Liquid Routes Study

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Presentation Outline

- Findings from the JTRP Study SPR – 3618, “Total Liquid Routes and Anti-Icing Liquids”
- Completed in 2013
- Bryan Donze – LaPorte District perspective
- Phil Ivy – INDOT statewide perspective

Final Report

- **Released on March 11, 2014**
- **Purdue ePubs**
- **Link to the Report:**

http://dx.doi.org/10.5703/1288284315222

Study Period

2011-2012 Winter Season

21 routes at 9 unit locations

Alternate between salt and brine: 3
Salt routes: 10
Brine routes: 4
Multi-lane (Brine on passing and salt on driving): 4

2012-2013 Winter Season

41 routes at 19 locations

Alternate between salt and brine: 3
Salt routes: 18
Brine routes: 16
Combo unit: 1
Combination of salt and brine across multiple lanes: 3

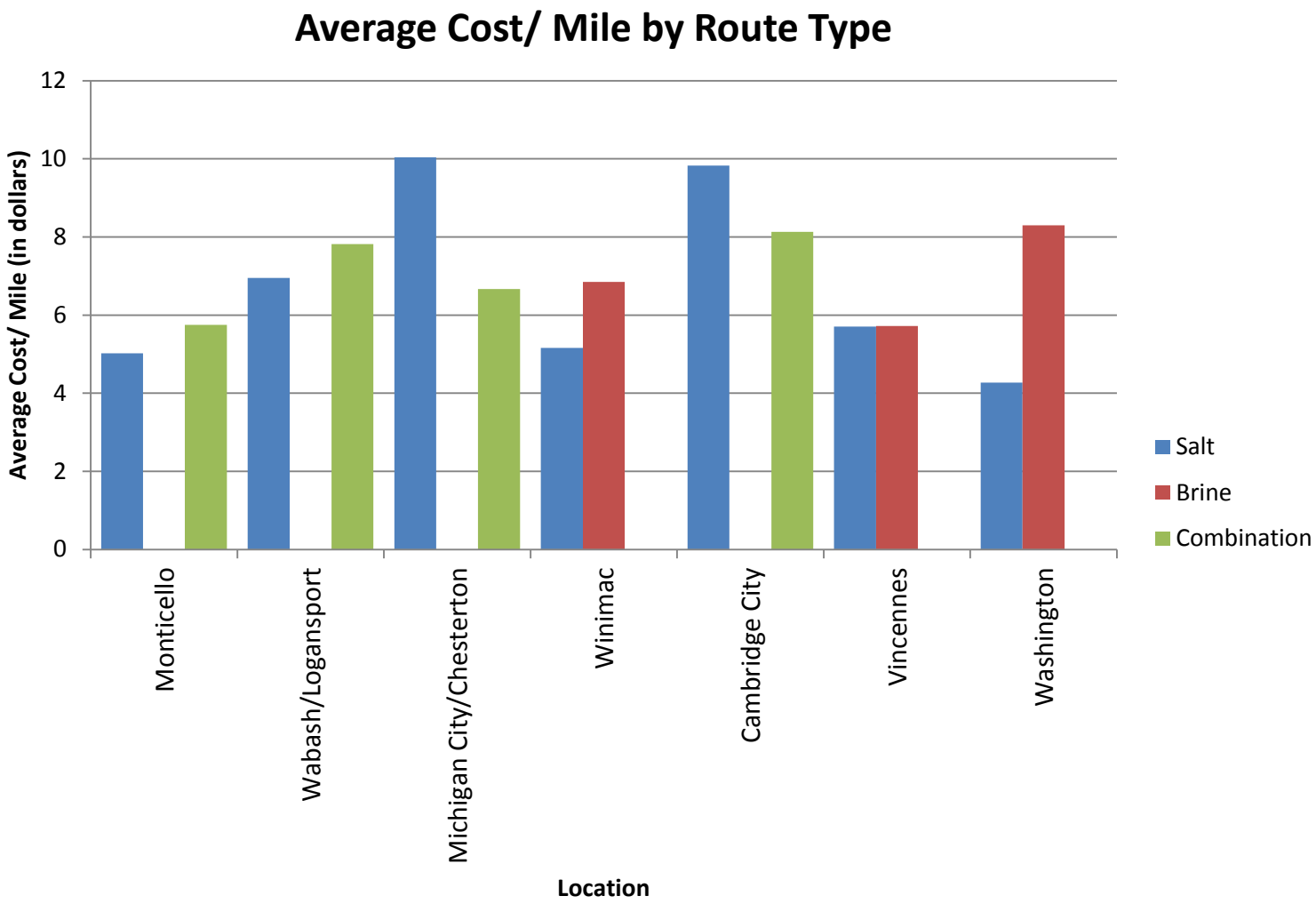
2011-2012

- **25 weather events!**
  - Started 11/29/11 , ended 3/5/12

Weather event type	# of events	Salt	Brine	Combo
Light Snow (< 0.5”/hr)	18	29	11	23
Medium Snow (0.5”-1”/hr.)	4	8	1	5
Heavy Snow (>1”/hr.)	3	10	3	12

- Combination Routes (alternate brine and salt) had lower costs than brine routes in all event types.
- I-94 route, combination route (brine lanes 1 & 3, salt lane 2) was most economical in all event types.

Light Snow Events Cost Data



Combination Unit

- 2400 gallon brine tank
- 4 CY Hopper
- Material cost - $14,011
- Fabricated at Indy Sub

2012-2013 Winter Season

Brine (gallons)	Salt (tons)	Service Miles	Cost	$/Service Mile
40000	103	2198	$21,235	$9.66*

