

# Transport and Environment Committee

10.00am, Thursday, 1 March 2018

## Finalised Strategy for Setted Streets

<b>Item number</b>	11
<b>Report number</b>	
<b>Executive/routine</b>	Executive
<b>Wards</b>	All
<b>Council Commitments</b>	<a href="#">15</a> , <a href="#">16</a> , <a href="#">17</a> , <a href="#">19</a>

### Executive Summary

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Edinburgh is recognised as having retained much of its traditional palette of street materials including stone setts, kerbs and channels as well as some examples of stone pavement flags. Around 4.6% of the city's streets are setted. Setts are important features of historic and cultural significance for the city. Edinburgh is required to safeguard the Outstanding Universal Value of the Old and New Towns of Edinburgh World Heritage Site; its Conservation Areas; and other historic parts of the city including the setting of its numerous listed buildings where setted streets are recognised as integral to the historic identity of its townscape and authenticity.

Initial collaboration with Edinburgh's partner city Krakow reinforced the cultural significance of setted streets, as well as identifying the complex range of measures that need to be applied to conserve, enhance and maintain setted streets.

The Council in partnership with Historic Environment Scotland (HES) and Edinburgh World Heritage (EWH) commissioned the British Geological Survey (BGS) to prepare a project that has reviewed traditional setted streets in Edinburgh; analysed the performance of setts and setted streets; and also, examined the prospects for sourcing and preparing stone for setts, kerbs and channels in Scotland. This work has provided invaluable supporting information and clear guidance assisting the Council in achieving the aims of the strategy for setted streets and incorporated into the Edinburgh Street Design Guidance Fact Sheet for setts.

Work has continued to have been undertaken on the setted streets review in the preparation of the strategy for setted streets now proposed.

## Finalised Strategy for Setted Streets

### 1. Recommendations

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- 1.1 It is recommended that the Transport and Environment Committee:
  - 1.1.1 notes the content of this report highlighting further information on the agreed actions;
  - 1.1.2 approves the finalised strands of work and the Principles for setted streets as detailed in appendix 2;
  - 1.1.3 notes the incorporation of these principles into the Edinburgh Street Design Guidance Fact Sheet for setts and its subsequent inclusion into Part C Detailed Design Manual for the Edinburgh Street Design Guidance previously approved by the Transport and Environment and Planning Committees;
  - 1.1.4 notes the close partnership working and input of Historic Environment Scotland, Edinburgh World Heritage and the British Geological Survey in the formulation of the strategy for setted streets;
  - 1.1.5 approves the additional principles outlined in connection with different techniques used to lay setts; the required skills associated with their maintenance and the supporting information on sustainability of setted streets provided as detailed in paragraphs 3.22 – 3.26;
  - 1.1.6 acknowledges the level of support for the retention, maintenance, repair and laying of new setted streets as demonstrated through the responses received via the consultation exercise undertaken; and
  - 1.1.7 approves the reconstruction of the setted carriageway in Brighton Place, as detailed in paragraphs 3.31 – 3.35.

### 2. Background

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- 2.1 An outline of the measures required to conserve, enhance and maintain setted streets in Edinburgh was presented to Transport and Environment Committee on 15 March 2016. Committee agreed that the following actions would be reviewed and developed into a strategy for setted streets:
  - Raise awareness of the cultural and economic value of the condition of setted streets;

- Prepare and compile an up to date survey of the condition of setted streets and review the traffic use on setted streets to assess where changes would help the long-term management;
  - Establish a range of specifications for the repair and maintenance of setted streets, including laying of setts, jointing and re-using or re-facing setts to improve the walking and cycling surface, for example;
  - Improve in-house maintenance skills, drawing on Edinburgh World Heritage (EWH) and Capital Skills Programmes, to enable repairs to be tackled at an early stage and avoid significant comprehensive repairs, review current budgets and funding and work with partners to build up additional funding and resource for maintenance; and
  - Review the Framework contracts to ensure that the appropriate specification is used for repairs and consider increasing the maintenance liability period to ensure better quality results.
- 2.2 The report was referred to Planning Committee on [19 May 2016](#).
- 2.3 The Planning Committee asked for a future report to be submitted that would include information on the sustainability of setted streets. This was to include the different techniques used to lay setts, the skills required and the costs associated with maintenance.
- 2.4 Further work was undertaken by Planning and Transport staff in relation to these strands of work and a draft strategy for setted streets was developed. A Setted Streets Progress Report outlining the draft strategy was presented to the Transport and Environment Committee on [17 January 2017](#).
- 2.5 The Committee agreed to continue consideration of the report by the Executive Director of Place at the meeting of the Transport and Environment Committee on [21 March 2017](#) to allow for further engagement/consultation and associated costs to be established.
- 2.6 The incorporation of the principles detailed within the draft strategy into the Edinburgh Street Design Guidance Fact Sheet for setts within Part C Detailed Design Manual for the Edinburgh Street Design Guidance which would be used for the design of both existing and new streets was also presented to the Transport and Environment Committee on [17 January 2017](#).
- 2.7 The report was referred to the Planning Committee on 2 March 2017 and approved matters within its remit without any further actions recommended.
- 2.8 Further work has been undertaken by Planning and Transport staff in relation to these strands of work to further develop and finalise the strategy for setted streets. Details of the progress against these actions are outlined below.

- 2.9 One such strand has involved the Council's partnership with Historic Environment Scotland (HES) and Edinburgh World Heritage (EWH) in the commissioning of the British Geological Survey (BGS) to deliver a project that has reviewed traditional setted streets in Edinburgh; analysed the performance of setts and setted streets; and, examined the prospects for sourcing and preparing stone for setts, kerbs and channels in Scotland. This has further strengthened the above actions and the principles of the strategy for setted streets as outlined below. The BGS report is presented in appendix 5.
- 2.10 A consultation survey was created and hosted on the Council's Consultation Hub, inviting comments between 13 September 2017 and 11 October 2017. A consultation description with a link to the survey website was sent to approximately 270 stakeholders including community and amenity groups and members of the public.

### 3. Main report

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#### **Cultural and Economic Value**

- 3.1 A further review has been undertaken to establish the contribution made by setted streets to the cultural and economic value of Edinburgh. The value is recognised by assessing:
- historical associations;
  - the role they have in understanding the cultural heritage of Edinburgh;
  - their contribution to the character and authenticity of an area;
  - public opinion;
  - their contribution to the state of repair of protected places, as part of national and local identity;
  - the use of local stone; and
  - the contribution of new setts.
- Details of these assessments have been presented in appendix 2.
- 3.2 Stone setts have significant historic importance as they have been part of Edinburgh's character since the end of the eighteenth century. Setted Streets, much like stone paved footways and other stone street details are all intrinsic features that are important to the character of Edinburgh's built environment and public realm.

