Development, Implementation and Evaluation of Reduced Salt Spread Rates

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0. CONTENT

1. INTRODUCTION - Highways Agency Network

- Trunk road network in England (UK)
  - Motorways
  - Major ‘A’ Roads
- 6,900km
  - 2% road network
  - 66% Heavy Good Vehicle (HGV) mileage
- Economic ‘backbone’

Research Strategy

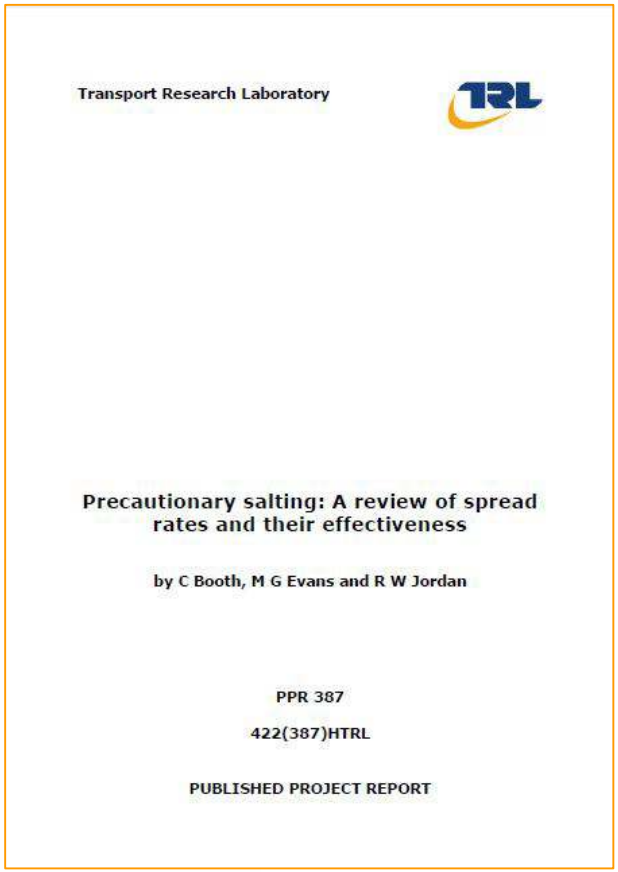
"Roads are kept open and in a safe condition during winter, with minimal impact on the environment" (2007)

- Introduction of pre-wet treatments
- Develop new lower precautionary treatment rates
  - Historical dry salt 10, 20, 40g/m^2
  - Pre-wet rates?
  - Dry salt rates?
- Environmental benefits
- Cost savings

2. SALT DOSAGE & ROAD RESPONSE PROJECT

Literature search confirmed:

- European salt spread rates often lower (e.g. 25 – 80% for RST -10°C)
- ...but might be good reason.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Precautionary salting: A review of spread rates and their effectiveness