* Compares to $11.02 (salt) and $9.36 (liquid) routes in Greenfield District.

Winter 2012-2013

	Liquid Routes (22 routes)			Control Routes (18 routes)		
	Salt Used	Total Cost	$/SM	Salt Used	Total Cost	$/SM
Crawfordsville	620.8	$68,933	$9.39	622.9	$56,344	$9.62
Fort Wayne	946.6	$146,381	$7.39	962.2	$109,179	$10.84
Greenfield	833.1	$102,975	$9.36	493.6	$62,653	$11.02[2]
LaPorte	1694.81	$213,021	$6.88	2061	$174,180	$7.46
Seymour	459.73	$59,574	$7.92	492.82	$65,778	$7.90
Vincennes	421.9	$46,089	$7.87	556.2	$67,570	$8.95
State Totals	4976.94	$636,973	$8.14	5188.72	$535,704	$9.30

- 26 weather events
- Started 12/10/12 , ended 3/25/13
- Pavement temps rarely dropped below double digit values.

Study Routes Comparison

Location	Date	Snow Amount (in.)	Route	Pavement Temp.	Route Type	Gallons / Mile	Salt- lbs / mile	$ / Service Mile
Fort Wayne	12/31/2012	0.5	25-5-201	28	Liquid	37	42	7.28
Fort Wayne	12/31/2012	0.5	25-1-202	28	Salt	NA	72	5.78
Chesterton	1/25/2013	0.75	41-6-1	26	Liquid	21	24	4.6
Chesterton	1/25/2013	0.75	41-3-6	26	Salt	NA	167	7.20
Chesterton	1/24/2013	1	41-6-1	10	Liquid	19	22	3.88
Chesterton	1/24/2013	1	41-3-6	10	Salt	NA	296	11.16
Winamac	12/28/2012	1	46-1-3	31	Liquid	14	16	2.40
Winamac	12/28/2012	1	46-1-1	31	Salt	NA	74	4.30
Winamac	2/2/2013	2	46-1-3	16	Liquid	48	112	7.21
Winamac	2/2/2013	2	46-1-1	16	Salt	NA	120	5.94
Winamac	12/26/2013	3	46-1-3	28	Liquid	52	120	7.42
Winamac	12/26/2012	3	46-1-1	28	Salt	NA	112	5.58
Chesterton	2/4/2013	4	41-6-1	25	Liquid	10	30	5.10
Chesterton	2/4/2013	4	41-3-6	25	Salt	NA	122	11.44