3.3 In the context of this tradition, a series of recommendations have been drawn together. These recommendations set out a series of principles for setts which propose that retaining setts and introducing new stone setts is prioritised in areas that are recognised for their historic importance. These protected streets include those that are within the World Heritage Site and Conservation Areas. Setted streets that provide an integral part of the setting of a listed building, may also be protected. These sites will be judged on their own merit. Recommendations also outline details relating to the ongoing maintenance of setted streets.

**Condition and Traffic Management**

- 3.4 Approximately 4.6% of the city’s streets are setted. These setted streets provide value to the city’s streetscape in a similar way as stone buildings do to the townscape. Like stone buildings, setted streets perform better if correctly maintained.
- 3.5 The greatest threat to the integrity of setted streets comes from commercial vehicles and other heavy axle vehicles, such as buses. Carriageways are designed based on the number of such vehicles using each road. However, only a small percentage of the setted streets in Edinburgh carry significant flows of such vehicles.
- 3.6 The volume of buses on each road is assessed. Table 1 shows how this is calculated.

**Table 1**

Bus Use	No. Buses per Hour
High	>50
Medium	15-50
Low	<15

- 3.7 Appendix 3 shows the list of setted streets in Edinburgh with their associated Road Type and bus use. Thirty setted streets (6%) are on bus routes.
- 3.8 Improvements have already been made to several setted streets in 2016/17 and 2017/18. These include Circus Place, Howe Street and Queen Street Gardens West. These streets have low bus use and their renewal will make them more robust to the impact of this loading. The investment in the repair and improvement of these streets amounted to over £1m.
- 3.9 A review of vehicular use and traffic volumes on setted streets will be undertaken to establish if changes could be made to the network in order to reduce the loading capacity on these streets and slow the deterioration of the setts as previously reported to Committee.

## **Consultation**

- 3.10 A consultation survey was created and hosted on the Council's Consultation Hub, inviting comments between 13 September 2017 and 11 October 2017. A consultation description with a link to the survey website was sent to approximately 270 stakeholders including community and amenity groups and members of the public. A total of 954 responses were received over the consultation period.
- 3.11 A total of 16 survey questions were the subject of the consultation exercise. The first five questions asked for information about the participant including their age and which ward of the city they stayed. The following 11 questions focused on the value of setts, their retention or removal and the impediments they may cause when using various forms of transportation in the city.
- 3.12 A range of feedback was obtained as a result of the consultation. This feedback primarily focused on the positive contribution setts have to heritage in all areas of the city, support for their preservation and increased maintenance, the challenges they present when cycling and the damage contractors can cause when lifting setts for utility or telecommunication works.

## **The Contribution of Setts to Heritage**

- 3.13 The consultation survey explored the value of setts to residents in all areas of the city. The results demonstrated that:
- Just over 90% of people agreed (90% with 70% of those strongly agreeing) that setted streets play an important role in defining Edinburgh's heritage, whilst 5% disagreed with this statement (1% strongly disagreed);
  - 89% agreed (74% strongly agreed) that setted streets should be protected and retained as an historic asset as they contribute to the identity, value and character of Edinburgh's UNESCO World Heritage Site, whilst 7% disagreed (2% strongly disagreed);
  - 87% agreed that setted streets should be protected in Edinburgh's designated Conservation Areas as they contribute to their identity, value and character, whilst 7% disagreed (2% strongly disagreed); and
  - Over 80% of respondents agreed that setted streets should be protected in other areas of the city (80% with 66% strongly agreeing), whilst 14% disagreed that setts contribute to the identity, value and character of these areas (5% strongly disagreed).
- 3.14 The overall consensus for this section of the survey shows that there is overwhelming support for the retention and protection of setted streets in Edinburgh, with over 80% of respondents in either agreement or strong agreement with each statement.

## **Cyclists and Setted Streets**

- 3.15 The consultation survey asked if setted streets present an impediment when walking, cycling, using a motorbike or using a motor vehicle. A number of participants commented on the difficulties that they or someone they know have experienced when cycling on setted streets.
- 15% of respondents agreed that setted streets present an impediment when walking (5% strongly agreed) whilst just under three-quarters disagreed (73% with 43% strongly disagreeing);
  - 41% agreed (20% strongly agreed) that setts present an impediment to cycling, whilst 34% disagreed (with 15% strongly disagreed);
  - 17% agreed that setts present an impediment to motorcycles (6% strongly agreed) whilst 43% disagreed that they do (22% strongly disagreed); and
  - 15% agreed that setted streets present an impediment to motor vehicles (with 5% strongly agreed) whilst over two-thirds disagreed (70% with 40% strongly disagreeing).
- 3.16 In addition, the consultation asked participants if any impediment they experienced whilst using setted streets influenced their behaviour.
- Almost one-third of survey respondents said that setts did not influence their behaviour (303/953);
  - Over half of respondents advised that they tend to slow down on setted streets (591/953), whilst 12/953 said that they tend to speed up;
  - Just under one-tenth of participants advised that they dismount on setted streets (81/953) and 43/953 respondents advised that they consider an alternative transport mode if they know that their route will involve travelling on setts;
  - Over one-fifth of respondents said that they take an alternative route if they know they will encounter setted streets (210/953); and
  - 85 respondents selected 'Other' as an option during the consultation exercise. The majority of follow up comments reiterated previous survey selections, for example, slowing down on setts or provided an alternative option not mentioned, for example, cycling on the pavement to avoid setts. In contrast, a number of comments advised that they actively choose a route that involves setts for pleasure, stating that they cause no impediment during travel. Some comments suggested that it is not the setts that creates an impediment, but the condition of the setted surface if poorly maintained.
- 3.17 Cycling on setted streets was commented on by a significant number of participants. Feedback advised that cycling can be a difficult task on setts when they are round-topped, uneven, wet or when they have large gaps between them. As in appendix 1, over 50 respondents expressed their support for the adaptation of setted streets to better cater for cyclists and their safety, including the introduction of segregated cycle lanes on setts with smoother, more suitable surfaces.

## **Contractors and Setts**

- 3.18 It is understood that contractors including utility companies, telecommunication companies and developers have to lift setts during construction or when carrying out maintenance works. Participants raised issues with these contractors during the consultation exercise that can be seen in appendix 1, particularly when they have failed to reinstate setts to an equivalent or improved quality following the completion of works.