by C Booth, M G Evans and R W Jordan

PPR 387

422(387)HTRL

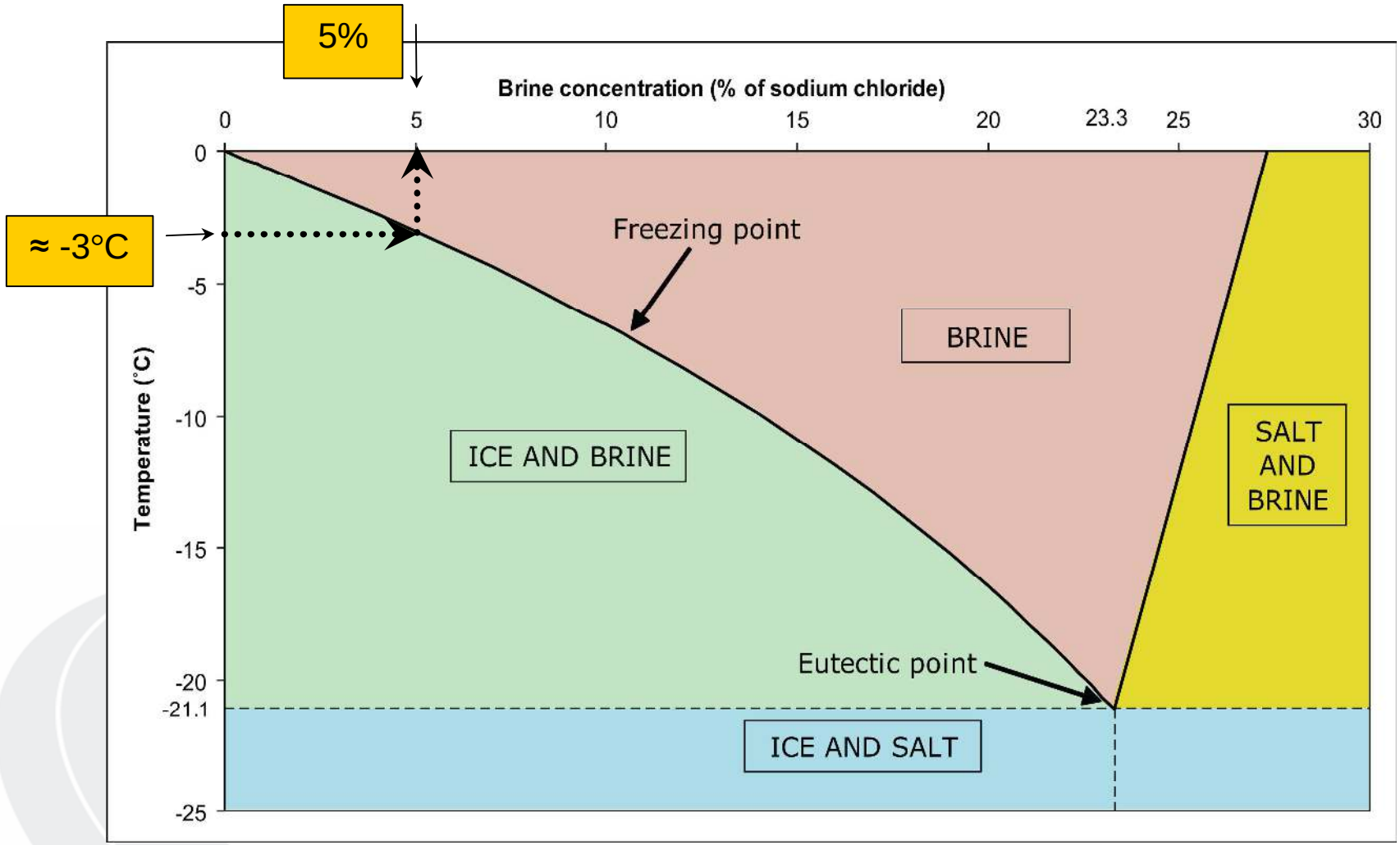
PUBLISHED PROJECT REPORT

Research aims

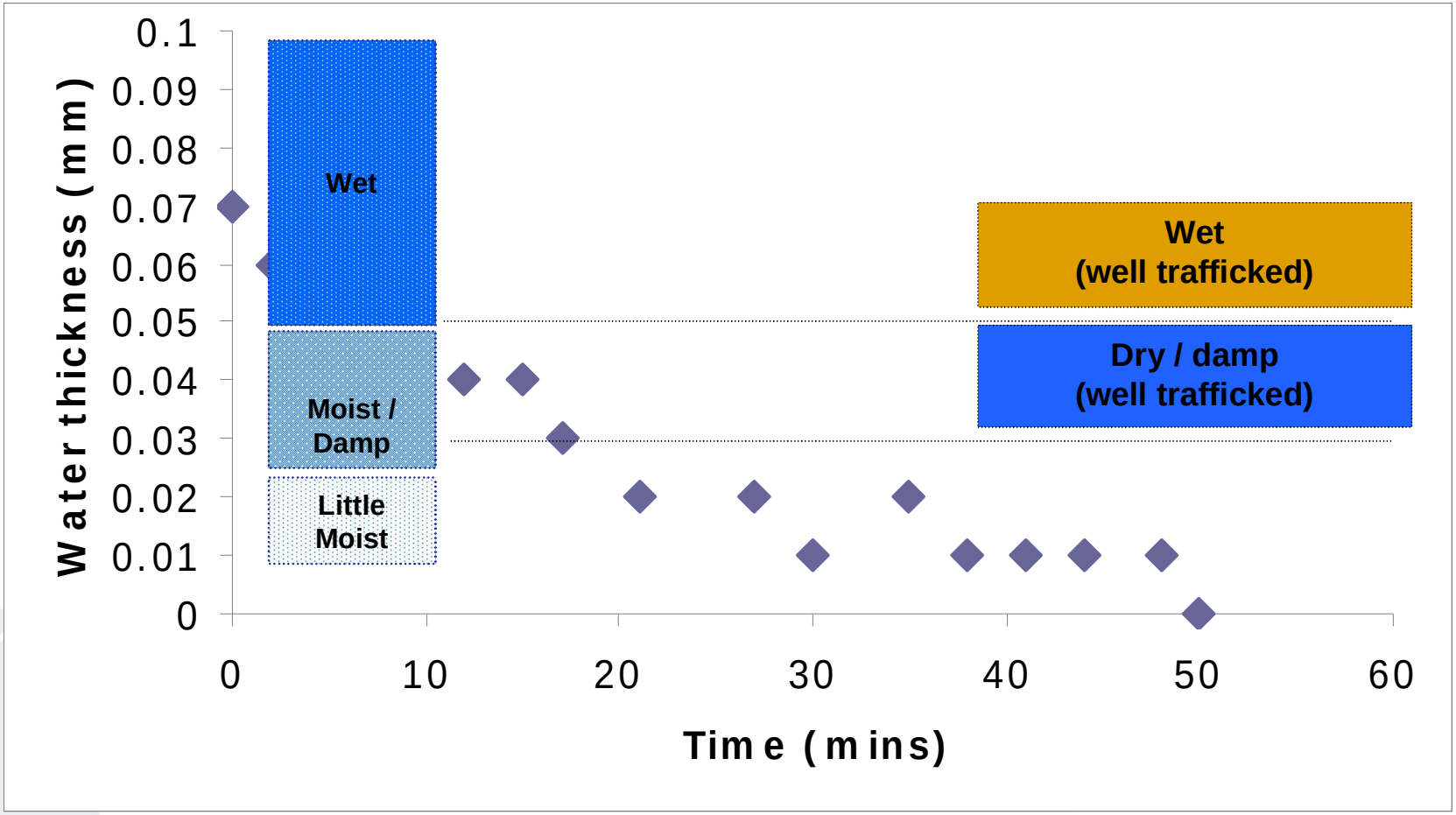
TRL appointed to determined safe salting levels considering:

