

Pulp and Paper Mill Car Fleets

NMRA Seacoast Division

Summer Event

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Pulp and Paper Mill Car Fleets

- Introduction
- Pulp capacity
- Paper out
- Wood in
- Pulp Chemicals in
- Paper Chemicals in



Introduction

- So you've modeled a pulp and paper mill complex
 - Or a pulp mill
 - Or a paper mill
- Chuck Hastings showed us what types of railroad cars would be moving in and out of a pulp and paper mill complex at the Seacoast Winter Meeting in Westbrook
 - <https://www.seacoastnmra.org/images/Clinic-Presentations/Modeling a Paper Mill.pdf>
- But how many cars of each type do you want/need?



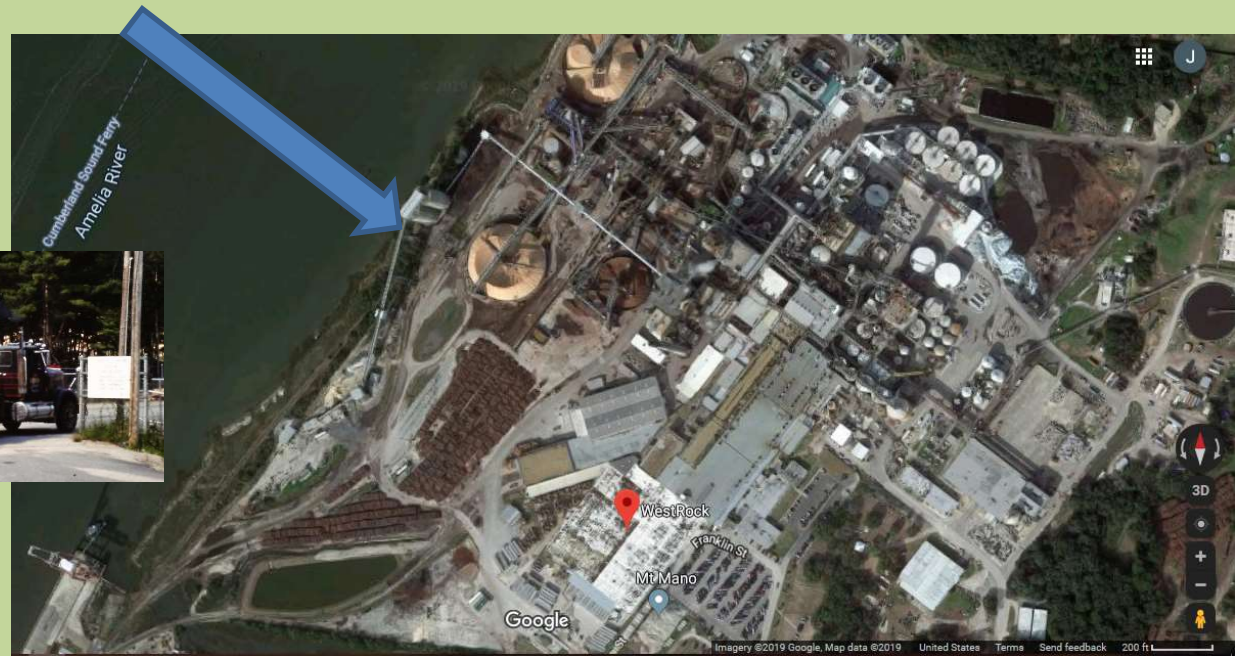
Introduction

- Somewhere in the past I've seen a suggested list of cars and roads you should have on your model railroad (John Armstrong?)
 - e.g., 50% box, 20% tank, 10% flat, etc.
 - e.g., 60% home road, 30% connecting roads, 10% other
 - Depends on time period modeled, region, etc.
- So what would this list look like for a pulp & paper mill complex?