## **Damaged Setts**

- 3.19 The consultation survey asked respondents their opinion on what to do if setts are damaged.
- Just over one-tenth agreed that damaged setts should be replaced with other alternative surfacing materials (13% with 6% strongly agreed), whilst 80% disagreed (57% strong disagreed); and
  - Almost one-third agreed that if damaged setts need to be removed, they should be replaced with new, modern setts (61% with 37% strongly agreed), whilst just over one-quarter disagreed (12% strongly disagreed).
- 3.20 The consultation exercise also asked if repair works to setted streets or proposals for large development schemes within an area that has setted streets should seek to match both the materials and laying practice of the existing setts.
- 86% agreed (with 72% strongly agreed) that any repair works or proposals for large development schemes within an area that has setted streets should seek to match both the materials and laying practice of the existing setts, whilst just under one-tenth disagreed (9% disagreed with 3% strongly disagreed).
- 3.21 A number of participants advised that they would like to see tarmac removed that has been used to repair setted streets in the past and setts reinstated.

## **Specifications for repair and maintenance**

- 3.22 The specifications for construction and maintenance of setted streets has been developed in partnership with Historic Environment Scotland, Edinburgh World Heritage through the commissioning of the British Geological Survey who has produced a detailed specification sheet for the repair, maintenance and laying of new settled surfaces for a variety of different street types dependent on their location, designation and traffic usage. This accompanies the Fact Sheet for Setted Streets and forms part of the Edinburgh Street Design Guidance. This is detailed in appendix 4.
- 3.23 Consideration must be given to all road users, including cyclists and walkers, when designing the renewal of setted streets. The use of new flat-topped setts brings additional benefits for walking and cycling across the city and will be an important consideration prior to carrying out maintenance, repair and improvements for setted streets. This should be looked at on an individual street basis.

- 3.24 A setted carriageway will have a longer life than an asphalt carriageway but the initial costs to reconstruct a setted carriageway is far greater. Depending of the location and traffic management required the costs for renewal of a setted carriageway are shown in table 2:

**Table 2**

Type of Construction	Cost per M <sup>2</sup>
Sett Reconstruction	£250 - £350
Asphalt Reconstruction	£50 -£70
Asphalt Overlay	£15 - £20

- 3.25 Whilst a setted carriageway will generally last a lot longer than an asphalt carriageway before maintenance is required, it should be noted that once a setted street has been excavated and reinstated, for example, to enable utility works, then the initial expected life of the setted street can no longer be guaranteed.

#### **Maintenance Skills**

- 3.26 In-house maintenance skills have been reviewed in tandem with the work undertaken in association with the production of detailed specification sheet for the repair, maintenance and laying of new settled surfaces by the British Geological Survey. The recommendation for a dedicated team to undertake repair, maintenance and laying of new settled surfaces is currently being investigated with a view to introducing an in-house squad to carry out all sett repairs in the city.

#### **Funding and Budgets**

- 3.27 The renewal of setted streets is currently funded 100% by the Infrastructure capital budget. Maintenance of existing setted streets, which includes reactive response to localised repairs and improvements, is committed from the Roads Revenue budget and managed by each of the four Localities. Details of the 2017/18 budget were contained within the Road, Footway and Bridges Investment Capital Programme report to the Transport and Environment Committee in January 2017.
- 3.28 Closer links between capital and revenue investment are being considered through the review and improvements that will be made to the Roads Asset Management Plan (RAMP). This review will take place in 2018/19 and will work towards improving in the funding and maintenance of roads and setted streets.

#### **Framework Contracts**

- 3.29 The Roads and Transport Framework has been revised and the new Framework was in place in February 2018. The new tender documents include specifications and requirements for setted streets.

3.30 Work undertaken by Statutory Undertakers and private developers is controlled under the new Roads and Street Works Act 1991 with the requirements set out in the *Specification for the Reinstatement of Openings for Roads*. The terms were last updated and revised in January 2015. Changes and addendums can be sought between formal reviews by writing to Transport Scotland. As an additional measure, and as a suitable starting point towards improvements on the quality of maintenance, the Council can add setted streets to the Gazetteer of Streets with Special Engineering Difficulty (SAD). In making these additions, the Council can apply more onerous specification requirements and these would, again, be drawn up in line with the Framework contract specifications.

### **Brighton Place**

- 3.31 The resurfacing of Brighton Place was approved by the Transport and Environment Committee, as part of the 2015/16 Capital Investment Programme, on [28 October 2014](#). It was agreed that consultation should be carried out in Portobello to determine the appropriate type of resurfacing. Brighton Place is a setted street in a conservation area.
- 3.32 The most extensive of the consultations was carried out by Portobello Community Council, receiving over 400 responses. The results from their consultation slightly favoured removing the setts and replacing with asphalt. Consultation was also undertaken by Brighton and Rosefield Residents Association, Portobello Heritage Trust and Portobello Amenity Society. All of these stakeholders strongly supported the renewal of setts in Brighton Place.
- 3.33 The Transport and Environment Committee approved the resurfacing of Brighton Place with asphalt, removing the setts, at its meeting on [12 January 2016](#).
- 3.34 Since this meeting several deputations have been presented to the Transport and Environment Committee and the decision was taken to put the resurfacing of Brighton Place on hold until the findings of this report were presented to Committee.
- 3.35 Based on the findings within this report it is recommended to reconstruct the setts in Brighton Place, in line with Council policy.

## **4. Measures of success**

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- 4.1 Addressing the actions will result in:
- 4.1.1 Positive improvements against the World Heritage Site, Outstanding Universal Value indicators;
  - 4.1.2 Improvements to data management;
  - 4.1.3 Improvements in the quality and performance of maintenance operations;
  - 4.1.4 Improved maintenance skills;
  - 4.1.5 Reductions in wear and tear of the asset;

- 4.1.6 Increasing the available funding;
- 4.1.7 Improvements in quality and reductions in maintenance liability;
- 4.1.8 Improved pedestrian environment with more walkable surfaces; and
- 4.1.9 Better conditions for cycling.

## **5. Financial impact**

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- 5.1 The cost of renewals of setted streets is funded from the existing Road and Footway Capital Investment Programme. The level of investment in setted streets is being considered through the RAMP workstream.

## **6. Risk, policy, compliance and governance impact**

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- 6.1 The loss of setted assets, and the failure to maintain and enhance conservation areas, continues to be a risk for the Outstanding Universal Value of the World Heritage Site.
- 6.2 Improving the approach and mechanisms to the way the Council maintains setted streets would remove the risk of increasing costs resulting from increasing deterioration of the road asset.

## **7. Equalities impact**

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- 7.1 A review of setted street management and maintenance will have a positive impact on human rights through potential improvements to health, physical security, education and learning and could provide for productive and valued activities.
- 7.2 Improved walking and cycling surfaces would also bring positive impacts to the elderly and those with disabilities and as well as for cyclists of all ages. The Council's Access Panel, and other user groups, will be consulted as part of the preparation of the Edinburgh Street Design Guidance.