- Road surface temperature
- Water at the road surface
- De-icer at surface after trafficking

Salt – Water Phase Diagram



3. WATER AT ROAD SURFACE



4. PERFORMANCE SPECIFICATION FOR SPREADERS

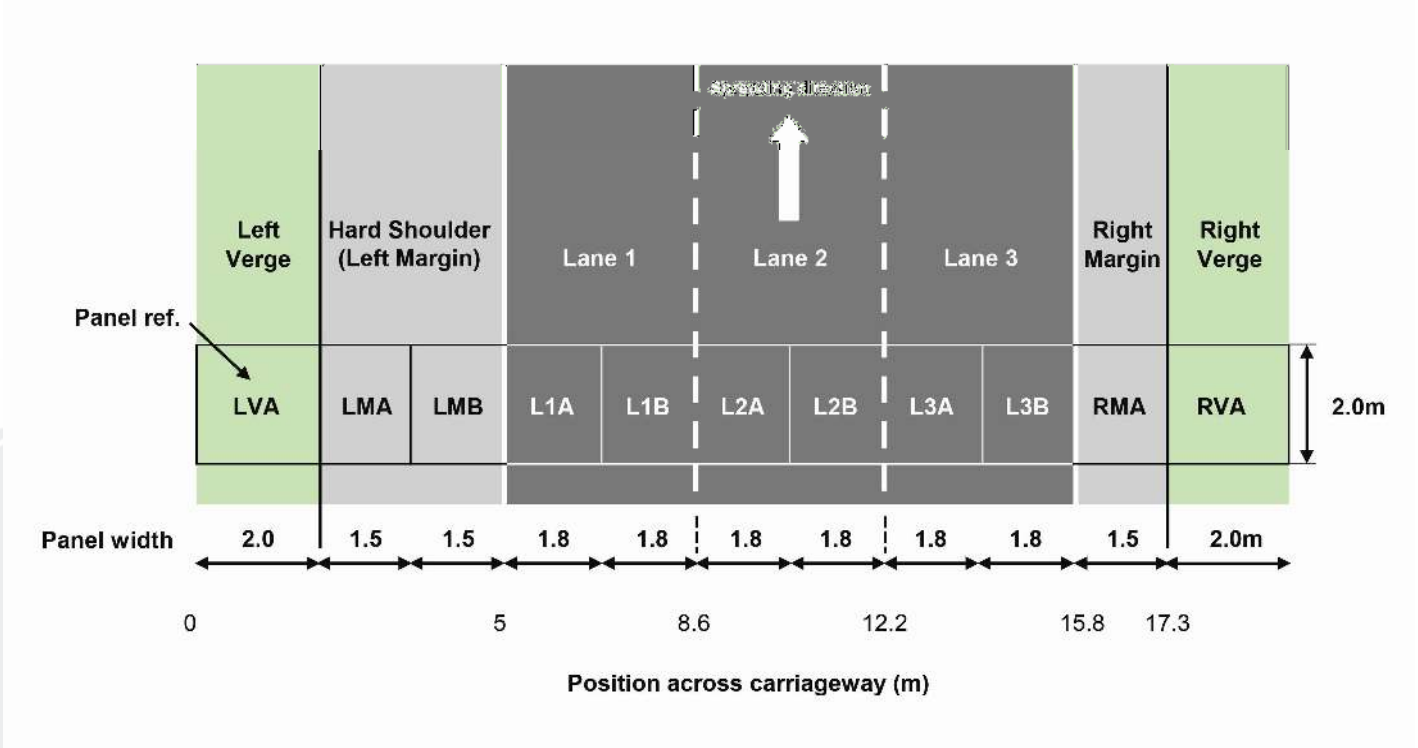
Stringent requirements for salt spreading:

- 6.3mm dry, pre-wet and treated salt tested at 10 and 20g/m^2
- **Discharge test**
  - ✓ Salt discharged 2km, 94 -106% of target
  - ✓ Hoppers at 100% and 10% capacity
  - ✓ 9, 11 and 13m spread width

Performance Specification for Spreaders Continued

Distribution Trial (64kph)

- ✓ Minimal under- or over-spreading
- ✓ 3 No. trial strips (10m - 14m separation)

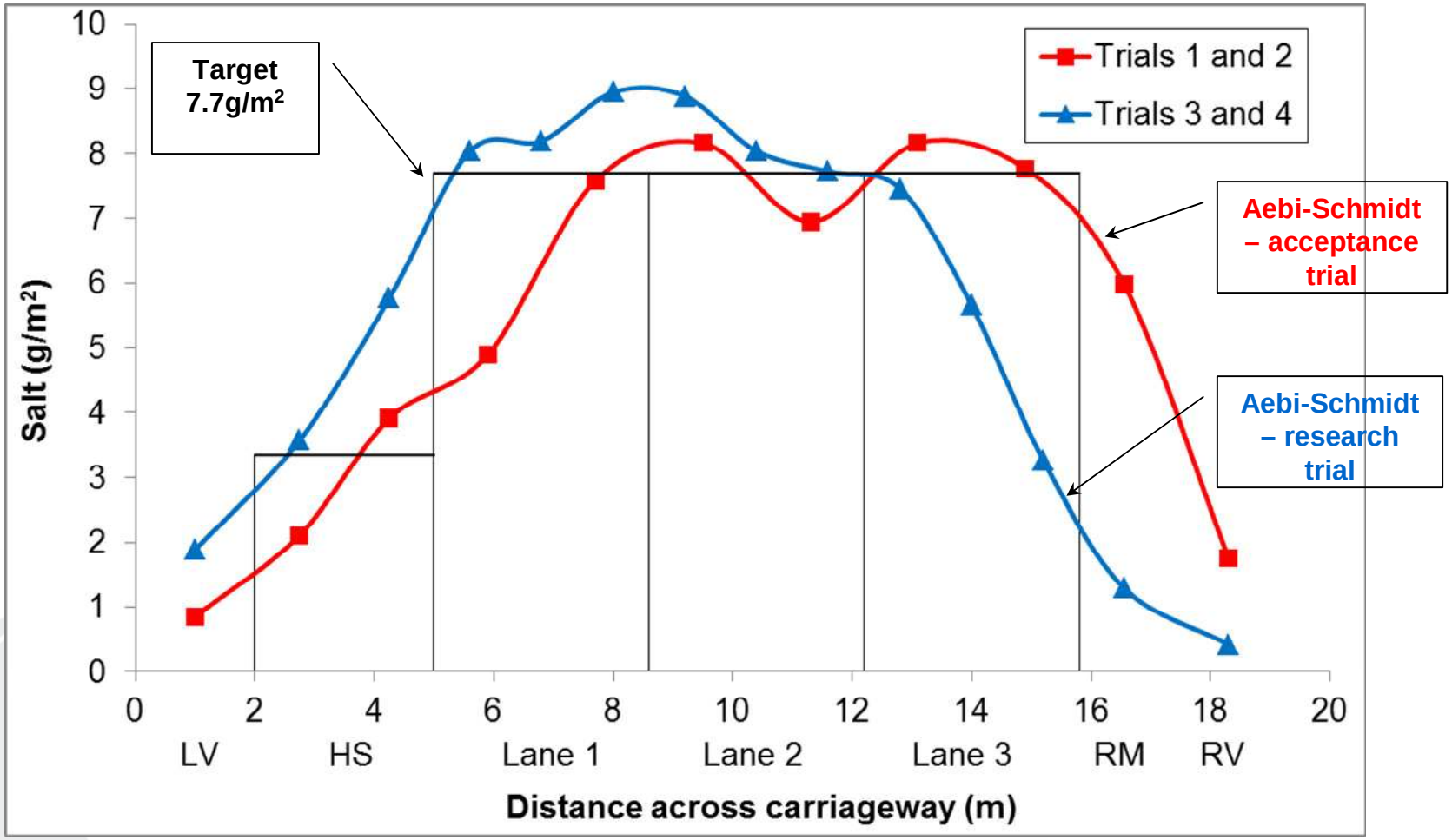


Performance Specification for Spreaders Continued



✓Total salt collected	90 – 110% of target
✓Lane coverage	70 – 130% of target
✓H/S coverage	>= 25% of target for lanes
✓Wastage L / R Verges	<= 5% of total collected
✓Strip to strip variation	80 – 120% of mean for strips
✓Panel coverage (pre-wet)	50 – 160% target