*Partial table

Observations of Table Data

- Pavement temperatures range from 10 to 35 degrees. Within this range liquid routes are more economical if normal material distribution rates are used.
  - Normal distribution rates are 40 gallons/mile for liquids and 200 #/mile for salt. When salt distribution rates are below 100 #/mile then salt routes can be more economical.
- When salt distribution rates are between 100-200 #/mile the lane mile costs typically fall in the $5-6 range.
- When brine distribution rates are between 20-40 gallons/mile the lane mile costs typically fall in the $4-7 range.

Route Comparisons per Period

Bi-weekly period and weather events	Liquid Route Cost Range	Salt Route Cost Range	Liquid Route	Salt Route
12/10/12 – 12/23/12 **Lake Effect events and 1 snow event**	$3.45 - $11.15	$4.82 - $10.52	4	2
12/24/12 – 1/6/13 **Lake Effect Events and 3 snow events**	$6.65 - $10.17	$5.81 - $10.66	2	4
1/7/13 – 1/20/13 **2 light snow events**	$3.27 - $$6.73	$4.21 - $7.89	2	2
1/21/13 – 2/3/13 **Lake Effect and Light Snow Events**	$5.98 - $12.21	$6.37 - $12.14	4	2
2/4/13 – 2/16/13 **Lake Effect events and Light snow events**	$5.51 - $7.50	$5.08 - $14.68	4	1
2/17/13 – 3/2/13 **Lake effect events and 2 sleet and freezing rain events**	$4.27 - $10.75	$6.32 - $12.00	4	0
3/3/13 – 3/16/13 **Lake Effect event and 1 snow event (1-10”)**	$5.99 - $11.71	$6.94 - $18.84	4	2
3/17/13 – 3/30/13 **1 heavy snow event**	$5.96 - $11.12	$4.32 - $10.94	2	4
Total	$3.27 - $12.21	$4.21 - $14.68	26	17

*Liquid routes were economical 26 times compared to 17 times for salt routes.

Conclusions

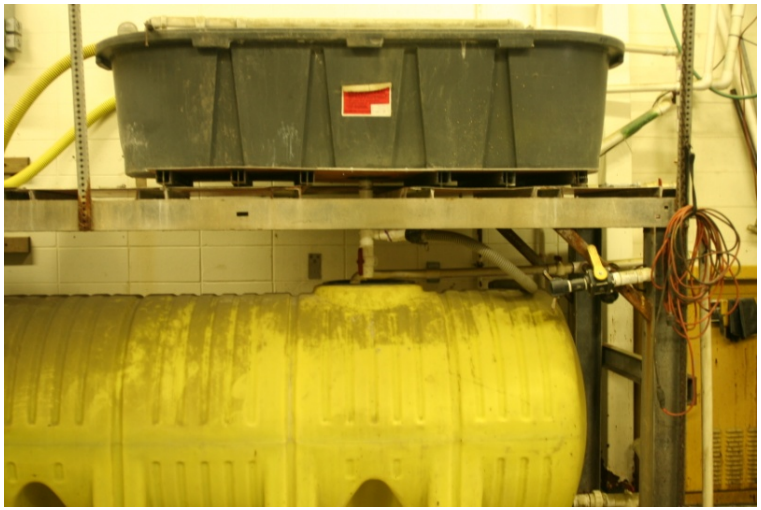
- On I-94, the interstate route, alternating brine and salt were considerably lower than an all salt approach.
- Liquid routes have a smaller cost range variance.
- LaPorte District had lower unit costs for brine and salt routes.
- Driver endorsement of the combination unit was lukewarm.

LaPorte District

- **Route characteristics**
  - Multi-lane combination
  - 2-lane rotation
  - All brine

- **Equipment**
  - Slide in tanks (1800-2000 gal)
  - Bladders (2500 gal)

- **Brine makers**
  - Automated and semi-automated
  - Homemade



- Phil Ivy comments
- Questions?