



Reducing Costs and Improving Efficiency Using Route Based Forecasting

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1. **What is Route Based Forecasting (RBF)?**
2. **How good is RBF?**
3. **Cost savings from using RBF.**
4. **What is Route Optimisation?**
5. **How do we optimise routes?**
6. **Cost savings from using Route Optimisation.**

1. INTRODUCTION

The Met Office works closely with our customers to continually improve our services to the transport sector.

This talk outlines two innovative services which reduce costs to our customers without compromising safety.

- Route Based Forecasting (RBF)
- Route Optimisation.

2. What is Route Based Forecasting (RBF)?

Domains



Representative for the domain.

Routes

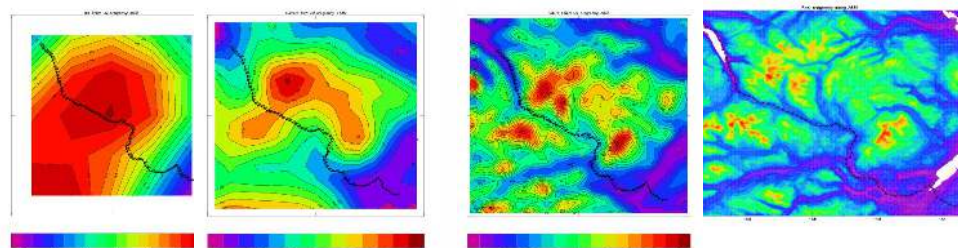
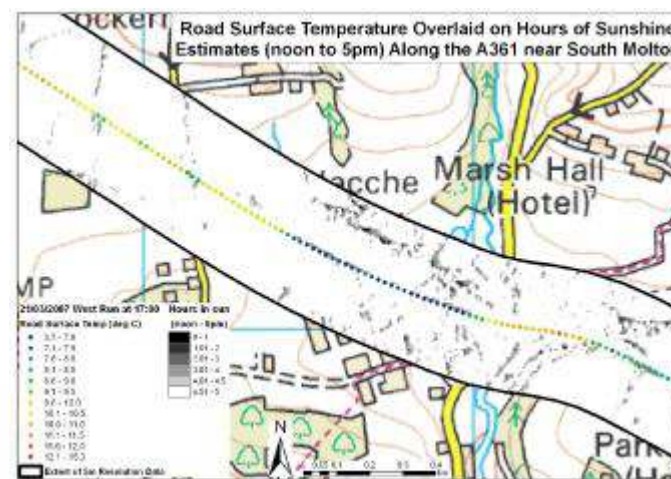


Representative forecast for the route.