Pre-wetted Salt Distribution Trial Results

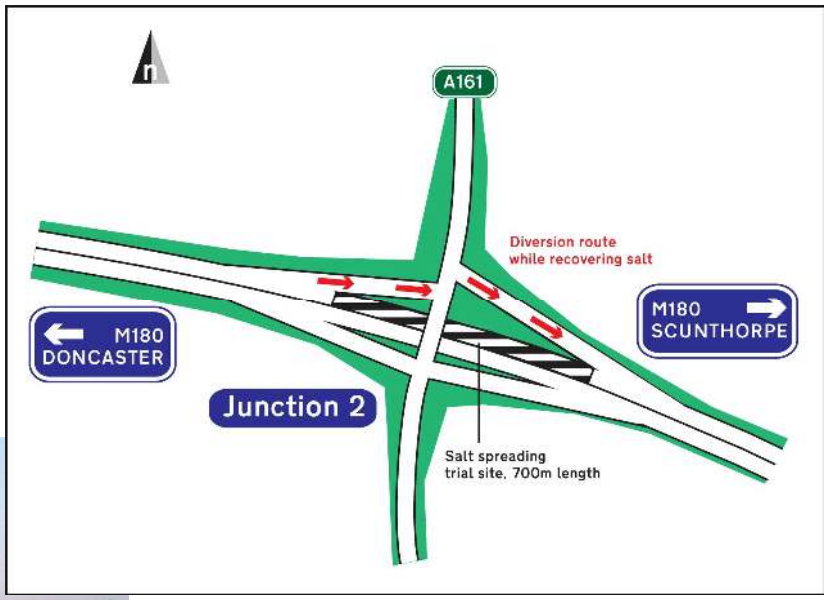


5. ROAD TRIALS & SALT LOSS

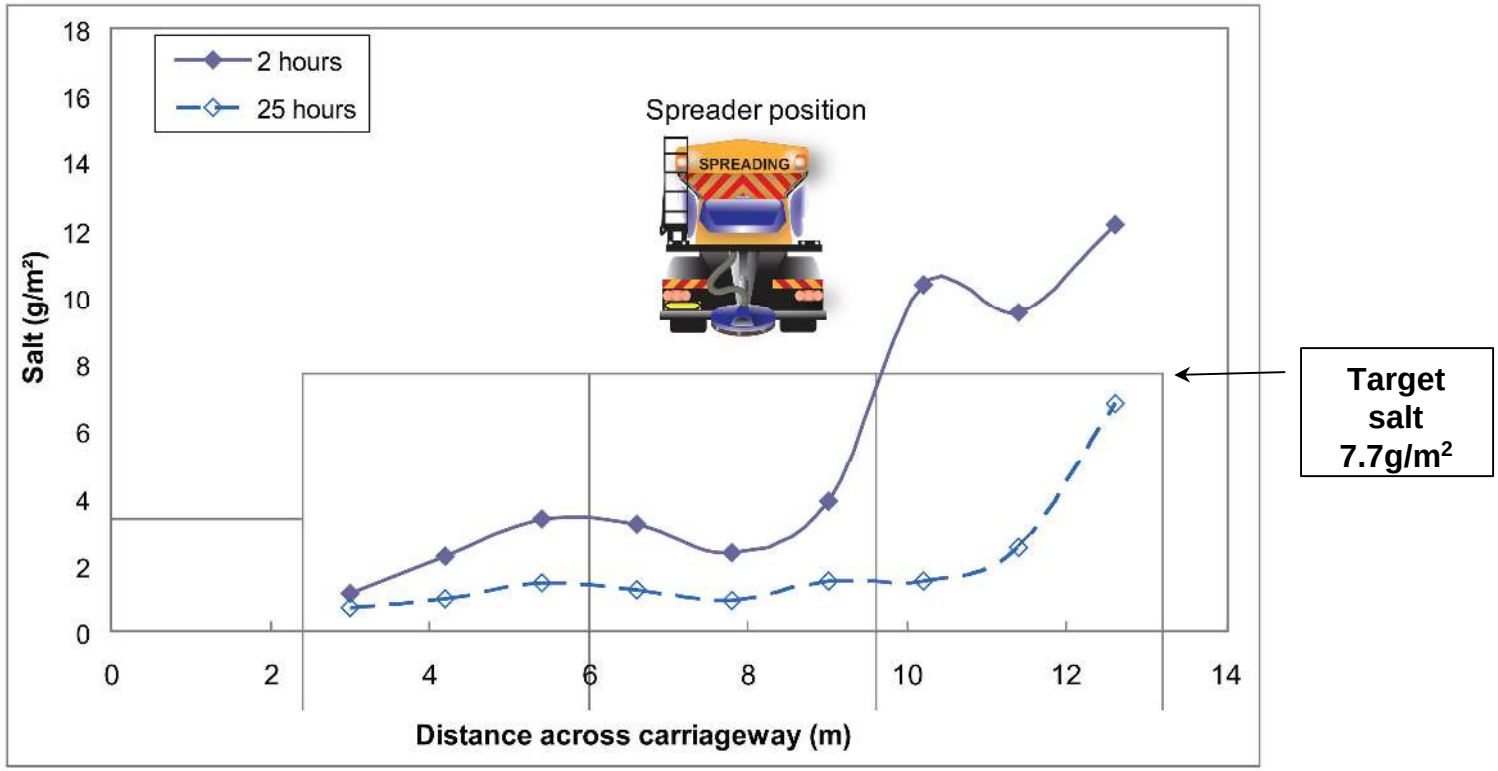
Salt spread and collected after:

- 2 hours trafficking
- 25 hours trafficking

Part of trial site not spread to determine background levels



Loss due to Trafficking Results



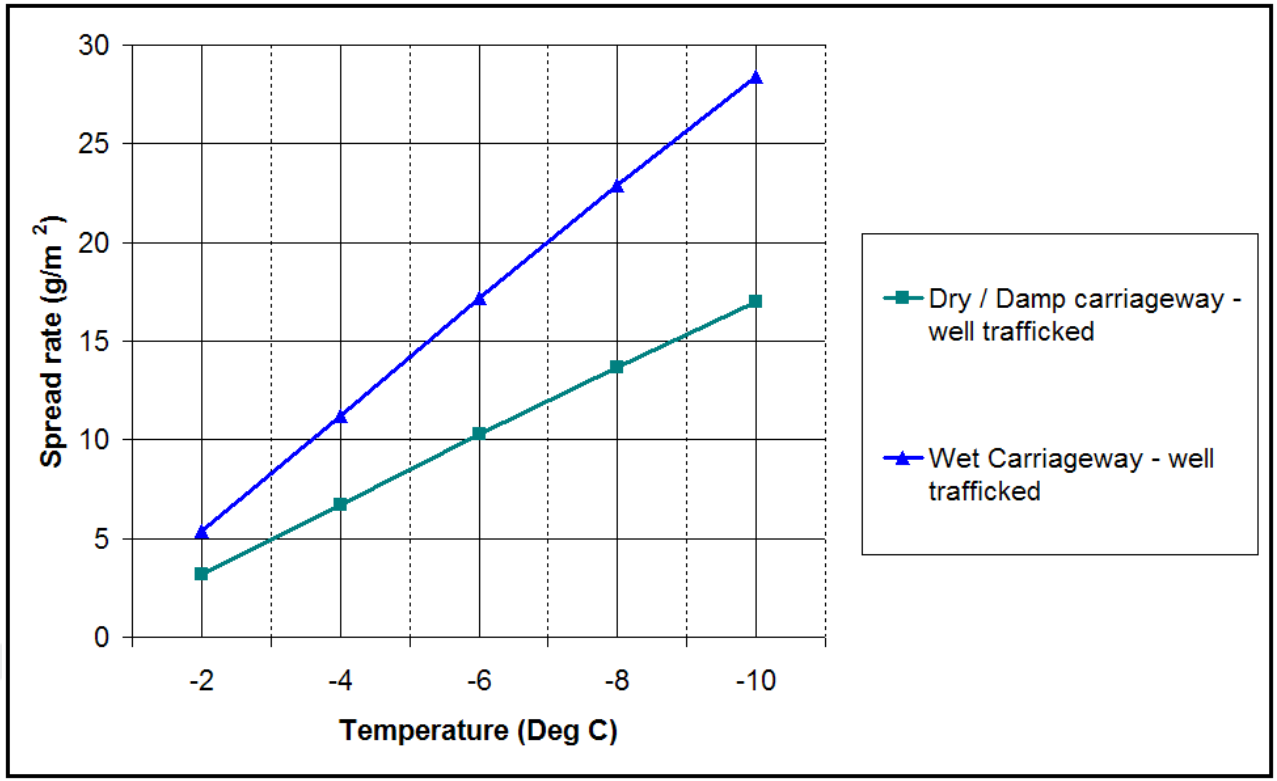
After 2 hours: 48% salt lost (lanes 1 – 3), 68% lost (lanes 1 – 2)

Taking other trials into account concluded **50%** loss appropriate.