## **8. Sustainability impact**

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- 8.1 The impacts in relation to the three elements of the Climate Change (Scotland) Act 2009 Public Bodies Duties have been considered below:
  - 8.1.1 The update on actions in this report will help to reduce carbon emissions, for example, the project design will seek to reduce energy and use improved materials;
  - 8.1.2 There are negative impacts from slower vehicle movements which can add to air pollution;

- 8.1.3 The proposals in this report will increase the city's resilience to climate change impacts by retaining original materials;
- 8.1.4 The proposals in this report will help achieve a sustainable Edinburgh because the design aims to improve setted streets for all users and deliver improvements to materials;
- 8.1.5 The proposals in this report will help achieve a sustainable Edinburgh as improvements in public realm are recognised as being key to economic wellbeing;
- 8.1.6 The proposals in this report will assist in improving social justice by improving public space; and
- 8.1.7 Further details regarding specifications to help to bring improvements for cycling and walking will be required.

## 9. Consultation and engagement

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- 9.1 A consultation survey was created and hosted on the Council's Consultation Hub, inviting comments between 13 September 2017 and 11 October 2017. A consultation description with a link to the survey website was sent to approximately 270 stakeholders including community and amenity groups and members of the public.
- 9.2 A blog post advertising the consultation was posted on [www.planningedinburgh.com](http://www.planningedinburgh.com) that has 53 followers and 214 e-mail subscribers. The blog post was subsequently tweeted on two occasions, reaching up to 2574 followers.
- 9.3 In total, 953 survey responses and four written submissions were received in response to the consultation exercise.

## 10. Background reading/external references

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- 10.1 Scotland's Building Stone Industry: a review. Minerals and Waste programme Commissioned Report CR/16/026N British Geological Survey 2016.

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## 11. Appendices

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Appendix 1 – Setted Streets Consultation Results

Appendix 2 – Setted Streets  
Cultural Assessment and Principles

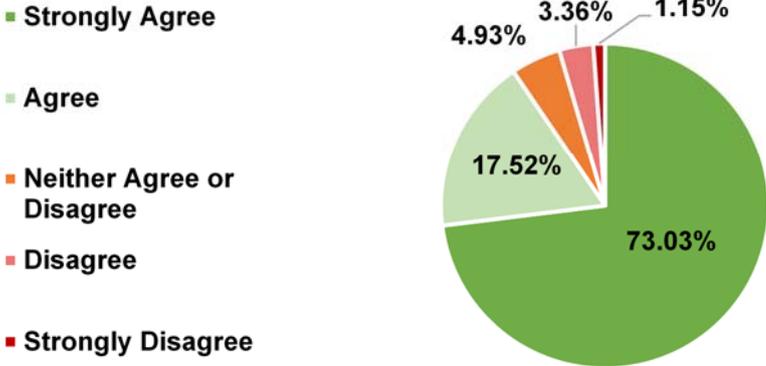
Appendix 3 – Edinburgh Setted Street Survey

Appendix 4 – Edinburgh Street Design Guidance: Part C – Footway Materials and  
Surfacing – Setts

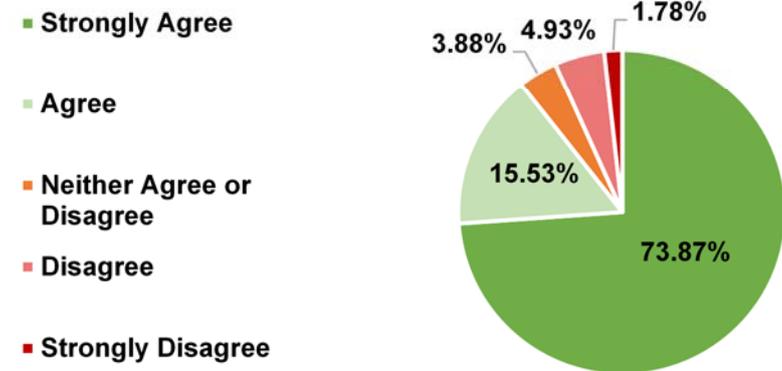
Appendix 5 – British Geological Survey Report

**Setted Streets Consultation Results**

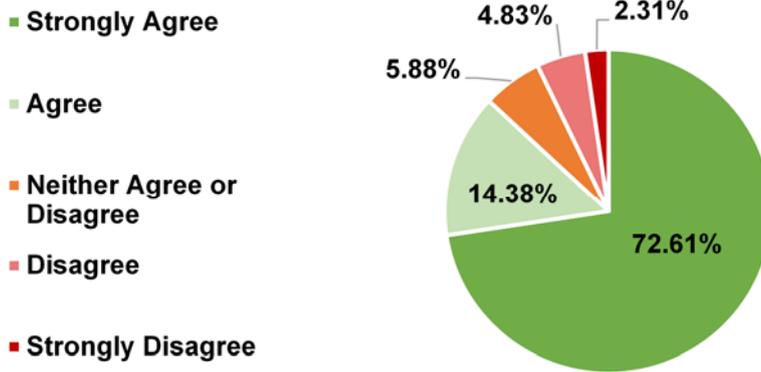
**Q6.** *“Setted streets play an important role in defining Edinburgh’s heritage”*



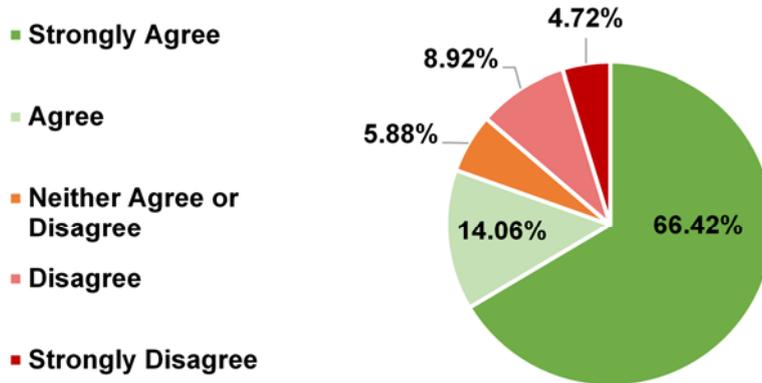
**Q7.** *“Setted streets should be protected and retained as an historic asset as they contribute to the identity, value and character of Edinburgh’s UNESCO World Heritage Site”*