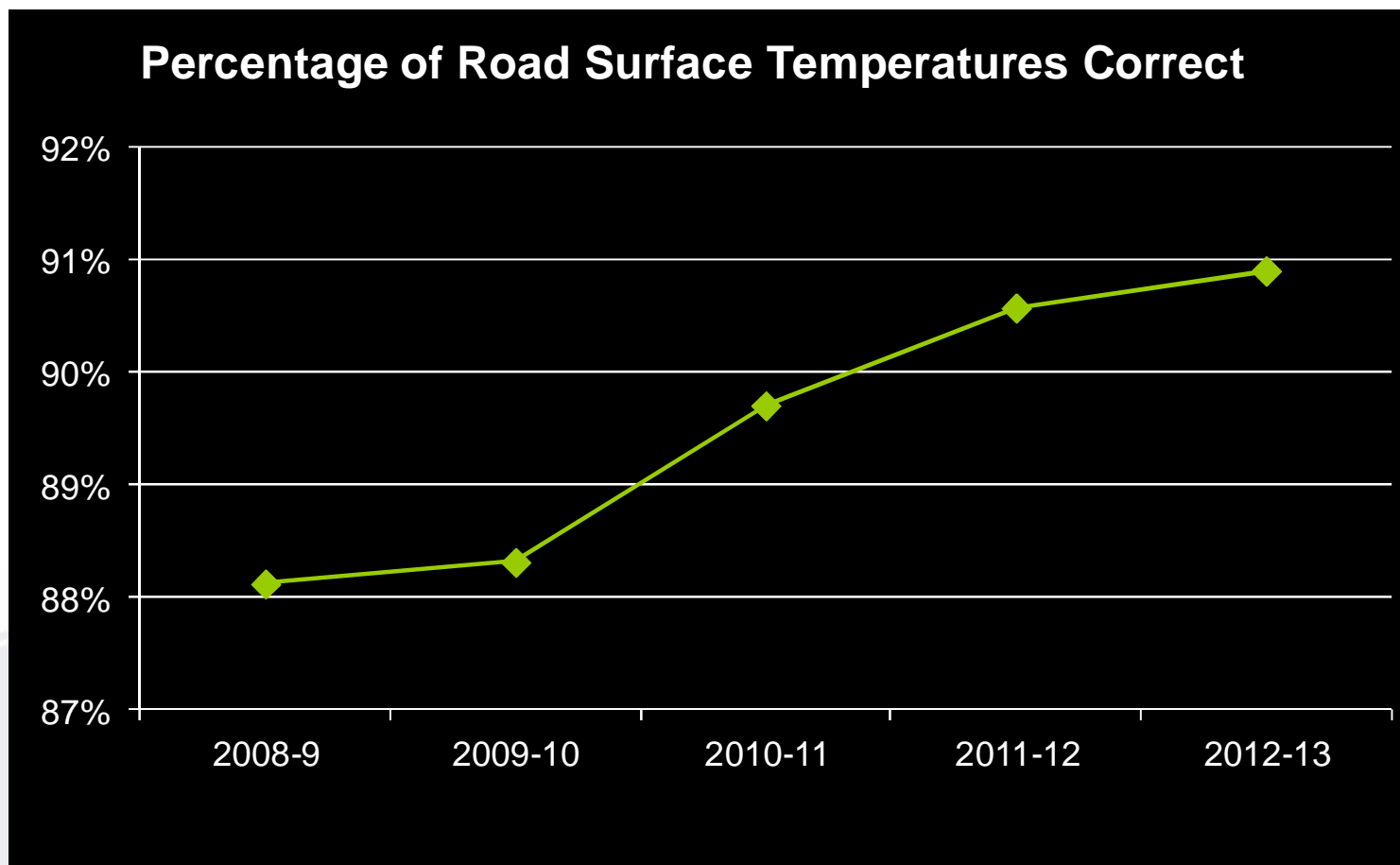
3. What does RBF add over Domain Forecasting?

As RBF is representative of the route localised features can be taken into consideration such as:

