



Improving Winter Resilience on UK Roads

A Winston Churchill Fellowship Report by Mark R. Corbin

December 2020

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JAN-FEB
2020

May I have your attention please?

To truly appreciate my journey, and why I have pursued this topic, I need to take you back to both a period and a person of great significance in my life.

My grandad Mervin Clarke, was born on the Caribbean island of Barbados in November, 1926. As a young man of 29 years old, he left Barbados in 1955 and emigrated to England. Whilst in England he lived in Harlesden and Willesden Green in Middlesex, where he made his living. He was an engineer with British Rail, and it was his approach to work that set the benchmark for me when it pertains to people and resilience. For 27 years, he worked for British Rail and never missed a day from work! Why is that important for me to tell you? Well, that is part of the context within which I consider my own resilience and sometimes that of others.

He was a man from the Caribbean who came into a foreign place knowing nothing about the environment and its extremes, particularly in winter, but made it out to work every day for 27 years. This was my grandad, and I hold him up in high esteem in the personal resilience stakes. On reflection, my journey is similar to my grandad's, as I too left Barbados and came to live in England, in September 2001.

I came in the pursuit of furthering my education and have subsequently gone on to a career in the Transport, Highways and Traffic sector where I am continuing to deepen my understanding of how we manage winter and resilience. I have always been fascinated and curious about winter because coming from the Caribbean, it was a new season for me.

I am seriously warm-blooded and was born in the sun, and for most of my life, I became accustomed to lots of it, coupled with a wet season characterised by rain and occasional hurricanes.

When you move to a country like England, you have to make a number of adjustments in order to be successful; perhaps one of the biggest ones for warm-blooded migrants like me, is adjustment to the weather and specifically winter.

As I have worked through my career from Oxford, Reading, Telford, Walsall and now Birmingham, I have grappled consistently with the weather and its impacts in my 20 years in England. Some days I have won and there are others when I am floored - unlike my grandad! For some time, I have been curious also by the response of people in the United Kingdom to winter events. I could never understand the element of surprise that always comes to the fore on the first day of a winter event.

Furthermore, given the numerous channels of information that we have in this generation, it is somewhat peculiar that we continue to behave the way we do in relation to winter and adverse weather. So, this curiosity and fascination have really been sitting in my mind, and I have always wondered, but why do we respond the way we do? Is this a normal behaviour or do we need to significantly improve our resilience as people on this island?

In 2018, while having a casual conversation with a friend, just out of the blue, she mentioned to me that I should apply for a Winston Churchill Fellowship, which is something that I had never previously heard about.

So, I decided to find out more and subsequently did some research to better understand what this was all about. I later found out much to my delight, that the Winston Churchill Memorial Trust offers 150 fellowships every year to British citizens who desire to travel to research topics of interest, in order to return to the UK with the knowledge that they have gained and embed that into their sector across the country. This was my moment! I saw this as the opportunity to go see how other cities across the world manage their winters and to observe how people respond, with a view of discovering what I could learn and bring back to the UK.

What you are about to read in this report is my learning journey from the seven cities that I visited during January and February 2020. This is not intended to be an academic report, rather, it focuses on the insights that I have gained from discussions with professionals in the sector. These are the people who are driving change, influencing travel, and helping to keep the economies of their cities moving during periods of disruptive winter events.

My Churchill Fellowship journey took me to Calgary, Toronto and Winnipeg in Canada. On my European leg, I visited Helsinki and Tampere in Finland and finally completed my journey in Stockholm and Borlange in Sweden.



MERVIN CLARKE

I am humbled and grateful for the valuable time that was offered to me by strangers who have become friends, and distant colleagues who work tirelessly for the organisations that I visited. They all gave me a huge amount of time and were prepared to be very generous with their knowledge, and opened about their experiences.

My objective in taking forward this work is to seek to find areas where I can lift out some of the best practices from my travels that I may then be able to embed into my work in the United Kingdom, and hopefully, this report will be welcomed. Of course, I want to thank you for your interest in reading it, and I will welcome your comments and feedback from anything that you will read on the following pages.

Thank you.

Mark R. Corbin,
Churchill Fellow 2019
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EXECUTIVE SUMMARY

Executive Summary

Winter service is a highly specialised area requiring technical expertise across the UK, in order to keep our roads and transport system functioning safely, during six months of the year from October to March.

To examine where we could learn more to enhance our mature approach, I went on a Winston Churchill Fellowship during the months of January to February 2020. During my Fellowship, I conducted more than 50 interviews with winter maintenance professionals, residents, and users of the road system in the cities of Calgary, Toronto, Winnipeg, Tampere, Stockholm, and Borlange.

I found that professionals across all cities visited are doing great work serving their citizens, but there is great pressure on the majority of these services. Data remains the most important component in winter service and this is obtained through Road Weather Information Systems (RWIS) and weather forecast. The subsequent decisions taken on this information requires a highly skilled and well-trained workforce adhering to levels of service.

The triggers for the levels of service can be before, during, and after a winter event. Many of these cities are now responding to the rise of active travel, particularly in cycling, and this is seeing changes being made to the levels of service.

Winnipeg in Canada represents a good example in how to vary the levels of service, to take consideration of the demands from the communities for winter cycling.

To achieve bare pavement on local roads and priority routes as specified in the levels of service requires heat from engines, churning of the pavement, and tyres to create the brine. So in places like cycle lanes where these are lightly traffic the expectations of users need to be carefully managed. This is an area that is continuing to increase in demand for winter maintenance professionals.

Challenges around the growth in cities and the loss of locations that can be used for snow removal were highlighted as critical issues for some cities visited, as snow disposal sites continue to be allocated to housing developments.

Some cities such as Toronto and Stockholm are in a constant battle to balance the requirements for more housing, along with the need for continuing to make space available for snow disposal. This was a particular challenge of note for winter maintenance professionals across the cities visited.

Again, all cities visited are facing the same issue with the use of rock salt (calcium chloride) as the main material used in ice-control.

All professionals acknowledge the damaging consequences on the environment, infrastructure, and mitigations in the form of new materials and salt-management plans are in place. I found the discovery of a multi-component salt product developed in Russia and showcased in Tampere, to be significant. The multi-component product and its associated approach saw a return to normal for the soils and vegetation in Moscow over a ten year period.

Finally, when I started this journey, I wanted to understand the first-day effect of winter events in the countries visited. It is worth noting that although all the nations visited have much more snow than the UK, the first-day effect is still a real thing. The key to combating this is extensive and sustained communications. The 311 service across Canadian cities was my most important finding regarding communications.

This is a consolidated customer service centre that places the community at the heart of delivery by simplifying the communication chain, and in all the cities visited it was very well understood and extensively used by residents during winter. In Calgary, the development of a multicultural strategy to address the needs of minority communities was also worthy of note, because of its impact and the desire of the city to be proactive with its communications.



The following are my main recommendations for the UK:

1

In the UK, there are too many customer contact channels in the transport system, creating a web of complexity for users of the transport network when there are issues and concerns to report. Further research is required on what a centralised transport communications hub similar to 311 in Canada could look like.

2

Invest more in the infrastructure, underpinning decision making to ensure that we have access to the best available data from the best sources, and that all equipment is functioning and participating in the delivery of accurate data.

3

Implementing an annual media briefing as part of the planning for winter, to provide clarity on the approach and access for the media to winter professionals. This is well attended in Calgary and helps to build relationships with the media as part of the winter programme.