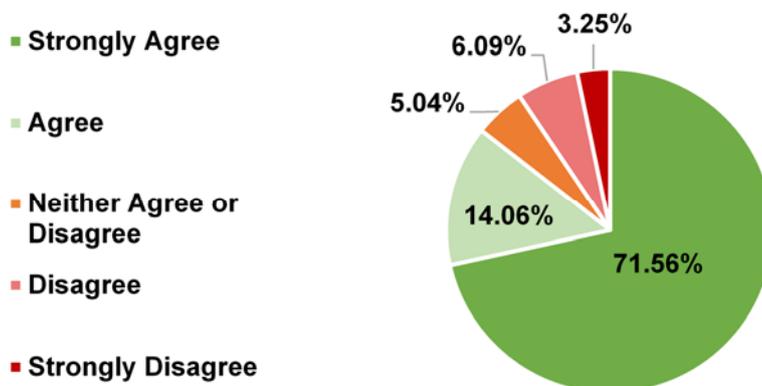
**Q8. “Setted streets should be protected and retained and as historic asset as they contribute to the identity, value and character of Edinburgh’s designated Conservation Areas”**



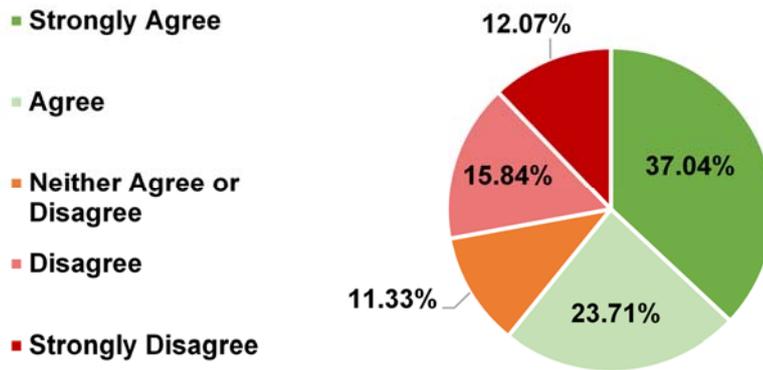
**Q9. “Setted streets should be protected and retained as an historic asset as they contribute to the identity, value and character of other areas of the city”**



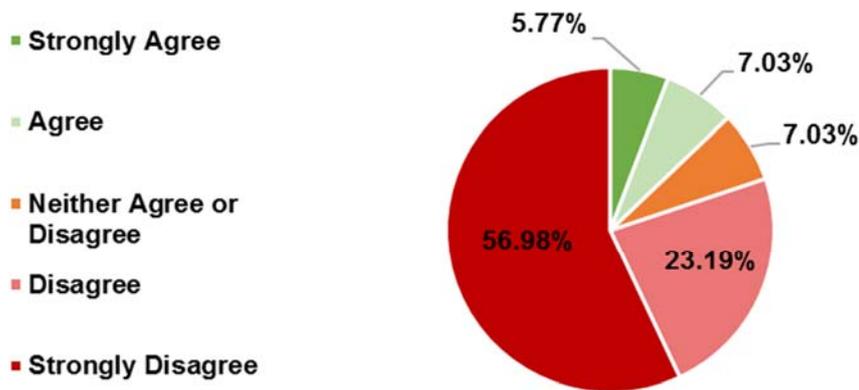
**Q10. “Any repair work to setted streets or proposals for large development schemes within an area that has setted streets should seek to match both the materials and laying practice of the existing setts”**



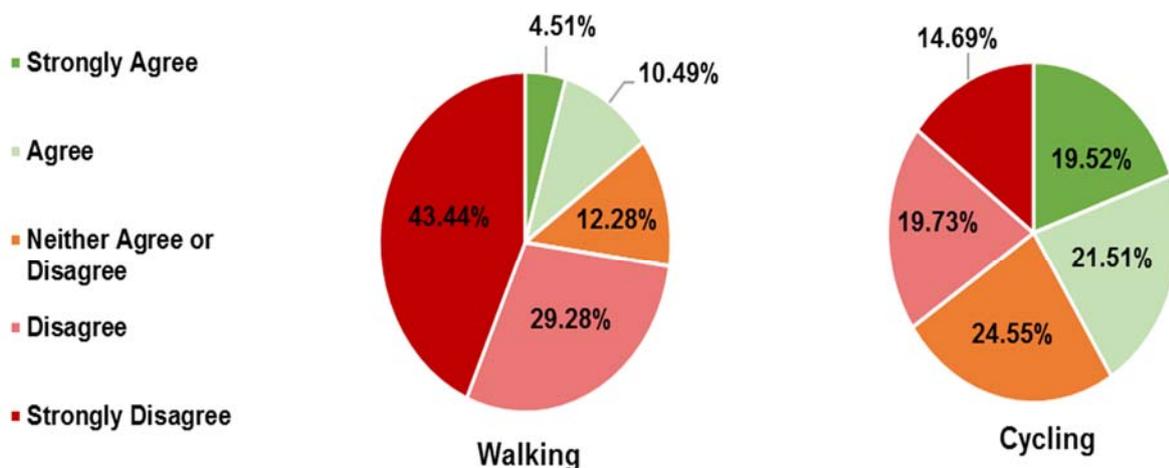
**Q11.** "If damaged setts need to be removed, they should be replaced with new, modern setts"



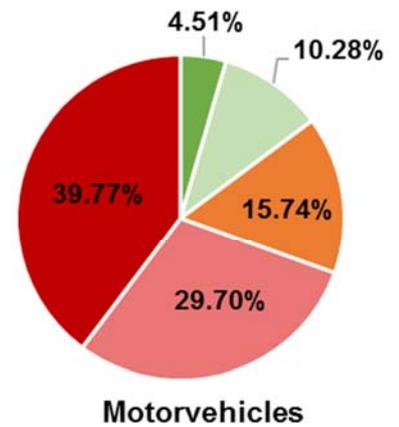
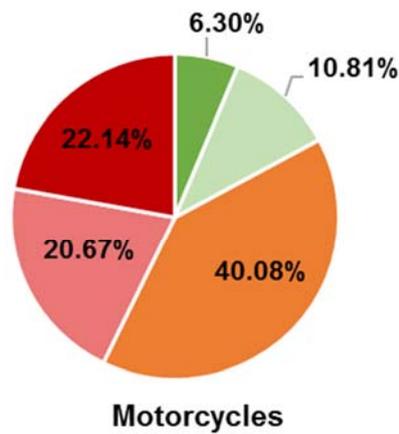
**Q12.** "If damaged setts need to be removed they should be replaced with other alternative surfacing materials"