- Shading
- Skyview
- Traffic speed
- Traffic volume
- Orography



4. How accurate is RBF?

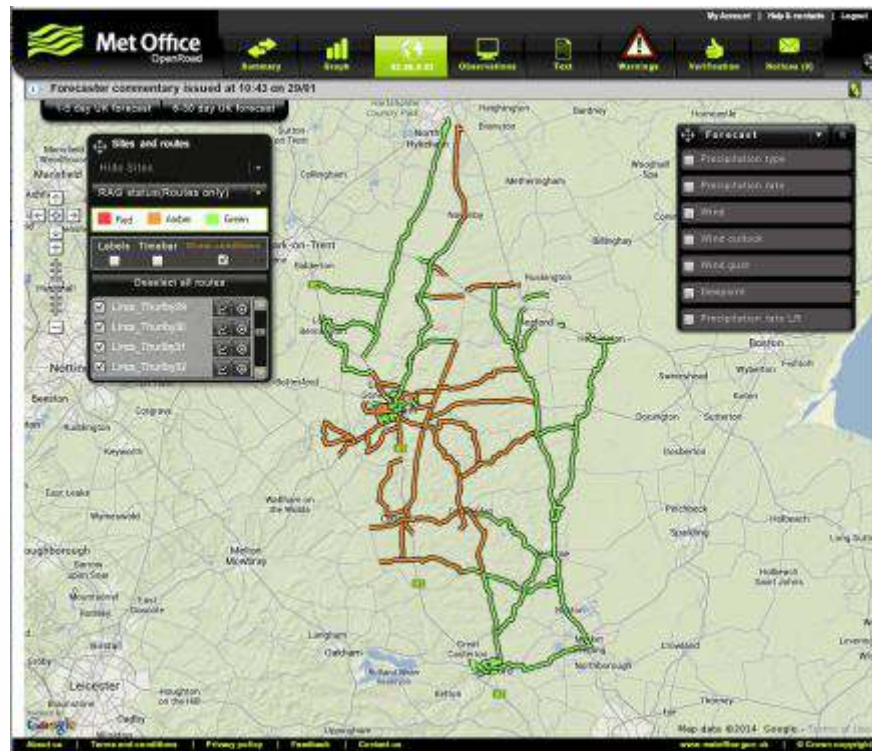


5. Benefits of RBF for the decision maker (part 1)

Colour state for the domain




Colour state for each route



Not all routes in the domain need treating

6. Benefits of RBF for the decision maker (part 2)

Colour state for the domain



24 Hour Domain Forecast for Lincolnshire
Valid from noon on Wednesday 29 Jan 2014 to noon on Thursday 30 Jan 2014

Forecaster Commentary: Assessment of RBF and Site-Specific Data
Generally good guidance given by the graphical forecast information today, however more clearer spells later this evening may allow RSTs to be up to 1C colder than suggested by the graphs.

Minimum Temperature and Hazard Summary									
Domain	Roadiness Colour	Min RST	Time Below Zero	% Prob Ice	% Prob Hour Frost	% Prob Snow (cm)	Fog	Strong Wind	% Prob Rain
Trent Valley	AMBER	PS01	N/A	30	00	20 (0)	N/H	N/H	60
Lincoln Ridge	AMBER	PS00	N/A	40	10	20 (0)	N/H	N/H	60
Wolds	AMBER	MS01	0400-0800	50	10	20 (0)	N/H	N/H	60
Coastal	AMBER	PS01	N/A	30	00	20 (0)	N/H	N/H	60
Grantham	AMBER	PS00	N/A	40	00	20 (0)	N/H	N/H	60
Ferland	AMBER	PS01	N/A	20	00	20 (0)	N/H	N/H	60
Wistech	AMBER	PS01	N/A	20	00	20 (0)	N/H	N/H	60

Colour state for each route



Route Based Forecast period: 12:00 on 29/01 to 12:00 on 30/01

Forecaster commentary issued at 10:43 on 29/01
Generally good guidance given by the graphical forecast information today, however more clearer spells later this evening may allow RSTs to be up to 1C colder than suggested by the graphs.

Domain summary table - 1: Trent Valley

Domain summary table - 2: Lincoln Ridge

Domain summary table - 3: Wolds

Domain summary table - 4: Coastal

Domain summary table - 5: Grantham

Domain area forecast issued at 10:43 on 29/01
As Trent Valley

Route	RAG (Risks)	Min RST	Time of RST below 0°C	Time of RST below 2°C	Ice	Hour frost	Rain	Snow
Linca_Ancaster25	Amber	6.7	N/A	21:00 - 10:00	N	N	N	N
Linca_Thurby25	Amber	6.7	N/A	21:00 - 10:00	N	N	N	N
Linca_Ancaster28	Amber	1.3	N/A	22:00 - 06:00	N	N	N	N
Linca_Thurby28	Amber	1.4	N/A	08:00 - 06:00	N	N	N	N
Linca_Ancaster24	Amber	1.7	N/A	05:00 - 07:00	N	N	N	N
Linca_Ancaster27	Amber	1.7	N/A	04:00 - 07:00	N	N	N	N
Linca_Thurby21	Green	2	N/A	N/A	N	N	N	N
Linca_Thurby22	Snow	2.1	N/A	N/A	N	N	N	N

Domain summary table - 6: Ferland

Domain summary table - 7: Wistech

Not all routes in the domain need treating

7. Savings of RBF over a domain decision process on Marginal Nights*

Results from a pilot study – 50 nights from Feb to Mar 2013

Customer	Km saving from using RBF	Average saving from using RBF on marginal nights	Average % of Network
Lancashire County Council	5 222 (8 marginal nights)	652	26.4%
Balfour Beatty Area 10	1 913 (7 marginal nights)	273	22.7%
Lincolnshire County Council	2 057 (5 marginal nights)	411	13.9%
Wiltshire County Council	124 (2 marginal nights)	62	27.0%
Enterprise Mouchel Ltd Area 1	54 (1 marginal night)	54	8.9%
		Overall average % of Network	19.7%

Approximately half of de-icing nights are marginal therefore 9.9% can be saved on de-icing actions

* - Marginal nights are defined as forecasted road surface temperatures between -2C and 2C.