4

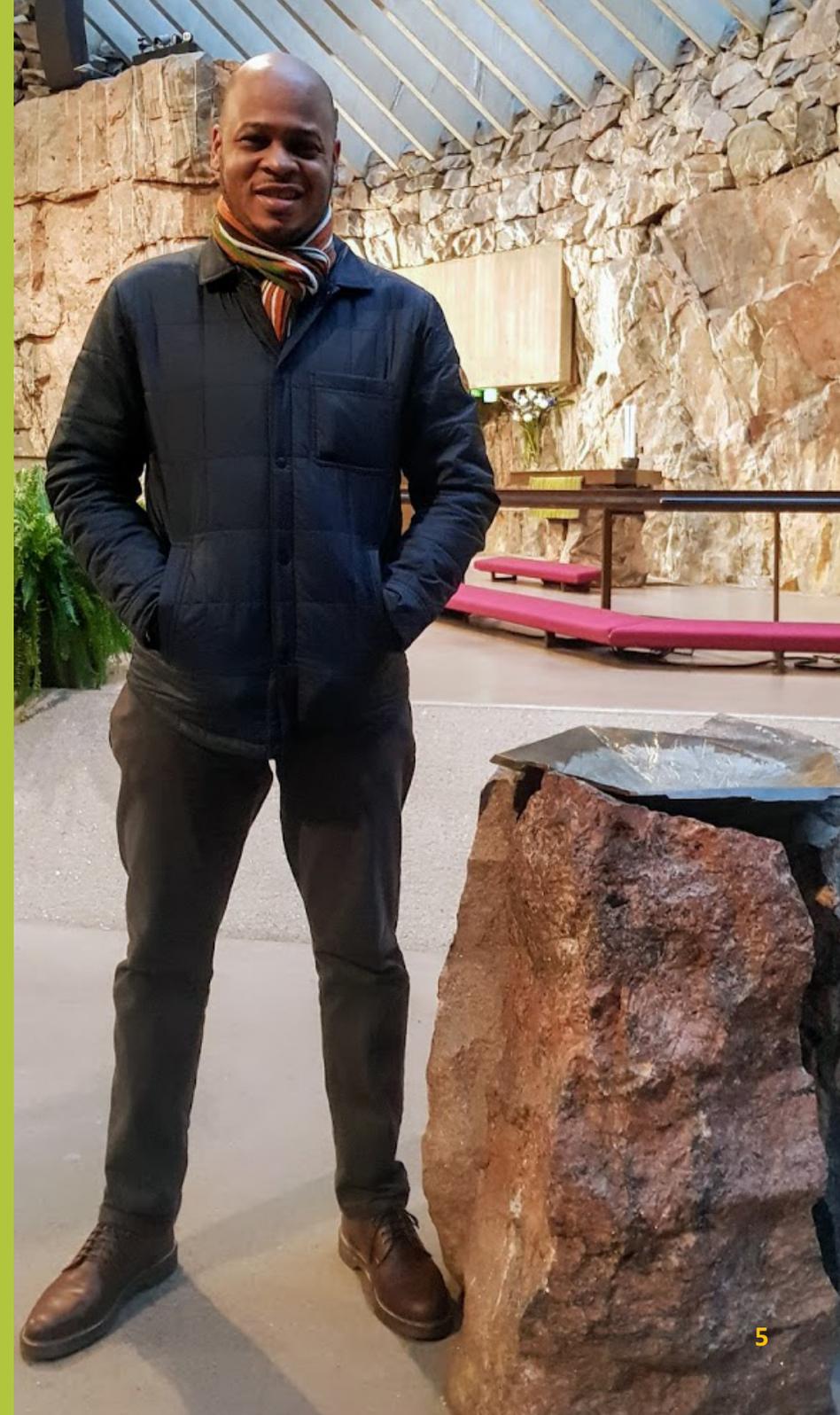
Further explore the work of the National Association of Winter Road Maintenance in Russia, and the multi-component products being used to improve the environmental impacts from salt and to further improve the salinity of soils and the environment. There is a vital need to look beyond Sodium Chloride.

5

The resilience of people and our behaviours needs to change, and this must be reinforced through a national campaign or a new body, setup to support transport resilience at a national level.

6

Collaborations and data sharing across the private sector and public bodies hold a vital role in improving customer experience and there is a need to remove the barriers to collaboration, for the greater good of our communities.





toronto.ca/snow

SNOW PLAN

KNOW ABOUT SNOW IN TORONTO

Winter in Toronto is cold and snowy. That's why the City of Toronto is ready with a snow clearing plan. We all have a role in keeping streets and sidewalks safe. Here is what you need to know this winter.

What we do



When we clear snow

All roads, including bike lanes, are salted first. Plows go out later.

Road Type	When does the City start salting?	When does the City start plowing?	How much snow is that?	How many hours after the snow stops falling does it take to clear an average storm?
Expressways (Don Valley Parkway & Gardiner Expressway)	When snow first accumulates	2.5 cm	Quarter	2-3 hours
Major roads, streetcar routes, bus routes, streets with hills and bike lanes		5 cm	House key	6-8 hours
Neighbourhood roads		8 cm	Bank card	14-16 hours



Sidewalk Clearing - We all have a role

What the City of Toronto does:

Sidewalk plows clear about 6,400 km of Toronto's 7,900 km of sidewalk, but they don't fit everywhere.

What residents and business owners must do:

Where sidewalk plowing is not available, please clear snow and ice from your sidewalk and nearby fire hydrants within 12 hours of a snowfall.

Do not push snow on the road or into bike lanes, it's dangerous and illegal.

What it takes to clear snow and ice



Toronto's roads



Driveway Openings: "Windrows"



A windrow is the snow left at the end of a driveway after a snow plow has cleared your street.

In the hours after the snow stops falling, plows with special blades clear the openings of about 262,000 driveways (houses) to an opening of no more than three (3) metres wide.

These plows can only operate where there is no on-street parking, roads are wide and there are no other obstacles.

Did you know?



There's a service for seniors and people with disabilities in areas where sidewalk plows don't operate. toronto.ca/snow



Toronto has a Salt Management Plan that manages how we use, store and transport road salt. toronto.ca/salt



We will test smaller plows this winter on some sidewalks that serve seniors or people with disabilities and are not currently able to be plowed.

Major Snow Event



What are "Snow Route" road signs?

Toronto will declare a major snow event when there's a lot of snow. During the event, parking is prohibited for about 72 hours wherever you see these snow route signs so that snow can be removed.

PlowTO Map



Use the PlowTO map to track snow clearing equipment in real-time and provide an approximate time frame for when an area was last cleared. toronto.ca/PlowTO

Source: From Winter 2019 Orientation



INTRODUCTION AND APPROACH

INTRODUCTION AND APPROACH

This report brings together all the learning gathered from my Churchill Fellowship travels to three countries and seven cities across North America and Europe. My research topic was Improving Winter Resilience on United Kingdom (UK) Roads. I travelled to Canada, Finland, and Sweden and focused on understanding how these cities are managing their winter programmes. As I commence the writing of this report, the UK is coming out of the grip of back to back storms - Ciara and Dennis. These winter storms have brought heavy rains and strong winds¹ but in the context of this report - no snow!

OBJECTIVES

1. To investigate techniques applied in other parts of the world to gain an in-depth knowledge and understanding of the contemporary approaches to managing winter events.
2. To capture the approaches used by the cities visited, through a series of interviews with key staff with responsibility for winter service or support services.
3. To draw a comparison with the UK approach and to determine best practices applicable for implementation in the UK.

SCOPE

Through investigation of the techniques applied in other parts of the world, I wanted to gain in-depth knowledge and understanding of the contemporary approaches to managing winter events. In the UK, we have very good practices which are generally applied from October to the end of March each year. However, although our statutory procedures are mature, we must not be complacent. We must keep seeking to improve the experience of those who use the road network and wider transport system during winter.

I acknowledge that I am undertaking this Fellowship study at a time when as a sector, we are being challenged to recognise that winter resilience is changing with an emerging focus not just on snow and ice control, but also extreme weather encompassing storms, flooding, and heavy rainfall being driven by climate change.

On my travels, I paid particular attention to data, legislation, policies and by-laws, materials and communications channels used, to enable successful delivery of winter service. In Finland, I attended the 32nd Annual Winter Road Congress² in Tampere, which featured winter professionals from across the Baltic and Nordic nations all sharing best practice approaches and learning.

METHODOLOGY

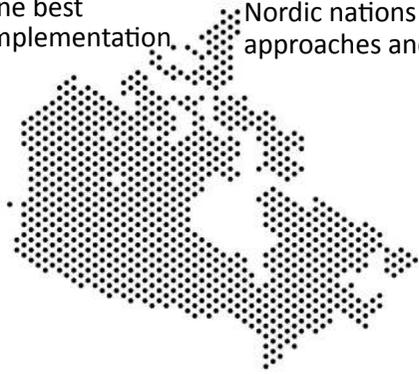
I chose to go to Canada and Scandinavia because these nations' climatic conditions cause them to deal with a lot more snow and adverse winter conditions when compared to the UK during winter. Snow and climatic conditions, though the critical parts of winter, aren't the only factors requiring examination when considering resilience. I also wanted to understand how citizens living in these nations engaged with, and responded to the messages and advice given by their authorities. In the UK, we often suffer from the first day effect of winter events i.e. irrespective of how much communications and engagements have been prepared and issued to our communities - the surprise factor still prevails on day one. This behaviour was a key area that I wanted to explore with residents and officials in the cities visited.

My research was focused on a series of semi-structured interviews with key stakeholders, first in the UK, and then within the cities visited. In terms of stakeholders, this was mainly city officials, public transport operators, and communication specialists.

Throughout my travels, I used Uber and taxis extensively and these trips proved very helpful in validating the information being gathered from the city officials, particularly across Canada. With their permission, I was able to voice record Uber and Taxi drivers whose experiences of using the road network was invaluable.

