



# Glasgow City Council Safecote Case Study

## Introduction to Glasgow



Glasgow is the largest city in Scotland, having the third highest population in the UK being home to 580,690 residents. The entire region surrounding the city holds approximately 2.3million people, being over 40% of the Scottish population.

The city has an area span of 68 square miles and is made up of a street grid system similar to those of American cities.

The River Clyde is a major river in Scotland and flows directly through the city of Glasgow. It is the ninth longest river in the United Kingdom, and the third longest in Scotland.

Despite some infrequent clear or dry days, winters in Glasgow are normally damp and cold. Snow is common but rarely lies in the city centre. (Lowest recorded temperature  $-17^{\circ}\text{C}/1^{\circ}\text{F}$ ).

The vision of Glasgow City Council;

*"We want Glasgow to flourish as a modern, multi-cultural, metropolitan city of opportunity, achievement, culture and sporting excellence where citizens and businesses thrive and visitors are always welcomed."*

The Council has a statutory obligation under Section 34 of the Roads (Scotland) Act 1984 to take such steps as it considers to be reasonable, to prevent snow and endangering the safe passage of pedestrians and vehicles over public roads.

Major refurbishment has been carried out to the Clyde Tunnel over the last few years and a major part of this was to replace and restore its cast iron frame that was heavily corroded caused to a great extent by salting over the years. Out of a total cost of £20m around £8m was attributable to corrosion.



## Winter Service

Traditionally Glasgow City Council used dry rock salt to treat their highway network in order to keep their road system clear from frost formation, ice, and snow. A liquid de-icer (Glycol) was used to treat foot paths and bridge decks because of its powerful de-icing and anti-freezing ability.



When treating the highway 6mm rock salt was spread at a rate of 20gms per metre<sup>2</sup> for standard pre-cautionary salting, and 40gms per metre<sup>2</sup> for snow events. A fleet of 53 gritting vehicles were used to treat the 38 routes within 180 minutes.

It was becoming increasingly apparent that the effects of de-icers used to treat the network caused not only a corrosion concern but also questions towards the impact to the environment.

Regeneration projects have been in progress for a number of years now throughout Glasgow. Increasing concerns were raised when the refurbishment of the Clyde Tunnel took place and the cast iron pipes were found to be heavily corroded. Bridge decks over motorways and the rivers were also noticeably deteriorating at a significant rate due to the nature of corrosion.

## Alternatives

Jim Knox (Winter Service Area Manager) at Glasgow City Council decided to investigate alternative materials to combat against the corrosion issues without any risk of jeopardising the service the authority provided. Jim was aware of Safecote having used Procoat salt which is a fast acting high purity marine salt coated with Safecote (a known corrosion inhibitor).

Procoat was being used at shopping centre locations as a premium fast acting de-icer and is ideal in contained areas, however is not economically viable to be used across vast areas.

Another option available on the market was pre-wetted salt, which consists of rock salt and salt brine mixed together upon application by the gritting vehicle. Although trialling this would have proved a worthless exercise as this method of de-icing is not only highly aggressive in terms of corrosion but also very costly to implement.