Introduction

- Forest Economist
 - My area of expertise extends into the woodyard, but really decreases after that



Source: Google Maps



Introduction

- So you are getting a literature review
 - No actual phone calls made
 - No visits to mills made
 - A little bit of knowledge, books and some internet searching
- But actual math was used
- Work in progress
 - Some issues with some numbers
- Presentation not designed to tell exactly how many of each kind of car will be present at your pulp/paper complex every day.
 - How your dispatcher schedules your deliveries and pickups is your problem.



Literature Review

- Pretty good numbers on how many tons of wood are needed to make a ton of pulp
 - Most sources talk about tons of *DRY* wood needed to make a ton of pulp
 - Just-harvested wood is about 50% water, so 2 tons of green wood = 1 ton of dry wood
- Amount of other materials varies considerably by type of pulp and by information source



Other Notes

- Does not include cars transporting coal or oil for energy
 - Many northeast mills use/used hydro power
- Does not include occasional shipments (every 10-20 years?) of very heavy equipment by rail
 - Flat cars, gondolas
 - Debarker drums (in sections?)
 - Lime kilns
 - Paper machines
 - Etc.



Pulp Production/Capacity

- Start with pulp mill capacity
 - Determines
 - How much wood is needed
 - Pulpwood cars (and trucks)
 - How much of some of the various chemicals are needed
 - Tank cars and covered hoppers (and trucks)
- Pulp capacity can be found in
 - USFS directories
 - Tons/24 hours
 - Company annual reports
 - Tons/year



Pulp Production/Capacity

Woodpulp mills using northeastern pulpwood by location, type of pulp produced, and oven-dry capacity, in tons per 24 hours, 1979.

Location	Company name	Type of pulp produced					
		Total	Sulfate	Ground-wood	Semi-chemical	Sulfite	Miscellaneous ^a
Maine:							
3. Brunswick	Pejepscot Paper Co.	175	—	175	—	—	—
4. Bucksport	St. Regis Paper Co.	500	—	350	—	—	150
5. East Millinocket	Great Northern Nekoosa Corp.	800	—	800	—	—	—
6. Jay	International Paper Co. ^b	1,350	1,200	150	—	—	—
7. Lincoln	Preco Corp.	360	360	—	—	—	—
8. Lisbon Falls	United States Gypsum Co.	100	—	100	—	—	—
9. Madison	Madison Paper Corp.	120	—	120	—	—	—
10. Millinocket	Great Northern Nekoosa Corp. ^b	1,500	—	900	—	600	—
11. Old Town	Lily Tulip Corp.	50	—	50	—	—	—
12. Old Town	Diamond International Corp. ^b	575	575	—	—	—	—
13. Rumford	Boise Cascade Corp. ^b	705	595	110	—	—	—
14. Shawmut	Keyes Fibre Co.	120	—	120	—	—	—
15. Skowhegan	Scott Paper Co.	850	850	—	—	—	—
16. Westbrook	Scott Paper Co.	300	300	—	—	—	—
17. Woodland	Georgia-Pacific Corp. ^b	1,040	800	240	—	—	—
Total (21 mills)		8,545	4,680	3,115	—	600	150
New Hampshire:							
20. Berlin	Brown Co. ^b	925	725	—	200	—	—
21. Groveton	Diamond International Corp.	250	—	—	250	—	—
Total (3 mills)		1,175	725	—	450	—	—



Source: Nevel, Robert L., Jr., and Richard H. Widmann, 1982, *Pulpwood production and receipts in the Northeast*. 1980: A statistical report, USDA Forest Service Resource Bulletin NE-072



Pulp Production/Capacity

Table 27.—Average production of active wood-pulp and composite product mills by company, location, and type of product produced, New England States, 2008