The stakeholders were selected through professional association, recommendations for colleagues, their international reputation on the subject, and organisations with a reputation for good management of winter in their cities.

I conducted over 50 interviews, most of which were between 30 - 45 minutes. Prior to leaving the UK, I attended the annual Cold Comfort Conference³ in May 2019 held in Harrogate. This is the UK's main event where the industry winter maintenance professionals gather to share experiences and best practice. There were also attendees from the United States and Finland.



UNDERSTANDING WEATHER IN THE UNITED KINGDOM

The UK has a temperate climate for which it has become very well known around the world. Our geography sees us straddling the higher mid-latitudes on the western seaboard of Europe. It is not uncommon to experience frequent changes in pressure and unsettled weather, due to the close path of the polar jet-stream.

Generally, we get cool wet winters and warm wet summers. The UK is not known for extremes in temperature be that hot, cold, wind, or drought that tend to characterise other climates. That said, it has been my observation over the years, that many types of weather can be experienced in a single day.

In the West Midlands where I work, our weather forecast is provided by Met-desk⁴ as part of our winter service delivered by the seven local highway authorities. From my pre-travel discussions⁵ with Met-desk, it became quite clear that the jet-stream, its position, and strength dictate the type of weather that we experience in the UK.

The jet-stream is usually located to the north of the UK near Scotland, but it can meander and shift position north and south relative to the UK. It is this shifting pattern that mostly impacts the type of weather we experience.

When the jet-stream shifts to the South of the UK, this allows colder air to filter in from the North resulting in more road frosts and the potential for any precipitation to fall as snow. A shift to the North allows warmer air to filter in from the African continent, which results in milder conditions but also a higher likelihood for what forecasters term as 'marginal nights' – nights when road surface temperatures are between +1 and -1 degrees Celsius making it less predictable and more difficult to tackle.

Roads in the UK are managed by multiple organisations and this is not always easily understood.

In England, the Strategic Road Network (SRN) of 4200 miles,⁶ comprising motorways and important A Roads (also called Trunk Roads) is operated and maintained by Highways England; formerly known as the Highways Agency. There are 11 sections of this network that are operated by private companies on what are known as Design, Build, Finance, Operate (DBFO) contracts. Overall the Highways England network represent only two percent of all roads in England by length, but carry a third of all traffic by mileage, and two-thirds of all heavy goods traffic.

WINTER MAINTENANCE IN THE UK

Funding for the SRN is allocated through the Road Investment Strategy⁷ which covers a five year period known as a Road Period.

The vast majority of remaining roads in England are managed by 154 local highway authorities, or what people commonly refer to as The Council. These roads are significantly less funded when compared to the SRN and are constrained by annual budget setting.

In the UK, maintenance of the highway is a statutory function for highway authorities where compliance to the 1980 Highways Act⁸ is required. The Act places a legal duty on highway authorities to provide a winter service, which is reasonably practicable and will permit the safe movement of traffic along a priority network. The aim is to minimise delays and collisions during periods of low temperatures, ice, and snow.

The provision of this winter service by highway authorities is constantly under pressure due to diminishing financial resources, increasing demands from residents and businesses, more lane miles being added due to capital projects, changing climate conditions, and the wider need of the industry need to find the next generation of winter professionals.

As part of the winter service, authorities will define a network which is treated each time there is a trigger. These triggers are determined by evidence or data from the weather forecast which considers road surface temperature, surface condition, air temperature, wind, precipitation, humidity, dew point, etc. A network of Road Weather Information Systems (RWIS) is vital for the successful delivery of winter service and accurate forecasting across the UK, as data drives all the decision making.

Ice control in the UK is predominantly done by the use of rock salt. The West Midlands highway authority Sandwell is a representative example of a typical authority in that region. Sandwell uses 6mm graded Thawrox Rock Salt⁹ from the largest salt mine in the UK located in Cheshire, which typically spread rates are 10,15 or 20g/m².



When it snows, we have a plan

Once a snowfall ends, the Council-approved seven-day snow plan comes into effect city-wide.

The plan sets out which roads, sidewalks, bikeways and pathways our crews will clear, to what extent, and on which day. While it's still snowing, and before the plan is activated, crews are out on major roads plowing snow to prevent build-up and applying anti-icing material.

Over 16,000 lane kilometres



Did you know? This would be equivalent to driving back and forth between Calgary and Edmonton 54 times.

Responsible clearing

The City follows a Council-approved Seven-Day snow plan, to maintain a safe network while being budget conscious. Our snow plan does not include:

- Plowing residential roads down to bare pavement
- Snow removal from residential areas
- Clearing back lanes, alleyways or engineered walkways



What we lay down

Keeping our roads clear and safe takes a lot of material. In 2018 we used:

- Nearly 95,000 tonnes of salt
- Almost 42,000 tonnes of pickle (salt/gravel mix)
- Over 1.2 million litres of anti-icing agents



Did you know? Most of the gravel material we lay down is picked up during The City's Street Sweeping program in the spring.

Learn more at calgary.ca/snow

What it costs when it snows

\$1.2 million is the cost to clear Calgary's roads

\$85,000–\$100,000 is the cost to clear Calgary's sidewalks

\$25,000–\$35,000 is the cost to clear Calgary's pathways

\$6 is the average monthly household cost for snow clearing on your property tax.



Day 1

OF SEVEN-DAY PLAN



Completed within 24 hrs.
4,030 lane km of roads (25% of all roads)
477 km of pathways
617 km of sidewalks

Major roads are Priority 1

City Crews work during snowfall and 24 hours after snowfall ends, plowing and removing snow on Priority 1 routes.

- Major roads plowed to bare pavement include: Crowchild Tr., Memorial Dr. and Macleod Tr.
- Downtown
- Pedestrian overpasses
- LRT platforms
- Downtown cycle tracks
- Designated sections of pathways and sidewalks along City-owned properties

Equipment/staff for a typical snowfall:

- 100–120 pieces of heavy equipment working daily
- 1,000–1,200 total hours
- 330 staff working 24/7 through the winter



Did you know? Deerfoot Trail and Stoney Trail are maintained by the province.



20,000 vehicles per day

Day 2

OF SEVEN-DAY PLAN



Completed within 48 hrs.
3,144 lane km of roads: (20% of roads)

Priority 2 roads include bus routes

After 24 hours, Priority 2 roads are plowed.

- Intersections and crosswalks controlled by traffic lights
- Emergency routes (e.g. hospitals and fire stations)
- Bus routes and roads with on-street bike lanes
- Includes roads such as Kensington Rd. and Acadia Dr.



5,000 – 19,999 vehicles per day

Did you know? Priority 2 routes are snow routes, and may be subject to a parking ban.



Snow Route Parking Ban: during a ban, parking is temporarily restricted on designated snow routes for up to 72 hours.

Day 3-7

OF SEVEN-DAY PLAN



Priority 3 & 4 routes:
9,083 lane km (55% of roads)

Feeder, collector and residential streets

After 48 hours, Priority 3 plowing includes:

- Feeder/collector routes
- Turn lanes and on/off ramps
- Windrows at busy crosswalks and wheelchair curb ramps
- Playground zones
- Designated hills

After 72 hours, Priority 4 clearing includes:

- Designated residential streets
- Bus pads





Across the cities I visited on my Fellowship, the use of accurate reliable data and the skills needed to interpret weather forecast, remained at the heart of winter service. I found the Swedish Transport Administration (Trafikverket) approach to data acquisition and use, to be significant. They have combined a dense network of 800 RWIS¹⁰ as well as data provided by the Swedish Meteorological and Hydrological Institute (SWHI). These weather stations are the heart of a well-managed winter service. They measure real-time atmospheric and road surface conditions, communicating these back to a central system via cloud computing. The locations of the RWIS in Sweden were determined by a thermal mapping exercise, with the concentration of stations located on the busiest roads.

Every half hour, data is collected from the stations, and every hour, from the SWHI. To support modelling calculation from SWHI, Sweden is sub-divided into a 22 by 22 kilometre grid net, and calculations are performed for each grid individually.¹¹

During my visit to Borlange in Sweden, I met with Mats Bayard of Triona. Mats and his company are leading providers of IT solutions within the transport industry across the globe. A key fundamental principle that came out of our discussion was the need to simplify data in our industry which can often be disseminated from multiple systems.