### Safecote Information & Research

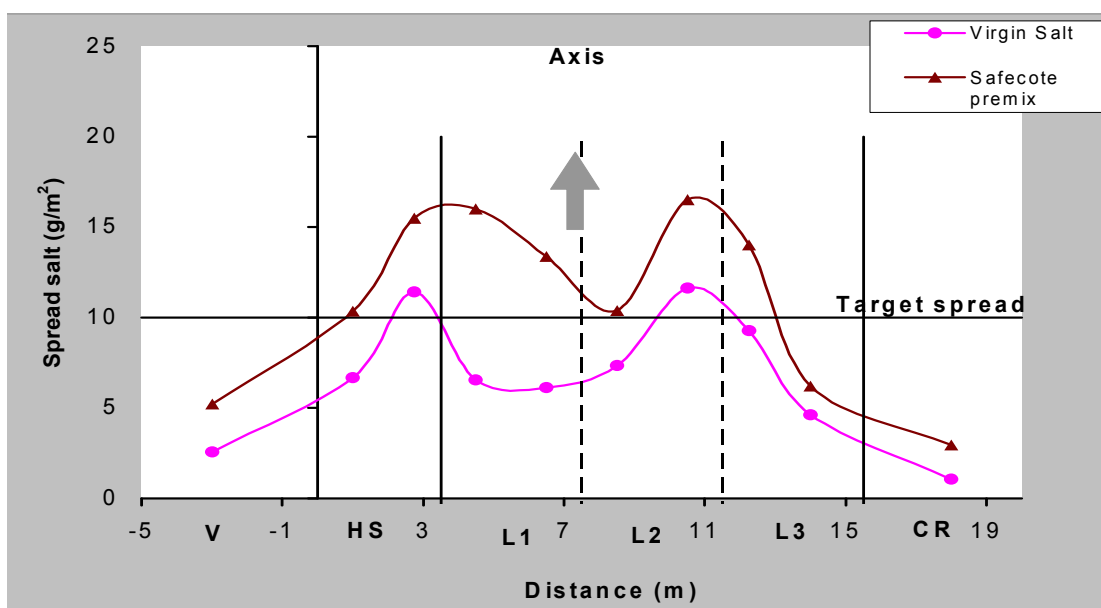
It was determined during researching Safecote that a number of other local authorities in the UK had been using it pre-treated to their standard rock salt and purchased directly from their salt supplier applied at 3% weight by weight and were spreading the salt reduced rates as low as 7gms per metre<sup>2</sup>.

Safecote is an agricultural co-product, its main ingredient being molasses and is made to a stringent specification by Tate & Lyle in the UK. Known as a salt enhancer it has been used in the USA for 20 years and was introduced to the UK in 2002. As of winter 2009/2010 the number of Safecote users was in the region of 60 in the UK, the majority being local authorities.



Safecote enhances salt by giving a number key benefits, control distribution, longevity, corrosion inhibition, lower freezing point depression, greater resilience and is environmentally friendly.

The following graph shows the difference in control distribution between dry rock salt and Safecote treated salt giving local authorities the confidence to reduce spread rates when using Safecote treated salt as it clearly shows more Safecote treated salt is present in the target area of the highway. This research was carried out on the TRL (Transport Research Laboratory) test track in Crowthorne, Berkshire. It is based on a motorway scenario and shows an average spread of 10grams per square metre Safecote treated salt compared with the same of dry rock salt (virgin salt). The Safecote salt hits the target zone and stays with very little loss into the verge and central reservation. Whilst the dry rock salt (virgin salt) shows greater loss into the verge and central reservation and has much less than 10g/m salt in lanes 1 and 2.





As knowledge of Safecote was built it was considered that Safecote could bring a number of additional welcomed benefits to Glasgow in addition to corrosion inhibition, being:

- Control distribution
- De-icing longevity
- Reduced freezing point
- Increased resilience
- Allows for route optimisation

These points would holistically give significant overall cost savings.



The UK's largest transportation research house - Transport Research Laboratory (TRL), in Crowthorne, Berkshire had undertaken their own investigations into Safecote treated salt on the following key factors:

- Freezing Point Temperature
- Application & Spread Characteristics
- Ice Melt/Ice Penetration
- Corrosion
- Skid Resistance
- Environmental Impact

To add to this CAPCIS one of the leading research bodies of corrosion in the UK had produced a study comparing the effects of standard dry rock salt, brine wetted rock salt (pre-wetted) and Safecote treated rock salt. The results show that the Safecote treated salt reduces corrosion by up to 82% against the other materials.

These mild steel plates were fixed to gritting vehicles operating out of Staffordshire County Council depots for just one winter period and the results are very noticeable:



Reports by Ulster University who are a leading researcher of highway used products were reviewed, these show that Safecote is a more powerful de-icer than rock salt. In neat form it will not freeze until it reaches temperatures lower than  $-70^{\circ}\text{C}$ . It is well known that standard rock salt has a depression point  $-6/-7^{\circ}\text{C}$  but with just the 3% coating of Safecote to rock salt, de-icing will continue to approximately  $-12^{\circ}\text{C}$ . Certainly during the recent winters temperatures have dipped very low and this benefit has also given local authorities additional comfort using the product.



