



## LOCH LEVEN HERITAGE TRAIL

### BACKGROUND

Having been introduced to Mackenzie Construction's sustainable surfacing solution, Smart Surface, during the Clyde Walkway project in Blantyre, The Regional Access Committee for Kinross-shire (TRACKS) and Perth and Kinross Council approached Mackenzie Construction to discuss the possible use of Smart Surface to upgrade parts of the Loch Leven Heritage Trail.

### PROBLEM

Sections of the Loch Leven Heritage Trail are showing signs of suffering damage from wear and erosion due to loss of the whin dust surface leaving a vast expanse of exposed Type 1 material and sunken areas of the path where water is collecting, resulting in areas of an unpleasant surface for path users.

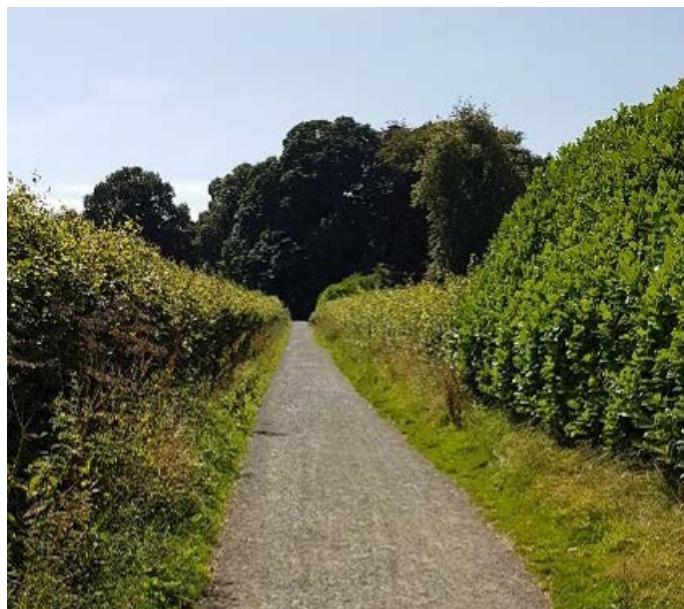


Figure 1 - Pathway before

### PROPOSED SOLUTION

This solution presented to TRACKS and Perth and Kinross Council is Mackenzie Construction's Smart Surface solution. Smart Surface is a solution that uses the existing strata (soils & aggregates) and combines these with a hydraulic binder to produce a bound, stable, concrete like material without the need to import large quantities of material to the location. The material is significantly more carbon friendly when compared with other fully bound materials such as an asphalt based material.

Following some discussions, and given Mackenzie Construction's confidence in the product, a small test area was identified near Kinross House for the application of the Smart Surface product to test its suitability as a potential option to upgrade sections of the trail.

The solution presented was to apply Smart Surface to a 100m section of the Heritage Trail and finish half of this with 6mm grit and the other half with a bitumen based surface dressing to display both options of finish.

The application of Smart Surface is at its most beneficial when the existing soil is treated without removing the existing material and replacing it with new quarried material. To carry out the process in this example, the existing material is first broken up and loosened to the target treatment depth of 100mm. Any low spots are filled in and the surface roughly graded to suit. If the soil contains a large proportion of larger particles (typically bigger than 50mm) then the skid steer mounted crusher will be passed over the area to break the soil down and

crush the particles to approximately 40mm and smaller. The soil is then ready for the application of the Smart Surface binder.

The Smart Surface powder is then dispensed over the area (Figure 2). The quantity per m<sup>2</sup> depends on the target % binder required and the target treatment depth. This is dry mixed into the soil using the skid steer mounted crusher or other similar implement (Figure 3). Water is then added to the soil and the soil mixed again using the same equipment. The water starts the reaction of the Smart Surface binder.



Figure 2 – Smart Surface powder being dispensed over the specified area



Figure 3 – Smart Surface powder being mixed into the soil using Skidsteer Mounted Crusher

The soil is then levelled again to remove undulations from the mixing process. Once this has been carried out, the soil is then compacted using a roller until the specified level of compaction has been achieved.

The two finishing options recommended for this particular application are the application of either 6mm grit embedded into the surface or the application of a bitumen based surface dressing. The 6mm grit should be adequate for most applications with the surface dressing recommended for areas of high wear or on steeper gradients on the pathway.

If the 6mm grit is selected, a thin layer of loose aggregate is placed over the area before curing takes place and it is embedded into the still curing surface while compaction process is in progress.

If the area is being treated with the surface dressing, it is rolled until the required compaction has been achieved. Once the surface has cured, the surface dressing is applied via the spray of a bitumen based tack coat and the application of 6mm grit. This adheres the grit to the Smart Surface giving high levels of durability.

The solution that is left is a fully bound pavement that is not susceptible to water damage, not susceptible to damage due to loss of fines to the sub soil, offers good resistance to wear and is a pleasant surface to walk or cycle on. This can be seen in Figure 4.