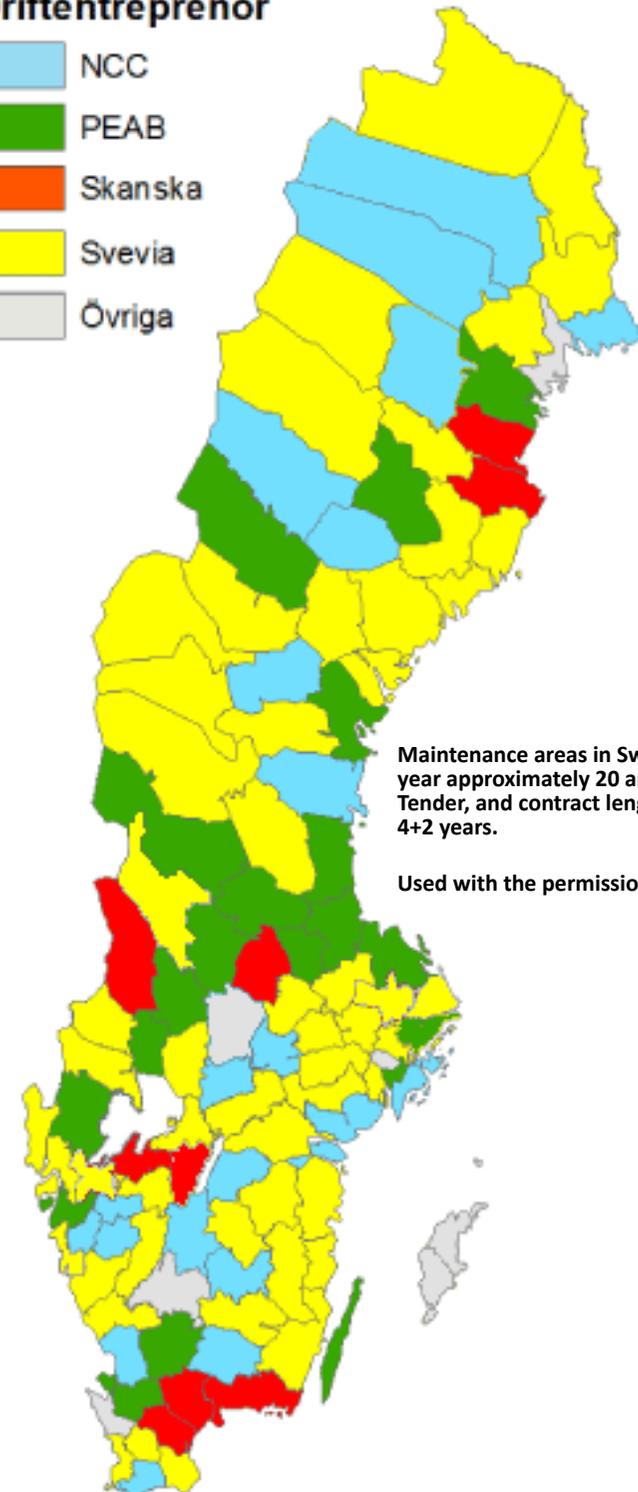
The integration and use of simplified data have the potential to contribute enormously to resolving many of the long-standing issues we face across our roads in the UK. For example, there is a national road database in Sweden that is a legacy system. This has now been combined with data from multiple new sources, to enable better use of a historic system. Leveraging their desire for collaboration has seen Triona established a partnership with Trimble Solutions to develop a Transport Network Engine. This serves as a central data source, enabling the import and maintenance of transport network and infrastructure data.

Again, working in collaboration with Road Cloud in Finland, a pilot is currently ongoing, assessing the benefits of an automated monitoring system showing in real-time the state of the surface and road condition, to enable better decisions from contractors and winter professionals. One message of note from Mats which he took time to dwell on and highlight, was the need for public bodies to overcome organisational hurdles, in order to maximise the benefits offered from multiple data sources on transport networks.

Data and its use are driving significant change across the transport industry in Sweden but there is still a need for trust in the data and the people who are doing the work. This is seen as a key ingredient for supporting the tools required for the future. There is a maturity around the sharing of data and technology in the roads sector from Trafikverket and its partners such as Triona, that is very admirable.

Driftentreprenör

- NCC
- PEAB
- Skanska
- Svevia
- Övriga



Maintenance areas in Sweden, where each year approximately 20 areas are put out to Tender, and contract lengths are currently 4+2 years.

Used with the permission of Trafikverket.

Over in Canada, the city of Winnipeg has truly embraced the need for better quality data and a complete management system to bring innovation to the street maintenance group.

The city moved away from a paper-based system to an online Geographic Information System (GIS) where all personnel can go to get what they need from an online catalogue that is the home of all associated products. This system can provide support to the winter operators and maps, that can be interrogated. It provides metrics on pothole patching, joint repairs, daily production from crews, history of locations, hazard analysis, safety documentation, and work activity guidelines. Everything is provided on the online system.

One of the disadvantages discussed regarding the development of the online system in Winnipeg despite its many successes, is keeping it up to date and having enough resources to be able to keep the platform current and accurate.

What also became clear in Canada and Europe is the rising need for greater expertise in the areas of software development, programming, data, and visualisations. The use of packages such as Power-Bi and GIS tools are increasingly becoming more valuable to teams in the sector.

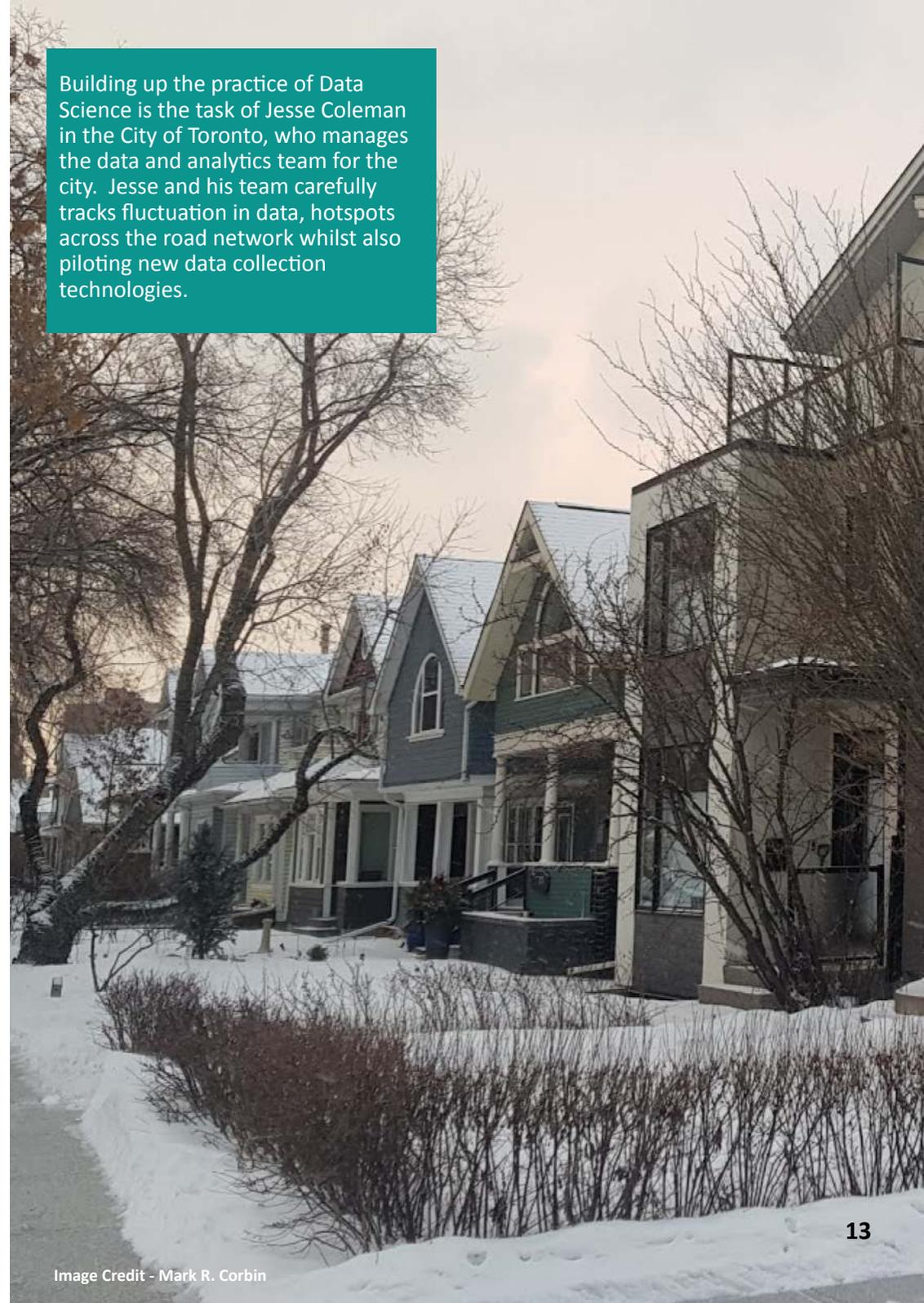
Elsewhere in the city of Winnipeg, it was also recognised that a complete revamp of systems to improve data quality and road user experience was critical.

