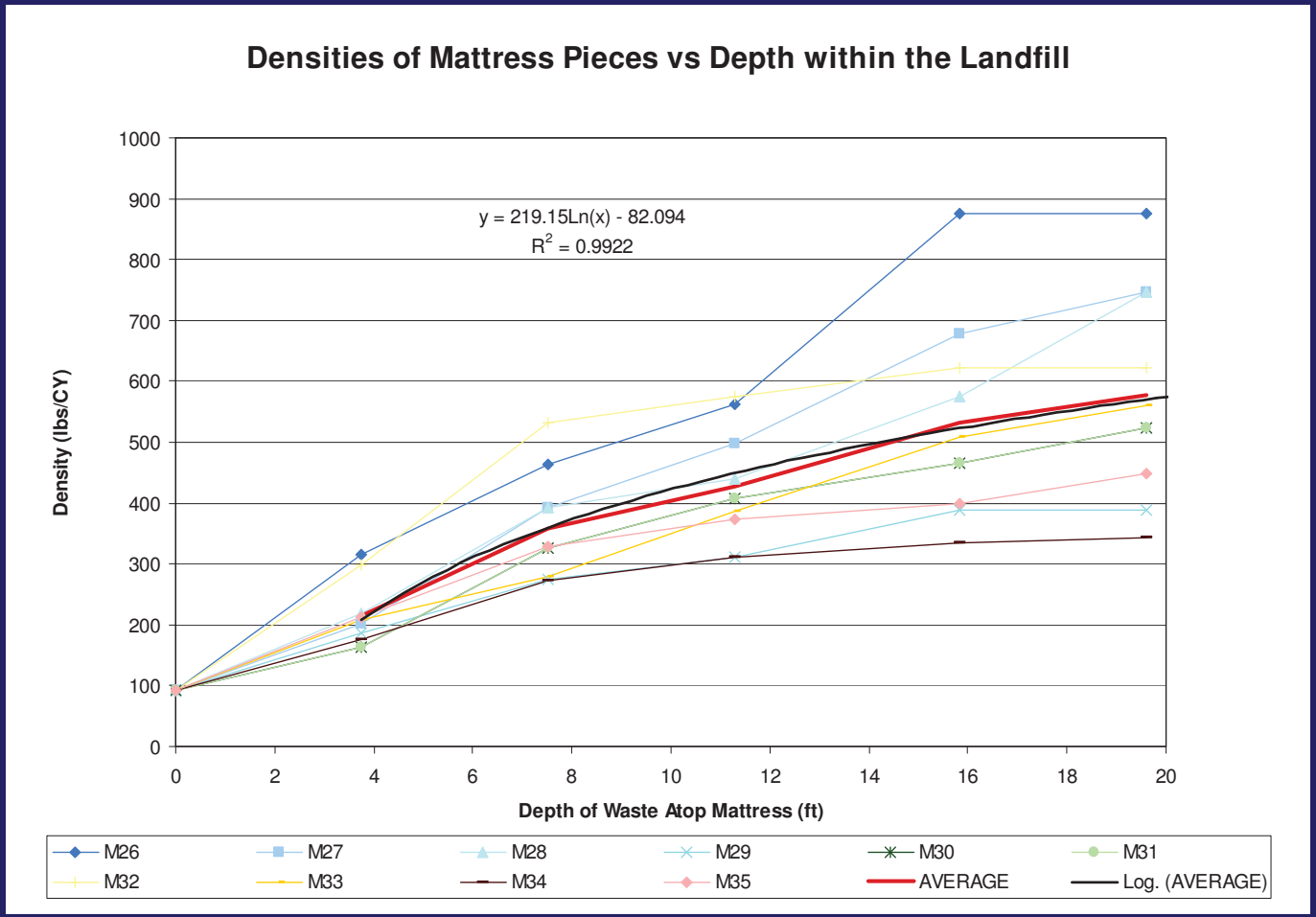
Density



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Therefore…

- $/Ton of Mattresses = W * X / Y
  - W = MSW Disposal Fee ($/Ton)
  - X = Avg. Density of Waste (lbs/CY)
  - Y = 219.51 * Ln (Z) – 82.094
  - Z = Depth of Waste To Be Placed Atop The Mattresses (ft)

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Example

- $/Ton of Mattresses = W * X / Y
  - W = $78 /Ton
  - X = 1,400 lbs/CY
  - Y = 219.51 * Ln (Z) – 82.094
  - Z = 20 ft

- $/Ton = 78 * 1,400 / (219.51 * Ln (20) – 82.094)
- Mattress Tipping Fee = $190 /Ton

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Conclusions

- Mattresses do not compact easily, instead they are mostly effected by compression forces.
- Mattress compression depends on its location within the landfill.
- $/Ton of Mattresses = W * X / Y
  - W = Gate Fee
  - X = Avg. Density of Waste
  - Y = 219.51 * Ln (Z) – 82.094
  - Z = Depth of Material Anticipated To Be Placed Atop The Mattresses

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Conclusions

- Our Findings have been presented to the New Jersey Department of Environmental Protection (NJDEP).
- NJDEP agreed with our conclusions and have approved the requested tipping fee of $225 for bulk loads of mattresses entering the WCDL.

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References

- Bolton, Neal. “Landfill Airspace and Waste Density: The Big Picture.” *MSW Management.* July/August 2000.
- Conigliaro, Gregory and Paul Careau. “Mattresses and Landfills: *Why recycling mattresses makes more sense economically than landfilling!*” Conigliaro Industries, Inc. February 2006.
- “How to choose before you shop”. C*onsumerReports.org*
- “MSW Landfills”. *Wastec Group*. February 2006.

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Questions?

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