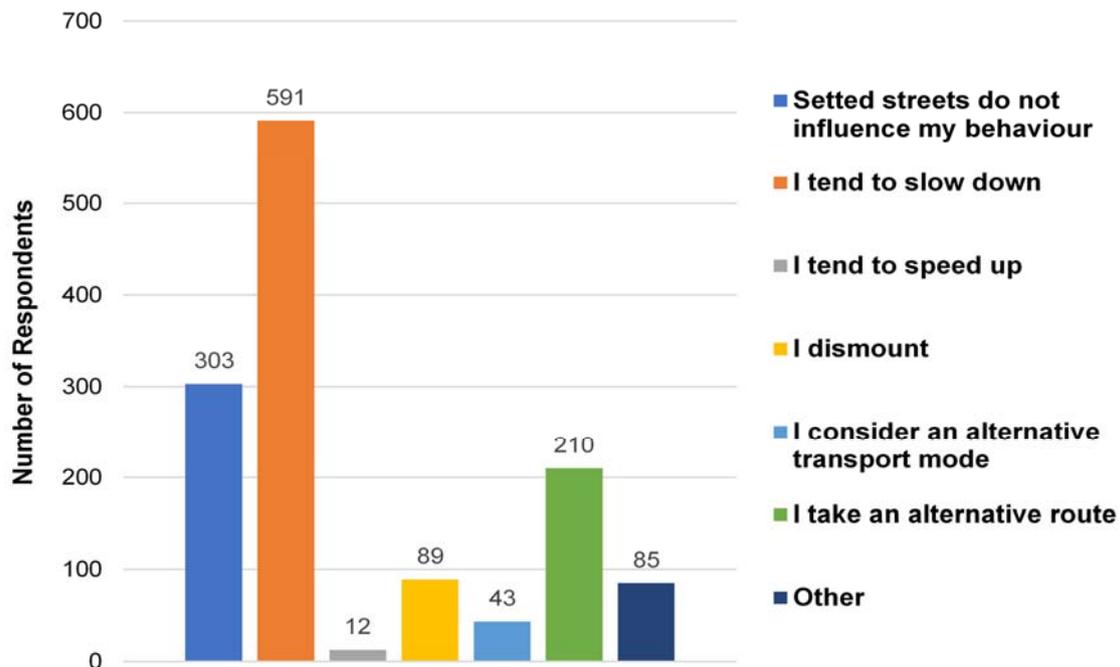
**13.** "Setted streets present an impediment to the following modes of transportation"



- Strongly Agree
- Agree
- Neither Agree or Disagree
- Disagree
- Strongly Disagree



**Q14.** "How do these impediments influence your behaviour when using the above transportation modes?"



**“Other” comments primarily reiterated previous survey options. A number of comments said that they cycle on the pavement.**

1. I will occasionally ride on the pavement if it is empty.
2. Cycle on the pavement instead.
3. I often cycle on pavement in Thirlestane Road (I know that I shouldn't!).
4. Cycle on the pavement. Very careful of other users.
5. Cycle on the pavement - with great care of other users!!
6. I'd probably cycle on the pavement.
7. Occasionally go on the pavement with bike if the setts are badly maintained.
8. If it's safe, I cycle on the pavement in setted streets.

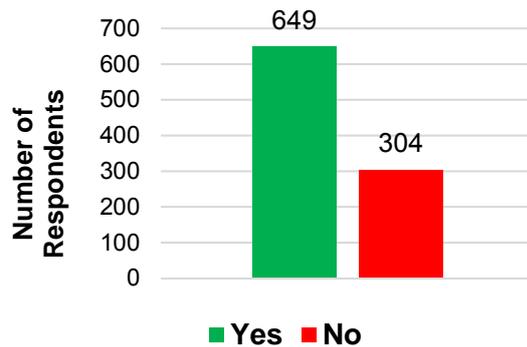
**Further follow up “Other” comments said that they experienced no impediment when using setted streets and rather enjoying travelling on them.**

1. *I will choose to walk on a setted street to enjoy the experience of being in a world heritage area.*
2. *Well laid setted streets do not impede my cycling.*
3. *When walking, I actively prefer to pick a route that will be pleasant and enjoyable. Setts are a component of that.*
4. *I cycle on setts every day and still enjoy the setted streets.*
5. *I appreciate their historic and visual character.*
6. *The use of the term 'impediment' betrays a bias.*
7. *I don't see them as "impediments"!!*

**Some “Other” feedback suggested that it is not the setted surface that causes an impediment but the condition of the setts.**

1. *If they were maintained, they would present less of a problem for walkers and cyclists.*
2. *In my opinion you are asking the wrong question (Q13 and Q14). When setted streets are properly installed and maintained, including appropriate detailing and construction of the bedding material they sit within, setted streets are not only a huge asset and positive feature of Edinburgh's urban realm, but also do not cause any impediments to cyclists etc (as per Q13). The issue comes when setted streets are poorly maintained or installed in the first place, resulting in quick deterioration of the quality of surface for cyclists or cars to move over and bumpy surfaces (and resultantly seem to be patched with tarmac as a temporary fix or cause issues to cyclists). In those scenarios where the setts are not appropriately maintained by CEC, setted streets do cause impediments. I am worried by phrasing your questions (especially Q13) as above people will respond that setted streets are an impediment to cycling/vehicle movement and this will be used as an excuse to get rid of them, when actually - in my opinion - they significantly add character and value to Edinburgh's public realm, street scape and heritage, and the issue is actually that they need to be better maintained or constructed in the first place. Compare the setts in the central parking area of George Street (well installed and maintained) with those on Brighton Place (poorly installed and maintained and as such cause an issue to cyclists, who often find it impassable)... I strongly believe setted streets should be kept in Edinburgh as an integral part of the historic and contemporary character of the city, but better installation and maintenance by CEC is needed to ensure their condition does not hinder cyclists or other forms of transport. Even if there are concerns around cyclists navigating cobbled/setted streets, there are ways to design around this (segregated smooth coloured tarmac bike surface adjacent to setted main carriageway). In my opinion, it is essential to keep the setted streets, and instead focus should be on how to better install/maintain these so issues do not occur.*
3. *Setted streets only represent an impediment when they are poorly maintained.*
4. *This only applies to setts that have been badly maintained e.g. George Square. Well-maintained setts do not cause a problem for me travelling by foot or bike.*
5. *The condition of the setts may be critical to these questions*

**Q15. “Can these impediments present a benefit to public and/or road safety?”**



**In total 41.03% of respondents agree or strongly agree that setted streets present an impediment to cycling. 89/ 957 respondents advised that they dismount on setted streets. The difficulties associated with cycling on setts has been commented on by a number of respondents:**