This saw the development of a new Transportation Management Centre (TMC) and a network of sensory technologies providing data to support intervention decisions needed on roads. The overall principle here was to harvest all the roadside data into the TMC, review, filter, and assess the data to determine what was relevant to push key messages back out to users of the road network.

This improvement saw a change to camera systems, signal systems, and data systems. It also transformed the way that traffic professionals provided the harvested data back to the public with Twitter in particular, being used extensively. In terms of disruption and the data received, the TMC is primarily concerned with answering the question - is it there or is it not? The old approach of providing a piece of information about an event that may have happened some time ago but might not still be relevant, is not considered good enough for the users of today's road network.

This data approach in Winnipeg and the reliance of roadside data in digital form is extremely valuable. This is now being significantly complemented by the use of social media channels such as Twitter. Also, the data gained from camera technology using Pan, Tilt and Zoom CCTV cameras remain vital for efficient winter service delivery.

Building up the practice of Data Science is the task of Jesse Coleman in the City of Toronto, who manages the data and analytics team for the city. Jesse and his team carefully tracks fluctuation in data, hotspots across the road network whilst also piloting new data collection technologies.





SNOW CLEARING AND ICE CONTROL BY NUMBERS



TECHNIQUES

Techniques across the countries visited were very similar with a number of minimum maintenance standards or levels of service required, with regulations and guidelines in place to enable these.

The levels of service across the cities visited determines the delivery of winter programmes and this is predominantly based on road classifications, volume of traffic, and other factors, but these aren't always easily understood by residents. One clear component in the Toronto level of service that is well understood is declaration of a snow emergency, which triggers a parking ban on main roads.

In Toronto, the minimum maintenance standards are set out in the Province-wide Ontario Regulation 239/02.¹²

A typical sequence of events for winter maintenance includes the following:

A defined season (example in 2019 Toronto - from 15th October to 15th April);

24/7 road patrols to monitor conditions;

Direct Liquid Application - anti-icing in advance of a storm event (12hrs prior) applied when pavement temperature reaches above -9 Celsius;

De-icing after the snow or ice begins to fall, takes place on routes broken down by road class;

Ploughing after the snowfall has met specific thresholds; Expressways, Arterials, local roads and sidewalks, cycling infrastructure;

Public transport stops.

The weather forecast is checked four times a day and there is a requirement to check and initial this, acknowledging that the forecast has been read and the actions taken recorded. A higher level of service above the minimum standards has been adopted in Toronto.

In Sweden, the standards are referred to as operating requirements and were first drawn up in the middle of the 1980s. The operating requirements contain six different standard classes, ranging from the highest volume roads with an Annual Average Daily Traffic (AADT) of 16 000 to the lowest volume roads with an AADT of less than 500. There is a considerable difference in standard between these two classes; e.g., the requirements stipulate that the roadway on highest volume road shall be free from snow and ice no later than two hours after the snow has stopped falling if the road surface temperature is above -6°C (21°F). Further, during the period when the snow is falling, the depth of the snow shall not exceed 1 cm and the slush depth shall never be more than 0, 5 cm. As regards the lowest volume road network, snow ploughing and any necessary skid control measure shall be completed no later than eight hours after it has stopped snowing, and the snow depth during the snowfall may be up to 10 cm. The operating requirements are written in functional terms, which means that they describe the road surface condition during different weather conditions. Thus, these requirements do not stipulate when measures are to be carried out. This is up to the contractor to decide.¹³

There is a growing recognition in all cities visited, that greater attention is required to ensure the entire customer base in the road network is being catered for during winter service delivery. Pedestrians and cyclists must be treated with equal consideration as motorised road users. It was my observation that this is increasingly, becoming an area for greater focus and attention across all cities. In Canada, I noted that they were experiencing significant pressure to respond to the rise in cycling during winter. As winter cycling becomes more attractive to residents, they are placing additional demands and in some cases, triggering reviews to the levels of service provided in cities. The areas occupied by most bike lanes cities I visited in Canada are the same areas required to store the snow, and these cities are critically reviewing these locations to better determine how to improve services for cyclists.

In Winnipeg, they have responded positively to this pressure by conducting a consultation in 2018¹⁴ to create a new active travel network, to be treated as part of its snow and ice control programme. The adoption of this active travel network means that although some of these routes may fall in residential streets off main roads, they now receive a higher level of service similar to a priority 1 route.

In addition to this, in Stockholm, the rise of micro-mobility solutions in the form of e-scooters poses a similar problem for that city. The demand for e-scooters observed in Stockholm showed this is an attractive mode for residents and visitors, but it does pose a number of concerns for delivery of winter maintenance particularly on footways, where abandon e-scooters were observed in multiple locations. There is also the potential risk of injuries¹⁵ to users and others in the road environment where the level of service being delivered, doesn't give the perceived expectations from users of these new forms of mobility. This will likely be a continuing issue for winter maintenance professionals across the world.

Two inter-changing terms followed me across my Fellowship travels, which may sound similar but are very different. Snow removal (picking up snow and moving it away to a designated snow dump) is different from snow clearing (ploughing and salting). Winnipeg and Stockholm are cities where snow removal is commonplace, but this is not done in Toronto where the focus is on snow clearing.

Snow melters were only encountered in Toronto and these are used to melt large quantities of snow which are then discharged into catchment sewers. This is one of the approaches adopted to provide additional capacity where this is lost in cities due to the rapid and continued growth in housing developments. This challenge of lost capacity was encountered mostly in Stockholm and Toronto.

Snow clearing in Stockholm is also supported by 100,000 sq. m of electric heating under the pavements, which aids the melting of snow. Special exemption has also been secured by the city to dispose of snow in a specific river in Stockholm at agreed locations which are considered less hazardous than removing it by vehicles out of the city. However, this practice is strictly regulated and only a maximum of 850 cubic metres can be disposed of in this way.

Conversely, in Winnipeg, snow removal is big business and appears to be a major source of employment for the trucking industry in the city. During my visit, I witnessed this operation first-hand following a 15cm snow event. Removal is critical here because of the capacity issue that is constrained by growth, and also to ensure that the city is prepared for the next snow event!

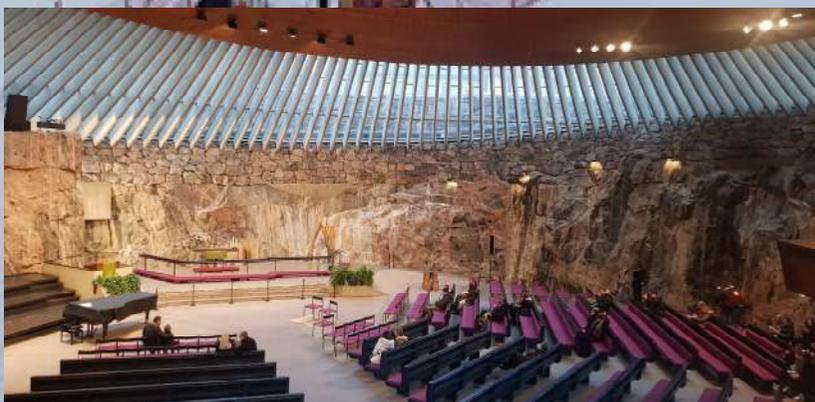


Image Credits:
Mark R Corbin



5

MATERIALS

Snow and ice control in the road system can have a dramatic impact on public safety, and road user safety remains the most important priority for all the winter professionals I visited during my Fellowship travels.

The materials used in winter service are all about providing traction to enable movement on the road surface. When traction is lost, slipperiness or skidding occurs, resulting in loss of control of vehicles and potential collisions and hazards.

Despite ongoing research into alternative materials, rock salt (sodium chloride) remains the mineral of choice in all cities for winter maintenance for ice-control, as it works well and is still cost-effective.

In 2004, Environment Canada¹⁶ issued a Directive mandating that all municipalities that use more than 500 tonnes of salt per year and have vulnerable areas in their territories, must have a Salt Management Plan in place and they must report use annually. The Plan must address salt storage, snow disposal, salt application rates, and improved protocols for pre-wetting.

Salt as a mineral, has a major impact on the environment despite its properties that are beneficial for ice control on roads in winter. In Canada, five million tonnes of salt chlorides are used per year¹⁷ and this has a negative impact on soils, roadside vegetation, wildlife, groundwater, and surface water. It doesn't just disappear; it enters the environment!