8. Reducing costs through Route Optimisation

Factors affecting optimisation

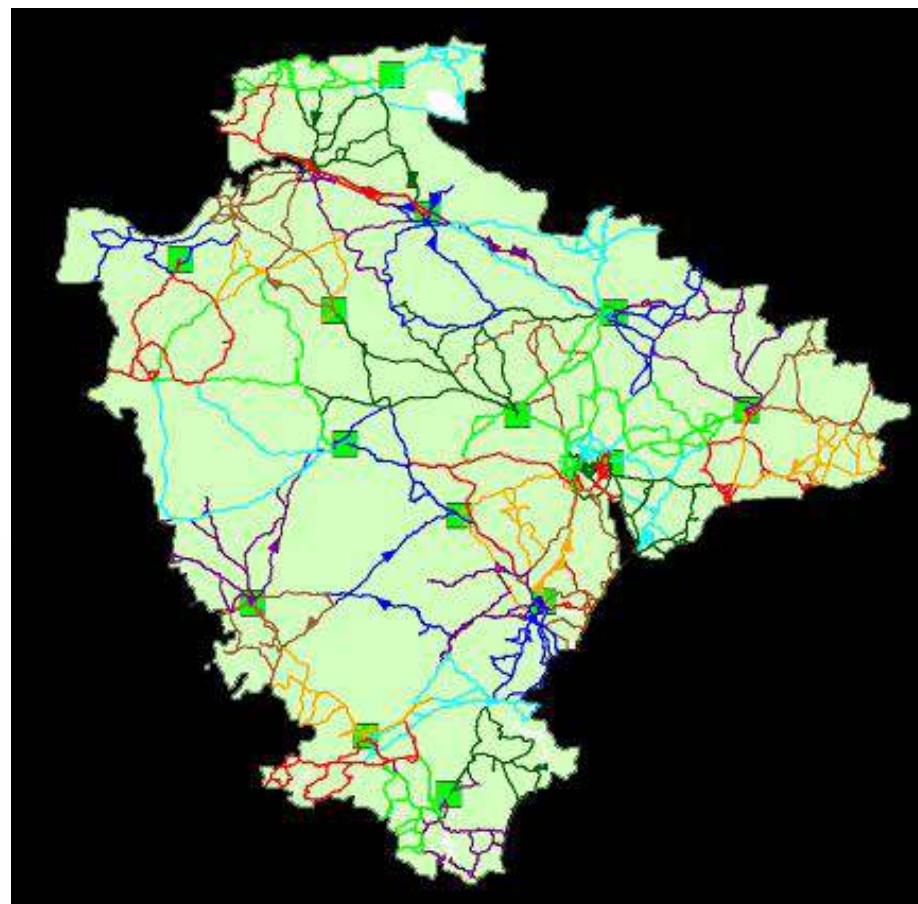
- Logistical

How to deliver the same service for less >>> mileage, fuel, fleet, labour

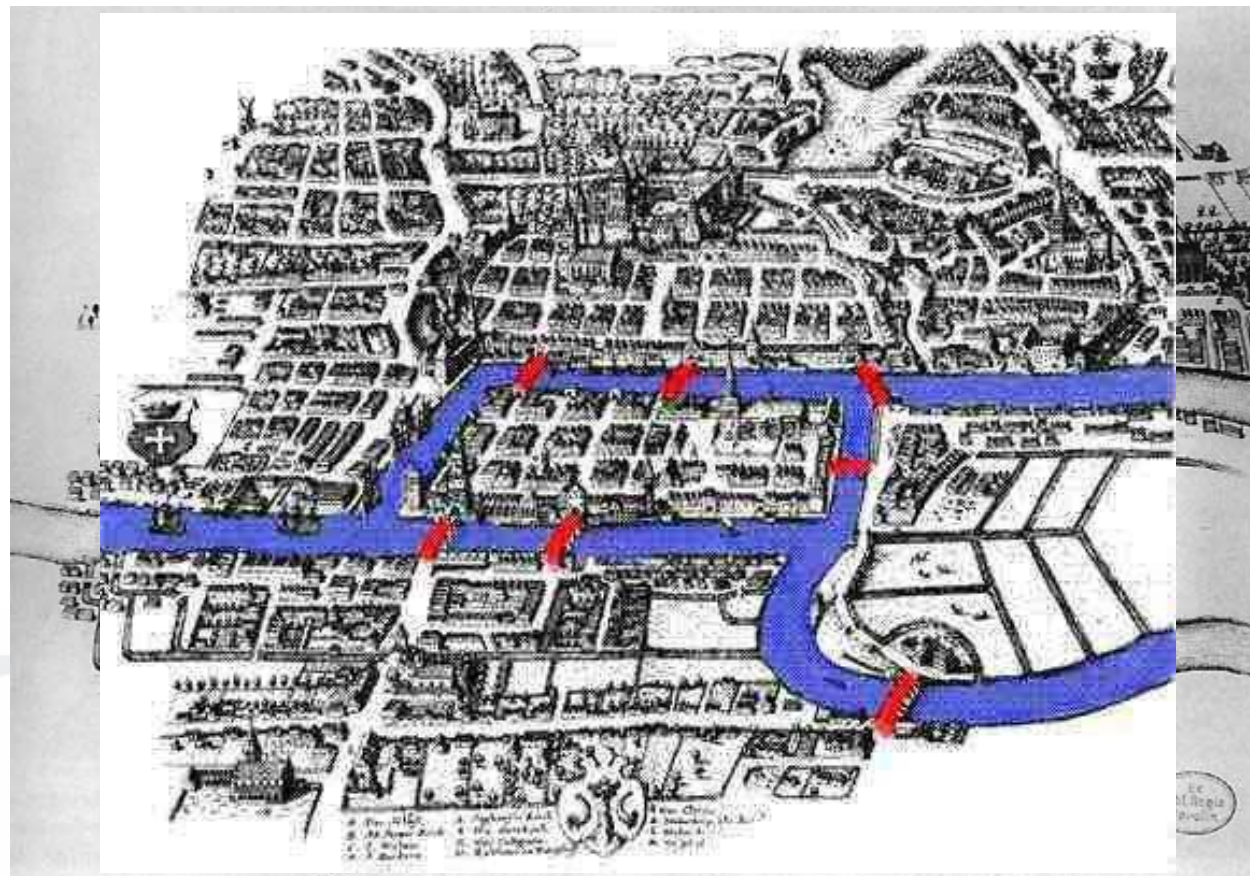