## Ongoing Research

It is the aim of Safecote Ltd to continue to research its product and exciting results have been documented to maintain confidence in its ability to provide optimum performance.

Lincolnshire is the second largest county in England and their County Council operate a pre-wet mix for de-icing treatments being 70% high purity rock salt and 30% salt brine. Its land is predominantly used agriculturally. It is one of the few counties in England without a motorway and therefore de-icing a network of 3081km within an 8800km network can prove a huge operational task.

As the county has lots of open flat land, salt remaining of the network was proving a problem for them and as Safecote is known to have residual properties the authority decided to implement the additive to their pre-wet mixing as a trial from one of their depots in winter 2007/2008.

After two years operating Safecote/pre-wet mix it was difficult to gauge in any detail comparisons on the performance. Although operatives made comment that it looked and seemed to give an improved performance analysis was needed to determine if this was the case.

The authority requested for their Weather Station suppliers Viasala to compare the data from two adjoining weather stations whereby one route operated Safecote/pre-wet and the other pre-wet alone. The data compared was taken from an average winter week window in December 2008. The results were significant and determined that not only was the Safecote mix de-icing faster but it also stayed and performed for longer periods continuing to re-activate.



Seven noticeable differences were found and are detailed below:

1. PW + Safecote shows greater average depression of freezing over the period  
**Reduced Number of freezing periods**
2. PW + Safecote appears to be more able to show depression point of freezing  
**Staying in solution for longer periods**
3. PW alone has more difficulty getting the salt into solution  
**PW + Safecote turning into solution quicker**
4. PW + Safecote has considerably fewer times of 0 degrees C depression of freezing compared with pre-wet alone  
**Staying and working on the surface for longer periods**
5. Depression of freezing values are much higher for PW + Safecote  
**Due to quicker performance**
6. Pre-wet + Safecote shows a less spiky profile of depression of freezing point – this is probably due to slower drying of the salt applied  
**Slower drying of PW + Safecote**
7. Depression of freezing readings of >0.1 degree C as a percentage of the number of readings PW + Safecote = 29.49% compared with 14.79% for pre-wet alone  
**Staying and working on the surface for longer periods**

This has resulted in Safecote now being used at a further depot within Lincolnshire.



### The Trial

The evidence, research and user references gave Glasgow City Council the confidence to trial Safecote as an alternative to glycol in winter 2006/2007 on one route treating the River Clyde Tunnel and all river bridge decks and were the first user of Safecote in Scotland. Spread rates on this route were reduced to 15gms per metre<sup>2</sup> for precautionary treatments and 30gms per metre<sup>2</sup> for snow events.



Regular visual inspections were made and compared to routes using dry rock salt and although less salt was used with Safecote a noticeable improved performance was reported. This continued throughout the season.

Based on evidence from the 2006/2007 trial of Safecote its use was then opened out to two of three depots as an extended and broader trial.





Again Safecote treated salt was reported throughout the season of 2007/2008 to provide superior performance over dry salt. The winter team's findings were encouraging in regard to the treated salt hitting the highway and staying where it should rather than being lost as found with dry salt. It is estimated that up to 50% of dry salt is lost due to the snaking effect out of the back of vehicles and its ability to bounce and travel into the channels or verge. It was also noted to stay on the highway for longer periods due to its viscous nature, which supports reports of longevity by other users.