The introduction of liquids has led to reduction in dry application rates as a way of reducing the amount of salt used in Canada. Toronto can deploy the use of salt up to 50 times in a season and on average 13,000 tonnes of salt is used.

For today's road authorities it is very important to keep track of the quantity of chemicals used in winter road maintenance. Variations in snow and ice conditions from year to year make it difficult to compare figures. In order to tackle this problem, the Swedish Transport Administration has developed a Salt Index. This provides a good basis for comparing salt consumption from year to year and a possibility to identify areas where too much salt is used for the prevailing weather conditions.¹⁸

There were some differences observed in the three Canadian cities with regards to the use of rock salt.

In Calgary, the relationship between the municipality and Alberta Transportation which operate the Provincial roads showed maturity in the cooperation achieved during the delivery of winter service. The teams work together on a consistent approach to anti-icing using either liquid sodium chlorides or calcium chloride before any snow events.



Henry Wong, leader of Business and Operations including Road Infrastructure Maintenance, Snow and Ice Control and Spring Sweeping Program.

- City of Calgary

These work in different temperature ranges and can contain over 70% water, so application has to be carefully considered. After application, the solution needs to dry up enough so that when it starts to snow, the solution on the surface melts enough of the snow to create a layer that does not bond the snow or ice to the road surface.

When it's snowing, salting, ploughing and the use of sand or aggregates are all used. Winter maintenance professionals have two options - get rid of the ice or add traction. Salt in Calgary is a by-product of potash and works effectively down to about -10 degrees Celsius. Beyond this, when salt becomes ineffective, aggregates or sand is used extensively to add traction.

Comparatively, in Toronto, the use of salt is the primary means for de-icing. There was a period when sand was used, but tracking of sand into the lobby of downtown establishments meant this was discontinued! Sand also provides no de-icing capability. Magnesium chlorides and alternative products are kept on hand when temperatures dip below -20 degrees Celsius in Toronto.

In Winnipeg, the city has introduced Smart Salt Training to optimise road salt usage by improving procedures and equipment used when applying it. This training is aimed at influencing behaviours centred around Five 'R's - Right amount, Right material, Right place, Right time, Recording.

The above 'Rs' were an ever-present over the course of my Fellowship travels and particularly the right amount and the right material. Continued developments through science are changing the industry and seeing innovation take hold to drive change.

When I attended the Winter Road Congress in Tampere, Finland, I discovered what a small amount (right amount) of sodium chloride can do when combined with other products. A team from Russia presented at the Congress and also showcased what is termed a multi-component de-icer, or as I term it, a multivitamin salt!

The team¹⁹ discovered that by combining many types of salts such as Sodium Chloride, Calcium Chloride, Magnesium Chloride, or Formate into one granule, they prove to be stronger together and have the ability to melt ice at a faster rate, cause less corrosion, and impact on the soil and reduce the salinity.



Roy Anceriz (left) Superintendent Area Roads & **Dominic Guthrie** (right) Program Manager, Emergency and Winter Operations.

- City of Toronto

The team spoke to me about the approach which starts with an assessment undertaken in a city to determine the climatic conditions, winter temperatures, how much precipitation and type of equipment used, etc. Importantly, the soils near the roads are then tested to determine baseline salinity. The recipe for the multi-component de-icing materials is then manufactured based on the city parameters.

The above approach was undertaken in one of the world's largest and harshest cities for winter conditions - Moscow. The initial test showed that the roadside soils and vegetation were dead and required replacement and re-cultivating every year. Over the course of a decade, following the continued use of the multi-component de-icer product, Moscow has undertaken eco-monitoring, and this has found that the soil condition has returned to normal.

This product and its impact was a major discovery on my journey. As winter professionals continue to deliver their services, there will be continued pressure to further reduce the impact on the environment and our citizens.

I became familiar with the work of Professor Alex Klein-Paste²⁰ during my visit with Dan Eriksson of Trafikverket. Professor Klein-Paste is a world-leading expert and his research on winter maintenance, snow, and ice is globally significant. I have continued to follow and read more of his research particularly into chemicals used in winter maintenance.

An important point to consider when looking ahead to the change in the vehicle propulsion systems is this - The phasing out of internal combustion engines as electric vehicles rise in prominence will be an interesting wrinkle for winter service professionals. The heat generated from engines partly contributes to the melting of snow on roads. I discussed this with Dominic Guthrie in Toronto and concluded that advancements in materials hold the key to off-setting this heat loss.



Anna Klimentova Chief of Operations, National Association of Winter Road Maintenance, Russian Federation and **Denis Klimentov**, International communication strategist and practitioner.

Russian Federation

WHAT RESIDENTS AND USERS SAID



Demand is huge for Uber and other rider sharing services as people are sometimes afraid to drive in these winter conditions.

- Uber driver, Toronto (Saturday 18 January 2020)

My morning routine includes checking that schools are open usually around 6am, as overnight storms can sometimes mean schools might be closed. On my work days I leave earlier than usual in winter, the main roads are usually good and my employer can use their discretion to let me leave early.

- Fabian Howell, Warehouse Supervisor, Greater Toronto Area (Sunday 19 January 2020)

It takes time to learn how to drive in this type of weather conditions, especially in Winnipeg. The city of Winnipeg do take care of their roads starting with major routes, I know it's a big challenge but they do a good job.

- Harjit Chahal, Unicity Taxi driver - Winnipeg (Monday 27 January 2020)

The city of Winnipeg website and radio really helps a lot.

- Ravindra Ahluwalia, Taxi driver - Winnipeg (Wednesday 29 January 2020)





COMMUNICATIONS

In Canada, Winnipeg is considered a leader in snow clearing and ice control activities, with awards from the American Public Works Association for excellence in ice control and snow clearing. An educational approach to staff and the community training underpins the success of how Winnipeg communicates about snow clearing and ice control. Facilitating, enabling, and training staff to be comfortable with the media, has proven to be an important component of the approach during winter. Specifically, there is a course on media interview skills development, used to train engineering staff in understanding how to approach interviews with the media. In terms of tools, this city utilises a suite of platforms, in combination to supporting the development of its communications plan.

These include:

- City Website
- Email alerts - for notifications particularly about parking bans.
- “Know Your Zone” mobile App
- Social media platforms using Facebook and Twitter
- Radio and public transport adverts
- Television interviews
- Digital Billboards (every minute you get 5 seconds and can be changed in real-time)
- News releases

The provision of real-time information for customers during the winter season is critically important. In Winnipeg, the city has developed an approach that keeps residents engaged during snow events. The city is divided into three zones and when ploughing is taking place, they can see what progress is being made. Residents are shown completion by zone – i.e. nothing has happened, 0-50% or almost complete - this has been well received.

The approach was complemented by the introduction of the Know Your Zone App in 2016, which alerts residents to take action during snow events. The app has had over 50,000 downloads. Alerts are provided on parking bans, restrictions, alternative parking options, street priority, and whether you are on a snow route. A survey of city services captures views from residents about satisfaction relating to snow and ice control.

Similar to Toronto, parking bans are also invoked in Winnipeg depending on the type of snow event forecasted. The street maintenance team also regularly reviews complaints from residents, taking the top five from these and producing videos in response, in order to further strengthen its education ethos and deepen understanding.

During winter 2020, news releases were introduced as part of the suite of tools. This is an update for media personnel about parking bans, plans for ploughing, sanding, and salting, links to Web pages and FAQs. This is proving to be a useful addition to the suite of tools for media outlets.

One intriguing thing of note in Winnipeg was something I termed as the attitude of acceptance by residents. They know that winter is coming, it's going to be disruptive and there appears to be a certain degree of acceptance around this. People know it's a winter city and they have to deal with it. However, this can change when there is a major snow clearing operation after a big snowfall. Attitudes can change quickly and scrutiny can be microscopic on the city's street maintenance teams, during these snow clearing events. It is not uncommon for residents to get the media involved if they perceive that levels of service aren't being adhered to. For the communications team, they measure success through media monitoring, including quotes in newspapers and perspectives represented in news stories. It is considered to be a huge advantage to be participating in the story in order to bring balance.

Despite the focus on education though, it is still a challenge every season to get residents ready for winters, even in a winter city!

Out west in the municipality of Calgary, communications are focused around the seven-day snow plan, which is the city's schedule for clearing snow from public spaces. The plan sets out which roads, sidewalks, cycle lanes, and paths will be cleared by the City, to what extent, and on which day within the seven-day plan.

The website Calgary.ca/snow²¹ is the primary platform for informing residents and has been in use since 2013. The invoking of a snow ban is a critical part of the response to snow in Calgary and must be communicated in time and be simple to understand. This is done through the city's website, Twitter (YYC Transport), emails, text alerts, and a lookup system to determine if your house is on a route with a snow ban.