1. *Generally discouraging to cycle use.*
2. *Setter streets in my neighbourhood are very badly damaged e.g. Halmyre Street. They are horrible to cycle on.*
3. *As a cyclist I don't like setted streets and I have actually fallen off on wet setts.*
4. *Why has Brighton Place been allowed to turn into a potential death trap due to the unrepresentative but vocal minority? I no longer feel I can object to adult cyclists on the pavement because the road is so dangerous.*
5. *While setts are a part of history I only feel they should be kept in the centre of town in areas of historical importance. I have witnessed many close calls due to bikes slipping on wet cobbles and hitting pot holes caused by them not being replaced correctly.*
6. *Setted streets form a danger to cyclists when they are mis laid.*
7. *So many of these streets are badly maintained with uneven setts and big gaps so lethal for bikes.*
8. *Setts are dangerous and uncomfortable to cycle on. Avoiding them on a bike, by cycling on the pavement or in the gutter, is hazardous to the cyclist, to pedestrians, and to other road users.*
9. *I can appreciate the aesthetic value of setted streets, and like the more modern paving solutions found on Waverley Bridge. The uneven surfaces of traditional setts can make cycling hazardous and unpleasant, especially on the steep hills of the New Town. The jarring can make cycling feel hazardous. More than once I've had bits of my bike shake off while cycling on setts.*
10. *Brighton Place in Portobello is a very good example where the setts have shifted under the weight of traffic and braking buses to create a very dangerous surface. I used to cycle this route but can't anymore because it's so dangerous.*
11. *They are very unappealing to cycle on.*
12. *Too much of a mixture of settled streets and not settled streets. It is not cyclist friendly.*
13. *Setted streets can be uncomfortable to cycle on but overall the benefits far outweigh the negatives, they keep the character of Edinburgh in a big way*
14. *We have some half and half in Leith that are odd and hard to cycle on.*

**Over 50 comments suggest that setted streets must be adapted to cater for cyclists and their safety. These suggestions include the introduction of segregated cycle lanes with smoother surfaces and better maintenance in general:**

1. *Segregated cycle lanes using either new setts or tarmac would be of great use on high-capacity streets with setts, as often cyclists are slowed and impede motor vehicle traffic flow.*
2. *Setted streets do indeed contribute significantly to the character of the city, however they are very difficult to cycle on. If the city is serious about encouraging active travel and harnessing the significant social, environmental and economic benefits of cycling then their retention in certain areas requires consideration. Cobbled setts require continuous maintenance and to be supplemented by safe and direct cycle routes. Where this isn't possible they may need replaced by cycle friendly surfaces.*
3. *Cycling is my main form of transport and I'm keen to see how we balance conservation with making cycling easier. I do believe that setted streets are an important part of Edinburgh's heritage, particularly in the world heritage site and conservation areas and as such I would not want to see large scale removal of setts. Indeed, we should make more effort to repair those we do have both so they look good and so they are easier to walk, cycle, and drive on. I'm interested in whether there are measures that can be taken to provide cycle lanes on setted streets. Could we take up existing sets, cut them in half and re-lay to provide smooth sets at the sides of the road where cyclists are? Done right, this could benefit cyclists and create a pleasing design feature on the road. Warrender Park Road is a good example of where this would be helpful, as I see an unusually high number of cyclists on the pavement here – traffic is low so they're on the pavement because of the cobbles.*
4. *Wherever feasible, cycle lanes in setted streets should be constructed in modern flat setts, in order to improve ride comfort/safety.*
5. *There are several potential solutions, including ...*
  1. *High quality flat-topped and skid-resistant setts such as the junction of George IV Bridge and the High Street.*
  2. *Asphalting, except in heritage areas.*
  3. *Smooth strips for cyclists through cobbled areas, and smooth crossing points for pedestrians, using asphalt or flat-topped non-skid materials, as in the cobbled stretch of Linlithgow High Street for example, or as with the flush-sided drainage channels in Edinburgh High Street for a short stretch near St Giles.*
    - a. *I stress that (3) is less good than 1 or 2, because (a) cars may park on the strips, forcing you to divert onto the cobbles, and turning across them whilst looking behind you is no fun (b) you can be forced out of them by traffic passing too close (c) you still need slightly more attention on the road surface, to ensure you remain within the strip.*
6. *Setted streets themselves are not terrible if they are perfectly maintained. The problem is that they are never maintained, even in high traffic areas. Modern Sett system are at least bearable. Edinburgh is a living city. It is the economic heart of Scotland. People have to get around, live, and make things happen. Setts should be moved to modern setts except around monument areas (castle, etc), and in general should be reduced because they block cycle traffic throughout the city. This city has to be the economic engine of Scotland. We need an attractive city for young people. So we need great cycling infrastructure. This means either eliminating most of the setts or converting to modern setts. Anything else is just creating a city for old people.*
7. *Any route that is a cycling thoroughfare should have at least a section of unsetted road surface for cyclists, or the setts should be modernised for ease of access. This includes many of the roads in New Town which provide access to areas such as Stockbridge and Comely Bank.*
8. *It could be a thought to have smooth cycle lanes on setted streets. Unless they are like on Waverley bridge where they are smooth - but most don't seem to be replaced like that.*
9. *Consider having smooth lanes for bikes, where possible?*
10. *Setted streets are part of the fabric and character Edinburgh's architecture; replacing them with tarmac may be convenient, but would homogenise the streets with those found everywhere in the UK. This seems likely to reduce the distinctiveness of Edinburgh, which would be to its detriment. Setted streets do present an obstacle for cyclists - an increased in the abundance of well-defined cycle lanes would help.*
11. *Where setted streets form cycle route a modern sett surface should be laid.*
12. *Need to design bike paths on setted streets.*
13. *Setts should be retained but where there are crossing points or cycle lanes these should make use of new flatter and smoother setts.*