While keeping driving times below 3 hours.

- Climatological

How to deliver the same for less than above
>>> Selective domain / route treatment.

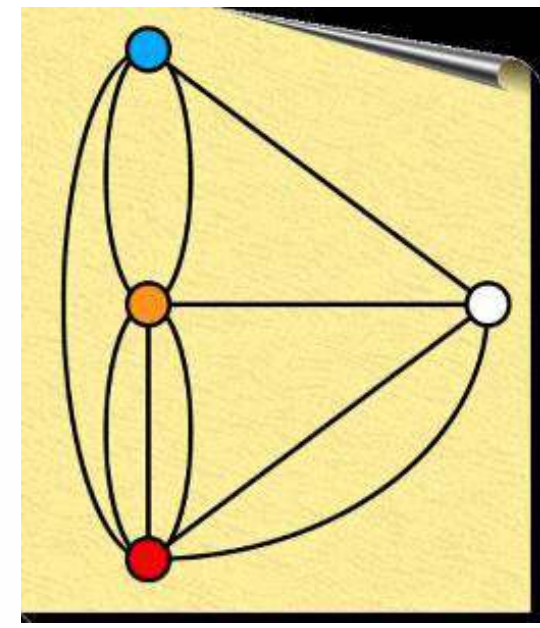
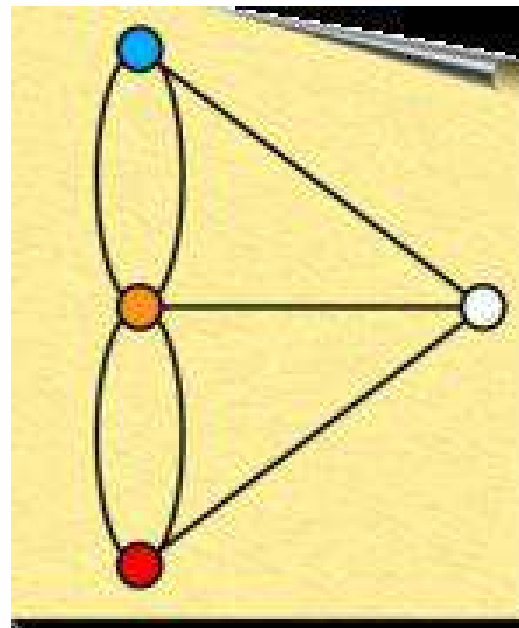