Strong relationships with the media in Calgary are also essential for successfully getting the message out to the community. A media line is operated from 6am to 8pm throughout winter (operating 8am to 8pm on weekends). This provides open access to members of the media community to engage with the city. An update is provided twice daily - one in the morning and one at 3pm. Like Winnipeg, the use of digital billboard advertising has also been added to the suite of tools used to provide messages on the road network. These can be triggered when needed and have been considered as an amazing addition.

There is a recognition in Calgary that people are emigrating to the region of Alberta all the time and many of them establish their living in Calgary. They come from different countries in the world and other municipalities across Canada. This has led to a review of how communications are delivered and have seen the development of a multicultural strategy²² to engage with sections of the population that are considered to be hard to reach. The northeast corner of the city has a high proportion of ethnic minorities and translated adverts are used to specifically help the community to understand their responsibilities during snow events.

The multi-cultural strategy sets out how the city engages with the five biggest non-English speaking demographics. The strategy also outlines their needs and preferences among different language-based cultural communities, as it relates to services, communication, and engagement from or with the city of Calgary. Radio and television are also important components in the strategy and serve again to provide key messaging to these communities.

Meanwhile in Toronto, following the snowiest winter in a decade in 2018, a review was conducted on its winter service programme. A key outcome of the review was a need for a sustained public awareness program to help inform or educate residents, of the winter services the city of Toronto delivers. This also entailed helping residents to understand the limitations of the service, and the important role that the public plays in delivering these services. To strengthen the approach, a one-page mail-out was adopted and distributed to all residents in Toronto, approximately 1.04m people.

The aims were first to summarise how the City of Toronto delivers winter operations and outline the levels of service. Secondly, it also sought to help residents understand the role they play in keeping roads and sidewalks safe and passable for everyone in their community.

Along with the mail-out which started in December 2019, the city of Toronto has a wider public education campaign which includes radio announcements, print, and digital adverts. The full campaign ran until late February 2020. Toronto has also retained a radio presence with a campaign titled 'Traffic on the ones'. This is a traffic and weather report at 01, 11, 21, 31, 41, 51 minutes past the hour providing updates for the travelling public on the transport network.

In addition to the above, the City has tracked changes in behaviour and attitudes amongst residents in 2014, 2016, and 2018. This is specific to its Transportation Services. Examination of the most recent survey²³ showed a 65% satisfaction with winter snow clearing and expressways, and 62% winter snow clearing of roads. One area considered to be most in need of improvements was winter snow clearing of sidewalks and paths for pedestrians.

Since 2016, winter snow clearing of roads, the quality of road surfaces, and the winter snow clearing of expressways rank as the most important issues among drivers in Toronto.²⁴

Perhaps one of my most intriguing discoveries across Canada was the 311 Consolidated Contact Centre. The 311 service is an easy to remember number to access non-emergency services in each of the cities I visited. The service is open 24 hours a day, 365 days a year, and is designed to provide citizens with the opportunity to ask questions about or to request any non-emergency city service at their convenience.

Whilst in Winnipeg, I was offered an opportunity to see the service in operation and to gain a deeper insight into how it manages customer services across the city. The city's Street Maintenance Division has provided 311²⁵ with a street snow clearing script, which serves as an essential reference for Call Centre staff. I noted that citizens who request a non-emergency service are provided with a unique reference number, should they need to follow-up in the future.

The service is critical to the successful delivery of winter maintenance in every Canadian city I visited. I consider 311 to be a remarkable operation as it separates and reduces the strain on managers and operators allowing them to focus on the operations work to be done. An important part of its success is the 311 operators being trained to deal with the public - unlike many managers. The scripts provided by departments are also vitally important to enhanced customer experience.

ESTONIA

Over in Europe the message of 'Stop hiding in the trenches' delivered by Diana Lorents from the Estonia Road Administration, resonated with me. Diana presented at the Winter Road Congress in Tampere and was passionate about encouraging the sector to stop being afraid of journalists. She highlighted the need for media training of personnel working in the sector to support them being better equipped when communicating with journalists. Diana is very proud of the way that the winter maintenance teams are now able to handle the media after three years. A major factor in this has been the building of trust across media and the transport professionals.

FINLAND

Also, during my visit to Tampere in Finland, I was given access to the full team of customer service personnel, most of whom have been doing the job for over a decade. The Finnish Centre for Traffic Customer Service²⁶ is a nationwide unit providing advice on transport (Rail, Road, and Waterways) matters and serving as a feedback contact point. They provide an essential role in delivering key customer messaging back to contractors and other agencies. Interestingly, they rely mostly on the traditional method of telephone calls from telephones located across the road network. This is coupled with emails and a map-based feedback channel to check, validate, and ensure that customer queries are being logged and resolved appropriately. Traffic Management Finland owns and operates all the customer service products, these products are built by private sector partners. Similar to other cities, they also provide visibility to customers about the status of ploughing in real-time. It should be noted that the service has taken over three years to compile its frequently asked questions, which serves as a vital resource for answering queries from members of the public.

Concerning social media, it was generally felt that there is good cooperation with companies and organisations on Twitter, while citizens tend to engage more on Facebook. The future for this service is considered to be one where automation and machine learning will be heavily utilised to deliver messages to customers based on keywords from customer contact forms, and utilisation of the knowledge base and other data sources.

SWEDEN

Across the Baltic Sea in Sweden, winter 2019 was considered to be one of the toughest; not weather-wise but from a communication perspective. The city of Stockholm is its most populated region with 1.6m people in the urban area and 2.2m in the metropolitan area and spanning 14 islands in the Baltic Sea. Similar to Canada, there are priority routes for snow clearing and removal including bus routes, and close communication is retained with bus companies, hospitals, police, and other emergency agencies.

There is an extremely high expectation from the residents of Stockholm that the city will manage and remove ice. Historically, it was considered by the team, that the communications approach was very reactive, but there has been a shift to a more proactive approach following winter 2019. The new approach aims to increase trust, promote understanding of the ways of working, reduce complaints, and help the community to play their part.

The winter season is kicked off with a press release and providing continuous updates about how the city is working and the prognosis. Social media is heavily utilised throughout the winter to reinforce messaging. At the end of the season, everything is summarised in the Spring, as a reminder of the job done.

'Winter always comes as a surprise!'

- Katariina Korteoja, Head of Operations - Customer Service Traffic Management Finland

Our Team

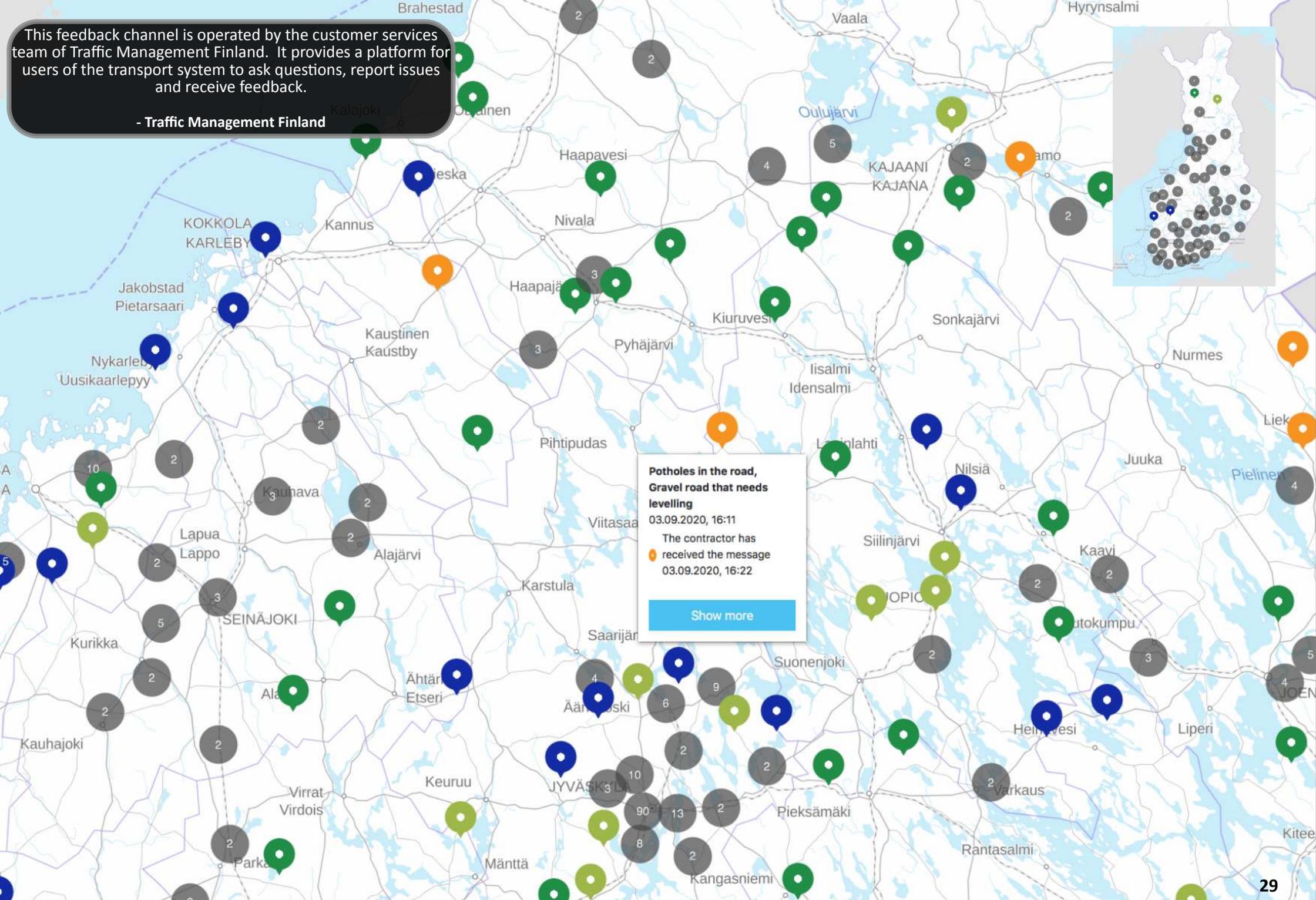
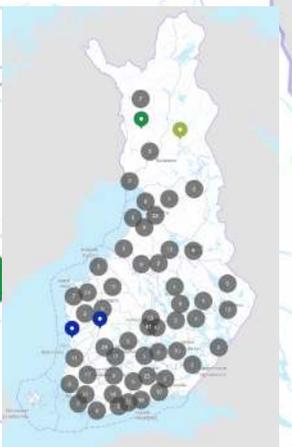