After 25 hours: 85% salt lost (lanes 1 – 3), 86% lost (lanes 1 – 2)

6. NEW SPREAD RATES DERIVED

Theoretical pre-wetted salt spread rates.



2°C temperature bands converted to match those in the 'Treatment Matrix Guide'. Minimum spread rate of 8g/m^2 used.

(See paper for dry salt rates and rates for lightly trafficked roads)

Presenting New Spread Rates

Weather Conditions Road Surface Conditions Road Surface Temperature (RST)	Air Temp	Treatment		
		Dry Salting (g/m^2)	Pre-wetted Salting (g/m^2) (see Note 1)	Ploughing
Frost or forecast frost RST at or above -2°C		**8**	**8**	No
Frost or forecast frost RST below - 2°C and above - 5°C and dry or damp road conditions (see Note 3 if damp and lightly trafficked)		**10**	**9**	No
Frost or forecast frost RST below - 2°C and above - 5°C and wet road conditions (see Note 3 if lightly trafficked)		**16**	**15**	No
Frost or forecast frost RST at or below - 5°C and above -10°C and dry or damp road conditions (see Note 3 if damp and lightly trafficked)		**18**	18	No
Frost or forecast frost RST at or below - 5°C and above -10°C and wet road conditions (existing or anticipated) (see Note 3 if lightly trafficked)		**2 x 15**	**2 x 15**	No

Rate of spread for precautionary treatments may be adjusted to take account of residual salt or surface moisture unless stated otherwise within NMM 5.6.4 (AMM 36-02).

Notes:

1.Spread rates for pre-wetted salt is the combined weight of dry rock salt and brine combined at 70:30 proportion by weight respectively with a maximum brine concentration of 23% salt.

2.When ice has formed or snow is lying dry salting is the preferred treatment unless the road is closed to traffic when pre-wetted salting may be used. Pre-wetted salting is the preferred treatment in advance of such conditions.

3.Treatments should be carried out, whenever possible, after traffic has dispersed standing water. Successive half rate treatments (for both pre-wet and dry salt operations) should be considered for lightly trafficked roads at the lower end of temperature bands indicated.

Salt Savings (compared with 2009/ 10)

Weather Conditions Road Surface Conditions Road Surface Temperature (RST)	Air Temp	Treatment		
		Dry Salting (g/m^2)	Pre-wetted Salting (g/m^2) (see Note 1)	Ploughing
Frost or forecast frost RST at or above -2ºC		**-20%**	**-11%**	
Frost or forecast frost RST below - 2ºC and above - 5ºC and dry or damp road conditions (see Note 3 if damp and lightly trafficked)		**-50%**	**-50%**	
Frost or forecast frost RST below - 2ºC and above - 5ºC and wet road conditions (see Note 3 if lightly trafficked)		**-20%**	**-16%**	
Frost or forecast frost RST at or below - 5ºC and above -10ºC and dry or damp road conditions (see Note 3 if damp and lightly trafficked)		**-10%**		
Frost or forecast frost RST at or below - 5ºC and above -10ºC and wet road conditions (existing or anticipated) (see Note 3 if lightly trafficked)		**-25%**	**-17%**	

Rate of spread for precautionary treatments may be adjusted to take account of residual salt or surface moisture unless stated otherwise within NMM 5.6.4 (AMM 36-02).

Notes:

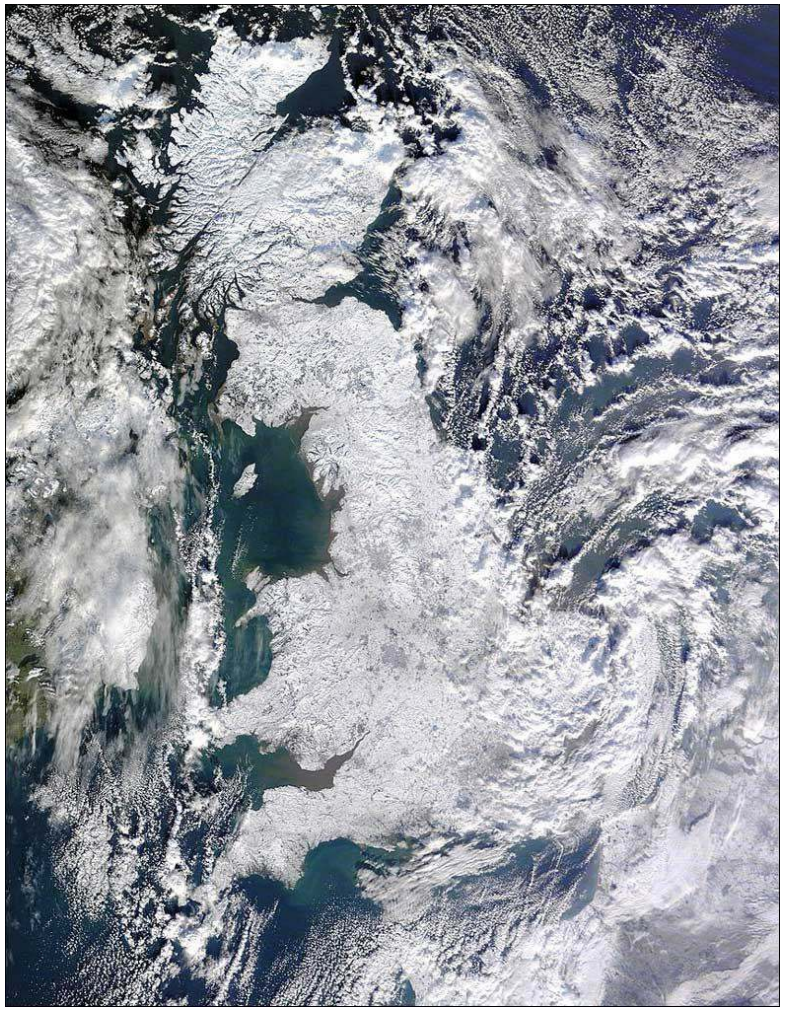
1.Spread rates for pre-wetted salt is the combined weight of dry rock salt and brine combined at 70:30 proportion by weight respectively with a maximum brine concentration of 23% salt.

2.When ice has formed or snow is lying dry salting is the preferred treatment unless the road is closed to traffic when pre-wetted salting may be used. Pre-wetted salting is the preferred treatment in advance of such conditions.

3.Treatments should be carried out, whenever possible, after traffic has dispersed standing water. Successive half rate treatments (for both pre-wet and dry salt operations) should be considered for lightly trafficked roads at the lower end of temperature bands indicated.

7. IMPLEMENTING & EVALUATING NEW SPREAD RATES

- ☑ Phased implementation planned
  - ☑ Pre-wet rates winter 2009/10
  - ☑ Guidance note on 'lightly trafficked'
  - ☒ Further incremental reduction
  - ☑ Immediate implementation to conserve UK salt stocks January 2010



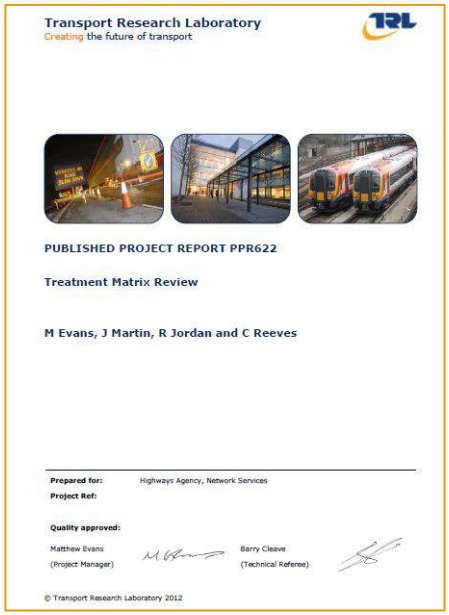
Evaluating New Salt Spread Rates

☑ No concerns identified 2009/10

☑ Confirmed as standard treatment rates 2010/11

☑ Formal review commenced January 2012

- ☑ Treatment matrix well understood
- ☑ No obvious issues from statistical analysis of (STATS19) accident data
- ☐ Improvements for specific conditions, e.g. heavy hoar frosts, treating after rain
- ☐ Cautious approach on surface wetness.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PUBLISHED PROJECT REPORT PPR622

Treatment Matrix Review

M Evans, J Martin, R Jordan and C Reeves

Prepared for: Highways Agency, Network Services
Project Ref:

Quality approved:
Matthew Evans (Project Manager)
Barry Cleave (Technical Referee)

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8. BENEFITS & CONCLUSIONS

- ☑ Improved resilience
- ☑ Reduced salt usage ≈ 30%
- ☑ Cost savings - £1.5M - £3M per annum (€1.8M - €3.7M)
- ☑ Environmental benefits
- ☑ Informed new spread rates for Local Highway Authorities managed by National Winter Service Research Group (NWSRG).

The End!

Thanks for listening

Be aware

In severe weather our winter teams need time and space to do their job.

HIGHWAYS AGENCY

Make time for winter
www.highways.gov.uk/informed