Product and company	Location	Product produced	Average production
Pulp mills			
Domtar Industries	Baileysville, Maine	Kraft pulp (sulfate)	1,450 tons pulp/day
Katahdin Paper Company, LLC	East Millinocket, Maine	Groundwood/mechanical pulp	100 tons pulp/day
Knight Celotex Corporation	Farmington, Maine	Groundwood/mechanical pulp	100 tons pulp/day
Lincoln Paper and Tissue, LLC	Lincoln, Maine	Kraft pulp (sulfate)	450 tons pulp/day
Madison Paper Industries	Madison, Maine	Kraft pulp (sulfate)	300 tons pulp/day
Red Shield Old Town Mill	Old Town, Maine	Kraft pulp (sulfate)	172 tons pulp/day
Rumford Paper Company	Rumford, Maine	Kraft pulp (sulfate)	860 tons pulp/day
Sappi Fine Paper Company	Skowhegan, Maine	Kraft pulp (sulfate)	1,500 tons pulp/day
Verso Paper	Androscoggin, Maine	Kraft/groundwood pulp	1,570 tons pulp/day
Verso Paper	Bucksport, Maine	Groundwood/mechanical pulp	650 tons pulp/day
Composite product mills			
Huber Engineered Woods, LLC	Easton, Maine	Oriented strand board	135 million ft ² , 3/4-Inch basis per year
Louisiana-Pacific Corp.	Houlton, Maine	Oriented strand board	250 million ft ² , 3/4-Inch basis per year



Source: Piva, Ronald J., 2015, Pulpwood production in the Northern Region, 2008, USDA Forest Service, Resource Bulletin NRS-094



Pulp Production/Capacity

- Two great branches of pulp production
 - Groundwood
 - Water, heat and pressure (no chemicals)
 - Chemical pulp (Sulfite and Sulfate (Kraft))
 - Sulfur smell
 - formerly Westbrook ME
 - I-95 in Georgia
 - (Other—TMP, CTMP, etc.)
- No two mills exactly the same



Pulp Production/Capacity

- Groundwood Pulp
 - Newsprint
 - 2 tons wood → 1 ton pulp → 1 ton paper
 - Coated papers
 - 2 tons wood → 1 ton pulp → 2 tons paper
- Chemical Pulp
 - Coated papers
 - 4 tons wood → 1 ton pulp → 2 tons paper
- No two mills exactly the same



Groundwood Pulp Production/Capacity

- Groundwood Pulp, Newsprint
 - 2 tons wood → 1 ton pulp → 1 ton paper
- 120 tons/24 hours
 - e.g., Madison Paper, Madison, ME (1979)



Paper Out

- 50' box car can carry 96 tons of paper
- 120 tons pulp/day = 120 tons paper/day
- 120 tons paper/day = 1.2 box cars



Closed Car Loading Guide

Part 2 Best Practices for Loading Roll Paper in Railcars



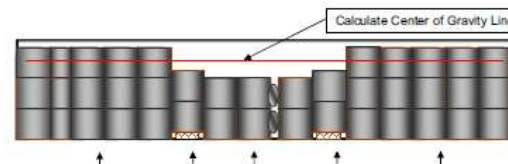
Approved August 2016 by the
Damage Prevention and
Freight Claim Committee

GENERAL LOADING INFORMATION

3.4.6 EXAMPLE: Roll Paper

Load: Seventy-seven 45 in. diameter x 50 in. wide rolls each weighing 2,500 lb, loaded in 29 floor spots with two complete layers plus 19 rolls in an incomplete third layer. 6 in. high risers are used to block the incomplete layer. Incomplete layer unitizing not shown.

NOTE: When loads consist of multiple sections or units having different unit heights and weights, each section or unit must be taken separately when calculating the CG of the load.