Customer Service Team

- Traffic Management Finland

This feedback channel is operated by the customer services team of Traffic Management Finland. It provides a platform for users of the transport system to ask questions, report issues and receive feedback.

- Traffic Management Finland



Potholes in the road, Gravel road that needs levelling
03.09.2020, 16:11
The contractor has received the message
03.09.2020, 16:22
[Show more](#)

- In process
- Processed and forwarded to a specialist
- The contractor has received the message
- The contractor has taken action
- The contractor has completed the action



CONCLUSION AND RECOMMENDATIONS

When I commenced this journey I set out to answer the question - how can we improve winter resilience on UK roads by examining the practices of cities in North America and Europe?

I took great care to examine the approaches in Calgary, Toronto, and Winnipeg. This was complemented by attending the Winter Road Congress in Tampere, Finland, and learning firsthand some of the contemporary approaches in the Baltic States, and completed my travels in Stockholm and Borlange in Sweden.

My conversations with city professionals, residents in cities, and professionals here in the UK drew me to conclude that despite the multitude of information that proliferates this sector, there are a small number of areas that require attention in order to improve the mature winter maintenance process in the UK.

I have focused on techniques which are broadly similar to the UK, but noted that changes focused on pedestrians and cyclists are already taking hold in most cities. Data is and will continue to be a vital part of the decision-making for winter professionals and the density of weather stations such as that deployed in Sweden is a best practice example to follow.

I have acknowledged that Rock Salt - Calcium Chloride remains the main material used across all cities, but its continued use is under pressure as cities seek to reduce the impact of their winter service on the environment. There is a clear need across all the cities I have visited, to address this specific issue and we must do the same in the UK. Progress is being made in this area and the multi-component products I discovered in Tampere is a good example of product and approach.

The role of communication and types of communication are pivotal to the success of winter service. I found this to be the area of greatest improvement required in the UK. Canada's 311 service holds a special place. It showed what can be done in a consolidated environment where the customer is the heart of the service.

CONCLUSION

Taking these factors into consideration I conclude with the following recommendations.

1

In the UK, there are too many customer contact channels in the transport system creating a web of complexity for users of the transport network when there are issues and concerns to report. Further research is required on what a centralised transport communications hub similar to 311 in Canada could look like.

2

Invest more in the infrastructure underpinning decision making to ensure that we have access to the best available data from the best sources, and that all equipment is functioning and participating in the delivery of accurate data.

3

Implementing an annual media briefing as part of the planning for winter to provide clarity on the approach and access for the media to winter professionals. This is well attended in Calgary and helps to build relationships with the media as part of the winter programme.

4

Further, explore the work of the National Association of Winter Road Maintenance in Russia and the multi-component products being used to improve the environmental impacts from salt and to further improve the salinity of soils and the environment. There is a vital need to look beyond Sodium Chloride.

5

The resilience of people and our behaviours needs to change and this must be reinforced through a national campaign or a new body setup to support transport resilience at a national level.

6

Data - Collaborations and data sharing across private sectors and public bodies hold a vital role in improving customer experience and there is a need to remove the barriers to collaboration for the greater good of our communities.

RECOMMENDATIONS

The recommendations made above can make a difference to how we improve winter resilience on UK Roads and more broadly across the transport system.

Through my work with Transport for West Midlands, regional partners and national networking, I will promote my work and seek to introduce these recommendations.

The next steps will be shaped by adopting the following five objectives:

- To positively engage with **teams** across Transport for West Midlands, about the findings from my research;
- To disperse findings to the **regional** West Midlands Traffic Managers;
- To disperse findings to the ADEPT **National** Traffic Managers forum including the Department for Transport;
- To actively seek opportunities to publish my findings and recommendations through **profession trade press** to promote WCMT and my research; and
- To engage with **local people** in my community about my findings and the role that communities can play.

NEXT STEPS



Dan Eriksson is responsible for strategies, effects, and guiding principles in the area of Winter Road Maintenance at the Swedish Transport Administration (Trafikverket). He is also involved in the organisations' Research and Development Plan in winter maintenance.

- Swedish Transport Administration



APPENDICES

THANK YOU

I extend sincere thanks to the Winston Churchill Memorial Trust and my employer Transport for West Midlands for their support in making this all possible. I am forever thankful for the generosity, time, knowledge and the willingness to share from all the following people. Without you my Fellowship journey would not have been possible.

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Jake Murgatroyd	Key Route Network Development Officer
Carolyn Harris	Key Route Network Corridor Manager
Shakeel Riaz	Key Route Network Corridor Manager
Danny Gouveia	Senior Development Manager, Transport for West Midlands
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Charlotte Hamilton	Assistant Business Partner, West Midlands Combined Authority
Trisha Patel	Centre Manager, Bilston People's Centre
Claire Melvin	Business Manager, Transport for West Midlands
Christopher Lucas	National Severe Weather Specialist, Highways England
David Batchelor	Severe Weather Plan, Severe Weather Research and Development, HE
Matthew Burling	Engineer, Highway Services Sandwell Council
Richard Hogg	Senior Commercial Manager, MetDesk
Paul Atkin	Highways England

CITY OF CALGARY

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Per Hurtig	Road Safety, Trafikverket



ABOUT THE AUTHOR



MARK R. CORBIN

I am the Highways Key Route Network Manager at Transport for West Midlands where I manage 605km of local roads in the middle of England. My career started in the automotive sector on the Caribbean island of Barbados before moving to the UK, to establish myself as a Traffic, Highways, and Transport professional.

In my current role, I work in collaboration with the seven local highway authorities and other stakeholders across the West Midlands, to deliver the transport vision on behalf of West Midlands Combined Authority. Prior to joining Transport for West Midlands, I worked for Highways England as a Project Manager leading on their route strategies and strategic studies for the first Road Investment Strategy. I have also previously worked for Walsall Council, Watermans, Jacobs, and Oxfordshire County Council.

Winter service is an area of major interest for me. I am motivated to bring about positive change to improve the experience of road users all year and especially during winter. I passionately believe we can build on our mature approaches in the UK and make them even better for users of the transport system.

I was awarded a Winston Churchill Fellowship in March 2019 which enabled this research to be undertaken.

I hold a BSc. (Hons.) in Automotive Technology from the University of Huddersfield and a Masters degree in Transport Planning, from Oxford Brookes University.

CONTACT

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COUNTRIES AND CITIES



- 1** **Canada**
Calgary, 10 - 17 January
- 2** Toronto, 17 - 24 January
- 3** Winnipeg, 24 - 31 January

- 4** **Finland**
Tampere, 7 - 15 February

- 5** **Sweden**
Stockholm, 15 - 18 February
- 6** Borlange, 18 - 22 February



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