9. Route Optimisation - Königsberger Brücken problem



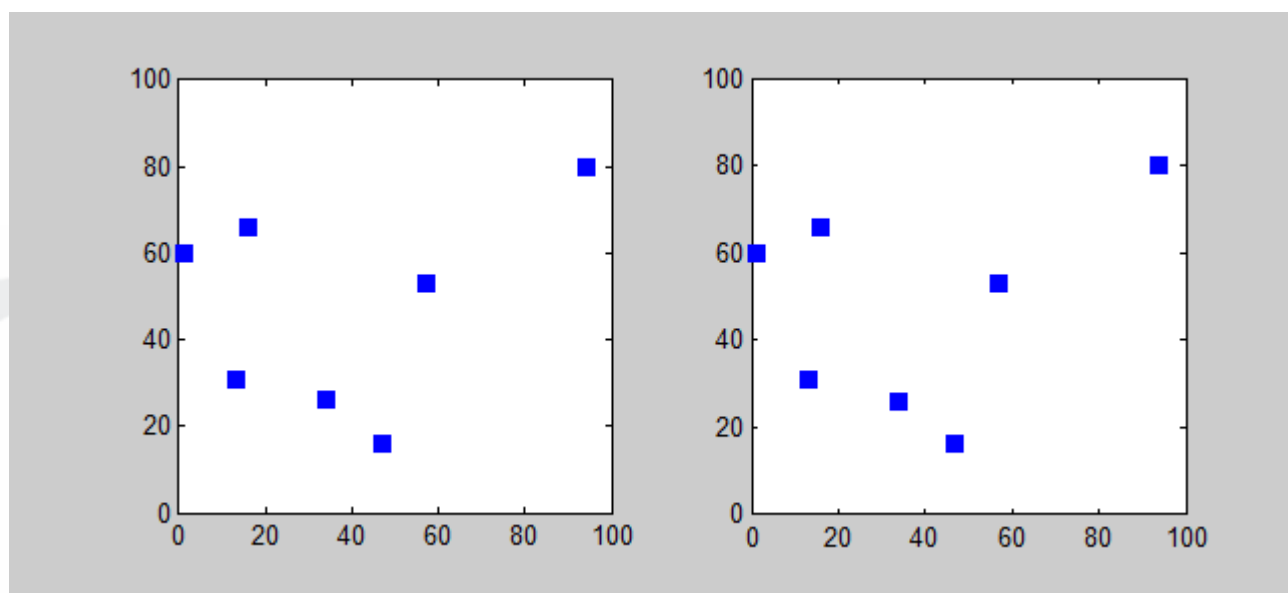
10. Reducing costs through Route Optimisation

- Far more complex road network
- Many routes and several depots
- Multiple passes along specific stretches
- Different speeds for different roads
- Time limit / salt capacity for each run
- One way streets / turn restrictions