Wood In

- 40' bulkhead flat (pulpwood car) can carry ~20 cords or ~45 tons of wood
 - Weight depends on species
- 120 tons pulp/day = 240 tons wood/day
- 240 tons wood/day = 5.3 bulkhead flats
 - Wood chips may arrive in hoppers



Groundwood Summary

- If everything moves by rail

	Car Type	Capacity (tons/car)	tons/day	Day	Week	Year
Outbound Cars						
Paper	50' Box	96	120	1.2	9	436
Inbound Cars						
Wood	Bulkhead Flat	45	240	5.3	37	1,867

- For coated groundwood papers, see paper section of chemical pulp



Chemical Pulp Production/Capacity

- Chemical Pulp, Coated Papers
 - 4 tons wood → 1 ton pulp → 2 tons paper
- 300 tons/24 hours
 - e.g., Scott Paper, Westbrook, ME (1979)
- (a few mills make more pulp than they need for their own use and sell the surplus--market pulp)



Paper Out

- 50' box car can carry 96 tons of paper
- 300 tons pulp/day = 600 tons paper/day
- 600 tons paper/day = 6.2 box cars



Closed Car Loading Guide

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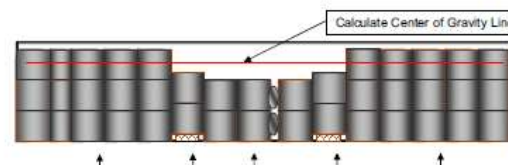
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Wood In

- 40' bulkhead flat (pulpwood car) can carry ~20 cords or ~45 tons of wood
 - Weight depends on species
- 300 tons pulp/day = 1,200 tons wood/day
- 1,200 tons wood/day = 23.7 bulkhead flats



Pulp Chemicals In

- Modern tank cars and covered hoppers can carry 90 tons
- 300 tons pulp/day
 - 31 tons sulfur (sodium sulfate)/day = 0.3 tank cars/day
 - 79 tons caustic soda/day = 0.9 tank cars/day
 - 105 tons lime/day = 1.2 covered hoppers/day
 - 27 tons chlorine/day = 0.3 tank cars/day



- Note: These are the volumes used to make 300 tons of pulp, but significant quantities of these chemicals are recovered during the pulp-making process, so these numbers are too high



Paper Chemicals In

- Tank cars and covered hoppers can carry 90 tons
- 300 tons pulp/day (600 tons paper/day)
 - 87 tons kaolin clay/day = 1.0 tank cars/day
 - 6 tons dye & pigments/day = 0.1 tank cars/day
 - 32 tons starch/day = 0.4 covered hoppers/day



- Note: If additives make up half the weight of coated paper, how come we're only using 125 tons of additives?



Chemical Pulp Summary

- If everything moves by rail

	Car Type	Capacity (tons/car)	tons/day	Day	Week	Year	% of Fleet
Outbound Cars							
Paper	50' Box	96	600	6.2	44	2,182	18.3%
Inbound Cars							
Wood	Bulkhead Flat	51	1,200	23.7	166	8,300	69.7%
Sulfur	Tank	90	31	0.3	2	119	1.0%
Caustic Soda	Covered Hopper	90	79	0.9	6	308	2.6%
Lime	Covered Hopper	90	105	1.2	8	408	3.4%
Chlorine	Tank	90	27	0.3	2	105	0.9%
Clay	Tank	90	87	1.0	7	337	2.8%
Dye & Pigments	Tank	90	6	0.1	0	23	0.2%
Starch	Covered Hopper	90	32	0.4	3	126	1.1%
Total				34.0	238	11,909	



Summary Summary

- A chemical pulp & paper complex will have one tank car and one covered hopper arriving for every four box cars

Type	Number
Box	4
Bulkhead Flat	16
Tank	1
Covered Hopper	1

- Not necessarily in that ratio in every train
 - Depends on your dispatcher
- You don't need as many tanks or hoppers as boxes



References

- Modeling a Paper Mill
 - https://www.seacoastnmra.org/images/Clinic-Presentations/Modeling_a_Paper_Mill.pdf
- Northern pulpwood production, 2008
 - <https://www.fs.usda.gov/treesearch/pubs/47700>
- Southern pulpwood production, 2012
 - <https://www.fs.usda.gov/treesearch/pubs/49209>
- Pulp & Paper Chemicals
 - <http://kellygreenclub.com/2017/07/31/how-much-wood-is-used-to-make-paper/>



Thanks for Watching