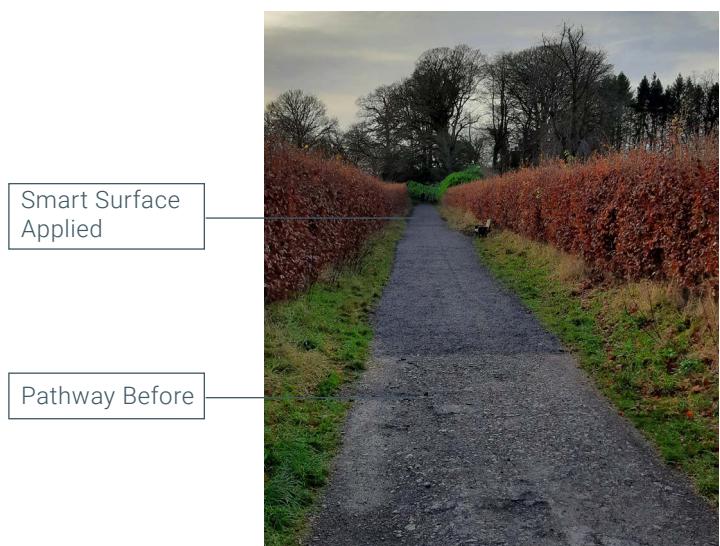


Figure 4 - Completed Section

## COSTS

Costs are very dependent on several factors. Existing site conditions such as path makeup, whether levels need adjusted or if material needs imported or excavated have a bearing on setup and preparation time. Ease or difficulty in access can also have a bearing on the cost through increasing the time required for moving equipment and materials between storage areas and work areas.

The total costs for the trial undertaken in November 2021 are only representative of a small section of works. If these costs are extrapolated to larger sections of work then the following costs could be used as a guide:

EXAMPLE WORK AREA SIZE (M2)	INDICATIVE COST PER M2
500	£32-£35
1000	£28 - £32
2000	£25 - £28

The above costs only include for the application of the Smart Surface material. Any filling, regrading or repairs to the pathway before application would be additional to this. Each area requiring additional preparation works would need to be priced on its own specific circumstances.

For any areas where the surface dressing option was to be considered (such as steep or very high wear sections) a further £15-18 per M2 should be allowed with a minimum area of 300m2 to be treated in one visit.

## BENEFITS

There are many benefits to choosing Smart Surface for this application. Smart Surface provides a durable and aesthetically pleasing finished pathway that has an expected lifespan that meets or exceeds that of an asphalt alternative. It provides an impermeable layer that is not susceptible to water damage as the fines are bound within the soil matrix. It also benefits from the removal of the need to import and transport along the pathway large quantities of material like you would have with an asphalt or Ultitrec alternative.

As the surface is bound, there is less opportunity for weeds and vegetation to grow that can reduce the quantity of maintenance via weeding or herbicide application.

In addition to the practical benefits, significant carbon savings can be demonstrated by the use of Smart Surface when compared with alternatives. This is expanded on below.

For larger areas, there are cost savings to be had when compared with alternatives. For smaller schemes where the area is in the order of 500m2, the cost is comparable with alternatives, however if larger areas can be programmed in the same mobilisation and timeframe, the costs do come down to better than alternatives.

## ALTERNATIVES (REFERENCE: PATHS FOR ALL - SURFACING GUIDE FOR PATH PROJECTS)

### WHIN DUST MAINTENANCE

While maintenance of the path using whin dust is certainly possible, it will need carried out every 2-5 years dependant on use and environment and will be more susceptible to weeds and vegetation as roots will be able to develop within the soil. Estimated maintenance costs for this are £3.50 /m2 to re-dust the path with any potholes or damages costing £18.50 /m2 to repair.

### DENSE BITUMEN MACADAM (DBM) & HOT ROLLED ASPHALT (HRA)

DBM and HRA are the closest of a range of alternatives to Smart Surface in the fact that both provide a fully bound surface from a structural layer of pavement. Both will require the import of significant quantities of materials, all of which will require a significant number of vehicle movements along the path to transport and place. The indicative cost range for this material is £24.80 to £52.80 per m2.

## ULTITREC

Ultitrec is a semi bound material made from recycled aggregates. While this is also a possible alternative, it comes with similar problems as both DBM, HRA and Whin Dust. It requires a large volume of material to be imported and transported along the existing pathway. Like Smart Surface, HRA and DBM materials, it requires specialist plant to lay properly. Previous experience with this material shows that the surface can be susceptible to water damage via the loss of fines and is not as resilient to wear as the alternatives. The indicative cost range for this is £26.80 to £38.10 per m<sup>2</sup>.

## CARBON

Significant Carbon savings can be demonstrated when compared with compatible technologies. The table below shows what can be achieved.

AREA TREATED (M <sup>2</sup> )	SMART SURFACE CO <sub>2</sub> EMISSIONS (KG)	SMART SURFACE WITH SURFACE DRESSING CO <sub>2</sub> EMISSIONS (KG)	ASPHALT CO <sub>2</sub> EMISSIONS (KG)*	UNBOUND TYPE 1 CO <sub>2</sub> EMISSIONS (KG)*
500	2,905 kg	3,223 kg	6,720 kg	797 kg
1000	5,809 kg	6,446 kg	13,440 kg	1,593 kg
2000	11,618 kg	12,892 kg	26,879 kg	3,186 kg
			*Emissions factor taken as an average of data from the following sources – Tarmac, CESMM4 Carbon and Price Book, Highways Agency Carbon Tool	*Emissions factor taken from the following source – CESMM 4 Carbon and Price Book - Section R1 – Unbound Sub-Base

No data for the CO<sub>2</sub> emissions for Ultitrec is publicly available at this time.

## SUMMARY

Smart Surface does present an excellent and sustainable solution to pathway upgrades to the Loch Leven Heritage Trail. Given large enough areas, it becomes more cost effective than competing technologies without the need for large numbers of vehicle movements during the construction. While the final lifespan of the product is not yet fully known, all indications are that it will last for at least as long as an asphalt alternative.