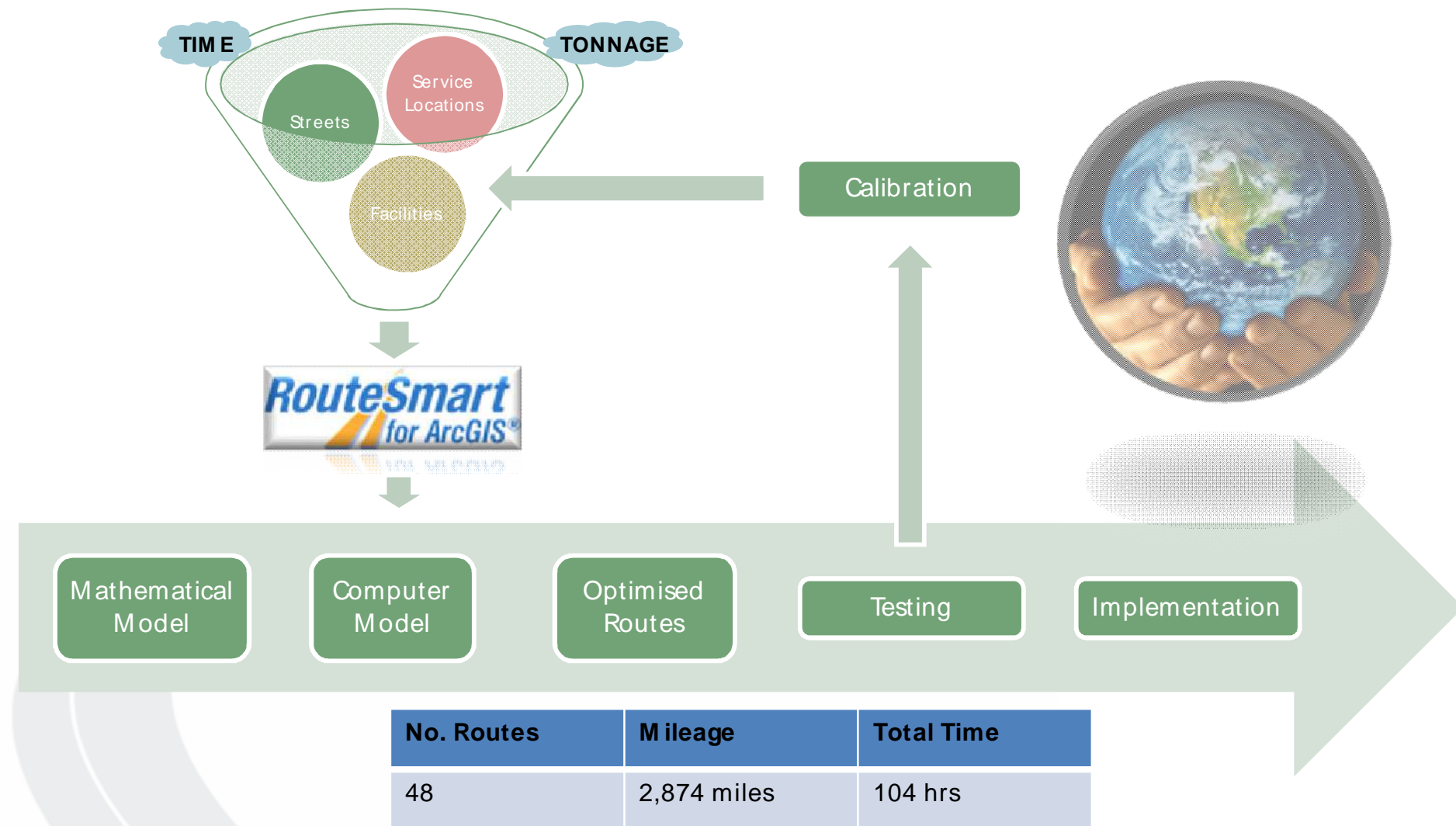


11. Aiming to find the optimal solution?

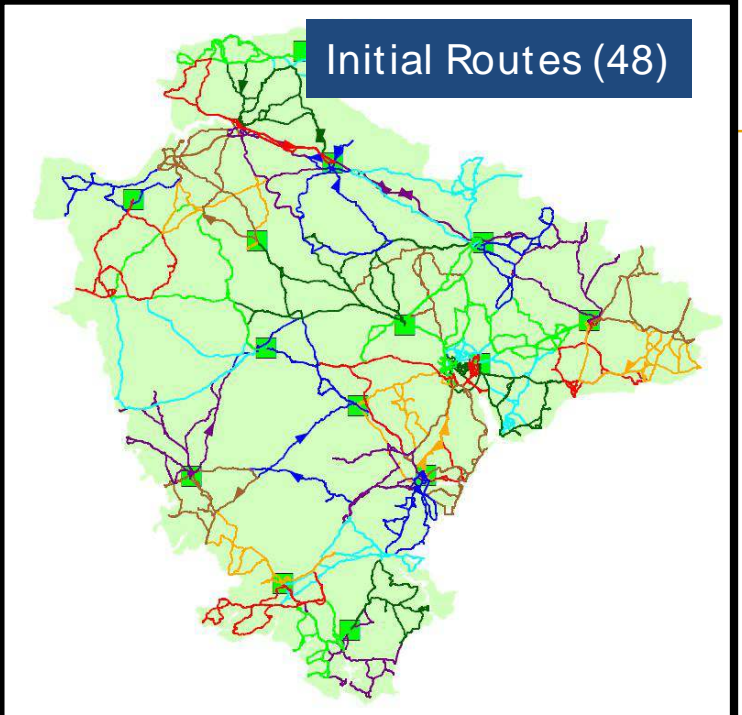
- 7 route sections = $(7-1)!/2 = 360$ combinations
- 14 route sections = $(14-1)!/2 = 3,113,510,400$ combinations