The two year trial results gave Glasgow City Council the confidence to roll-out the use of Safecote treated salt to all depots and consequently a further depot used this salt from winter 2008/2009

### The Results

Glasgow's findings are detailed in the table below comparing the two salt types which gave confidence to use Safecote treated salt throughout their estate:

	<b>Dry Salt</b>	<b>Safecote Treated Salt</b>
<b>Spread Distribution</b>	Good but noticeable loss	More in wheel tracks – less loss
<b>Residual Performance</b>	Easily trafficked away or blown away on open roads	Gives longevity staying on the highway
<b>Sustainability</b>	Causing great concerns to the corrosive effects on bridges and highway infrastructure across the network	Improvements noted in areas where used, less deterioration and increased gritter life
<b>Freezing Point</b>	De-ices to approximately -6/-7°C	De-ices to approximately -11/-12 °C
<b>Storage Requirements</b>	Covered storage (recommended)	Covered storage (recommended)
<b>Vehicle Requirements</b>	Standard gritting vehicle/machine	Standard gritting vehicle/machine
<b>Environment</b>	Concerns on the affects to the environment	Environmentally preferred due to its ability to reduce salt use which also results in reduced carbon footprint as less vehicles are needed
<b>Resilience</b>	No scope to reduce treatments	Ability to maintain higher stock levels as less salt can be spread and longevity on the network
<b>Route Optimisation</b>	Minimal scope for movement	As less salt is required gritters can therefore go further spreading which has resulted in a reduction of 17 routes. The number of vehicles in use have also been reduced by 26)
<b>Overall Performance</b>	A good de-icer although huge loss of material and staying power, ineffective at very low temperatures and causing costly damage to the highway infrastructure, gritters and the environment	A powerful de-icer that performs quickly and for longer periods. Cost savings made on spread rates reduced and reduced treatments. Noticeable improvements to gritting vehicles and bridge/tunnel areas





## **Conclusions**

### **Savings**

Glasgow City Council have reduced their spread rates by 50% and are operating Safecote treated salt now out of their two depots.

Spread rates at dry salting were 20g/m for pre-cautionary salting and 40g/m for snow events. Using Safecote salt spread rates have been reduced to 10g/m for pre-cautionary salting and 30g/m for snow events.

An estimated cost saving based on the purchase of salt alone is over £105,000.

This calculation is based on winter 2008/2009 alone and does not include savings for:

- Reduced labour for washing down vehicles
- Reduced gritter costs following route optimisation
- Reduced labour costs following route optimisation
- Reduced vehicle running costs following route optimisation
- Reduced maintenance costs to fleet due to protection Safecote gives to vehicles
- Corrosion inhibition to network infrastructure

### **Performance**

The performance following implementation has increased with a most marked improvement in the condition of the footway spreaders at the end of the season since the introduction of Safecote.

### **Resilience**

In recent years there has been growing concerns raised towards stock holding and resilience levels of de-icing material stored by local authorities. Based on treatments from winter 2008/2009 Glasgow City Council used approximately 6,875 tonne less salt by operating with Safecote treated salt, this in itself will give over one month's additional resilience to treat their network.

### **Carbon Footprint**

During recent years using Safecote salt at lower spread rates has allowed local authorities to gain maximum efficiency from their fleet and Glasgow City Council have reduced their fleet by a staggering 26 vehicles. This not only has a huge effect on cost savings (estimated at £80,000 per gritter) but a huge step to reduce the Co2 emissions by the authority.

The introduction of the Local Authority Carbon Emissions Programme which was initially trialled in Scotland in 2003 became legislation in the UK under the Climate Change Act in November 2008. It sets a target for the UK to reduce carbon emissions to 80% below 1990 levels by 2050. It also set an interim target of a 34% reduction by 2020 (with the potential to increase this to a 42% cut given an international agreement) and established the concept of carbon budgets.

To date with efficiencies made to the gritting fleet, Glasgow have reduced their emissions by approx. 21.58 tonnes of carbon and this does not include any reduction for reduced treatments which Safecotes residual ability allows or delivery of reduced volumes of salt.



## Environment

The reduced volumes of salt used by the authority because of Safecote's use has not only been welcomed towards reducing the impact to the environment but has also contributed towards Glasgow winning the APSE award in 2008. Quality audits were carried out quarterly and it was determined that the authority's performance indicators had constantly improved. Its gaining of ISO14001 accreditation towards the environmental pollution reduction of 25% to 50% has been an outstanding achievement.

COSLA 2007/08 IMAGES