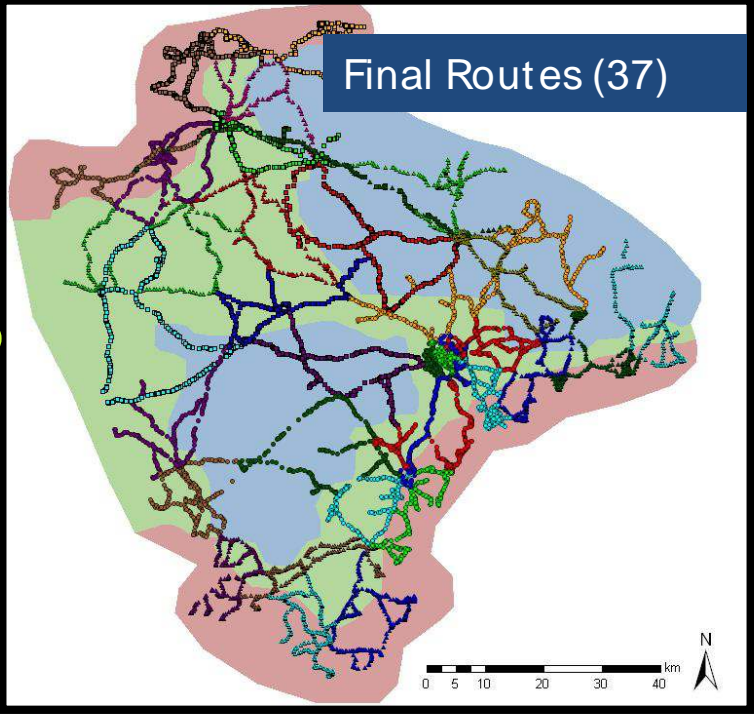
12. The process



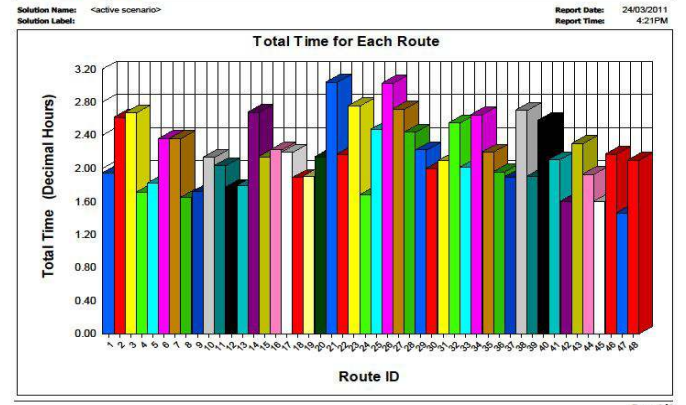
Initial Routes (48)



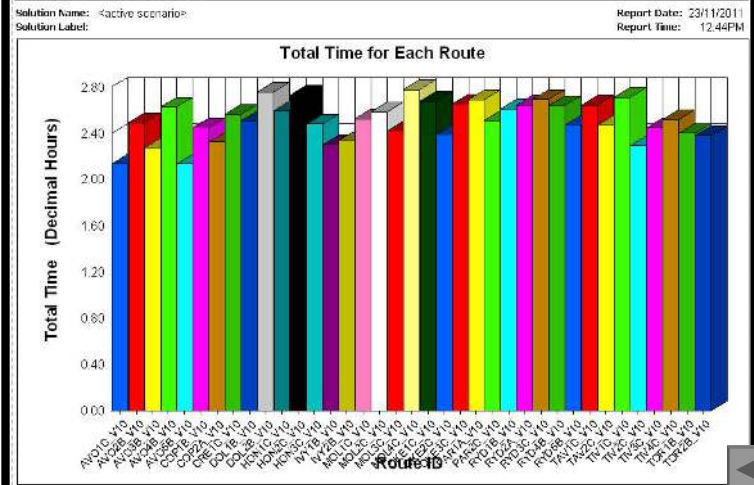
Final Routes (37)



Route Summary Chart



Route Summary Chart



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14. Summary

- **Route Based Forecasting** - 10% saving on expendables i.e Fuel, Labour, Deicing chemical.
- **Route Optimisation** - 8% saving on expendables i.e Fuel, Labour, Deicing chemicals. Plus reduced assets i.e Lorry Fleet.

15. Questions

Questions?