14. *I'd like strips of unccobbled arias as cycle lanes where possible.*
15. *Edinburgh has a lot of work to do to not only repair existing setted streets, but to maintain those we have already and bring them up to 21st century active travel standards.*
16. *I am a committed cyclist and cycle into to the City for meetings most days. Properly laid setts are fully acceptable to me even with increased vibration.*
17. *Relaying or patching of setted streets must be done to a high standard to reduce the possibility of bicycle wheels catching between setts and to minimise vibrations caused by traffic passing over them.*
18. *Using mastic/grout between the setts makes the ride somewhat smoother for people on bikes, see for example speed humps at west end of Thirlestane road. <https://goo.gl/maps/aG6hF1E8cf12>. Consideration should be given to adding filtered permeability to streets with setts. This would reduce number and speed of heavy motor vehicles, and thus the damage caused. When in Trondheim, many of the cobbled/setted streets had been laid with a bike lane made of paving stones. This made it much easier for bikes, but kept most of the historic character. <https://goo.gl/maps/8yWL8k4MFY12>*
19. *Edinburgh should seriously consider - and implement - the modern solution for cycling on cobblestones / setts: a narrow smooth, stylist lane as done recently in Norway and also in New York City. Here is a picture link: <https://i.pinimg.com/736x/f8/a5/d6/f8a5d6b8b6d033a1229469f921544ae3--lower-manhattan-manhattan-new-york.jpg>*
20. *Where setts are retained, I would like to see tarmac or other smooth surface lanes provided for cyclists where the street is a key cycling route. These need only be narrow spaces towards the edge of the street. If you watch cyclists cycling up the Royal Mile you will notice that many go up the gutter channels as a smoother alternative to the setts.*
21. *From a cyclist's point of view, the flatter setts used for example on the High Street are greatly preferable to the more traditional ones.*
22. *Edinburgh should look to the example of cities like Copenhagen who provided smooth gulleys for the safe and easy movement of cycles along setted streets. Edinburgh should also consider restricting through traffic on most setted streets in the city. This would prolong the life of the streets, reduce maintenance costs and present opportunities for active travel routes.*
23. *If setts have to stay, as a cyclist it would be great to have a smooth section of road to avoid the setts, where segregated cycle paths are not possible.*
24. *From recent experience, standard design practice in Germany for setted streets was to provide a narrow 50cm or so smooth strip in either direction for cyclists otherwise with no markings and colored to match setts.*
25. *I'd be happy for them to be replaced with suitable surfaces, for better cycling and walking.*
26. *They make life hard for pedestrians and cyclists, and thus encourage people to use the car - contrary to the city's proclaimed policies, and bad for health and the environment. By contrast, freshly tarmac'ed streets are a pleasure and relief to ride on, and take much less energy. Well surfaced streets could do much to encourage cycling. It would be better if certain roads used as through routes were "de-setted". For example, getting to Stockbridge by bike from the city centre it's almost impossible to avoid setts, and the roads are steep, and when wet, too hazardous. Randolph Cres, Gt Stuart St, Dean Park Cres, Comely Bank Ave, East London St, Warrender Park Rd, Drummond St and other similar near the University - all these should be 'de-setted' to encourage cycling and walking.*
27. *Please invest in flat-topped setts that are suitable for cycling on for cycle routes. Currently, existing old sets are very uncomfortable and difficult to cycle on, which discourages people from using active modes of transport. Flat-topped setts retain the pleasant aesthetics of a setted street, while enabling people to travel actively.*
28. *I think that there needs to be some creative thinking around setts - so that the traditional appeal is retained but modern needs are met. Flat stone cycle paths and crossings (modern setts or similar)...replace traditional setts on bus routes - with modern setts rather than tarmac except for main arterial routes ...and hold onto the traditional setts and resurface tarmac roads in conservation areas with setts (eg: John Street, James Street etc in Portobello/Joppa).*
29. *there needs to be careful and diligent consideration to how stone setts affects cycling in Edinburgh. If the city is to become more cycling friendly then this should be a priority. Stone sett streets tend to be quieter and therefore safer for cycling. If there was a lane down the side of the streets which had flat-top setts for bikes to travel along then this would be a fantastic way to improve the streets for bikes and at a relatively cheap method which maintains the visuals of having stone setts and using the original stones. My previous comment points out a method of cutting the top of stone setts to make them flat for cycling. This has been done in other parts of the country, and globally, with much success.*

30. *Settled streets are key to maintaining the character of the city. However I would also like to see cycle friendly routes/surfaces incorporated in to part of the street to support cycles. Settled streets cause a hazard to cyclists especially when wet.*
31. *I would like to see a strip of tarmac in every settled street that could be used by a cyclist. This would mean a safer & more comfortable ride. If CEC policy is to promote active travel then this step would support the policy.*
32. *There are setts and setts. Modern setts can accommodate cyclists and pedestrians in wheelchairs and pushing buggies better than the old fashioned kind.*
33. *The idea of slicing setts in two to create a flat top that, when laid together in a bike lane, create a better surface for cyclists would make big difference for encouraging people to cycle on setts without adversely impacting the appearance of Edinburgh's streets. Ideally, this should be on a section of street that heavier vehicles are unable to use so the levelness of the setts is not disturbed through overuse by buses etc (i.e., segregated cycle lanes, ideally protected by parking bays or kerbs). I have also seen the same approach successfully used for pedestrian routes in Freiburg (at pedestrian crossings and across a public square to the front door of the cathedral). Again, this approach is unobtrusive but makes setts more comfortable for wheelchair users and buggies. It goes without saying that following any utilities work on settled areas it must be a requirement that the setts are relaid by properly trained and qualified sett-layers to ensure the integrity of the surface is maintained.*
34. *If you want to keep setts for historic reasons then please consider adding a tarmacked cycle line to the side that is segregated and cars cannot drive on. The cost of repeated replacement of settled streets is disproportionate - Tarmac lasts much longer.*
35. *Generally, I think the priority should be to preserve the original setts. However, to address emerging concerns about the 'uneven' surface traditional setts have, it may be appropriate to look at having modern flat-topped setts at pedestrian crossings and (preferably only in essential circumstances) to surface cycle lanes within a street.*
36. *I do strongly favour settled streets in historically significant areas. However the findings of neurological damage risk for cyclists on such areas seem to me to require a modification of the yes/no approach to deciding. Instead an approach of strongly favouring a settled surface but adapted to take account of the needs of cyclists would seem to me to be called for.*
37. *Use flat setts or smooth cycle strips.*
38. *Make settled streets smoother to cycle along.*
39. *I would like to add that even though I support the preservation of settled streets, cycle lanes should be built in.*
40. *I generally cycle around town. I don't like cycling on settled streets but would still rather the setts were retained because of what they add to the historic environment. Maybe a non-settled cycle lane could be introduced on settled streets? it makes absolutely no difference to me when driving or walking or going by bus.*
41. *Traditional repair methods should be followed, using local materials to minimise the carbon footprint of the works. Settled streets are a marvellous, hardwearing and useful part of Edinburgh that add mightily to its character. They age far more gracefully than grotty tarmac and retain a classy air. My only fault with them is that when cycling down New Town streets they can be uncomfortable awkward. The possibility of reducing cars in Edinburgh and making smooth settled cycle lanes should be investigated, along with planting trees in the centre of areas of excessive traffic such as Queen Street, reducing lane numbers and the speed of vehicles. Pedestrian boulevards...one must dream!*
42. *Ideally there would be flat paved or settled corridors on settled streets for prams/wheelchairs to cross and for cycling. An example of this is in Norwich on Pottergate.*
43. *There should be a smooth path for cyclists in a safe location along all settled streets. This can be made of stone to blend in.*
44. *It would be handy if there were a smoother bit near the gutter (bigger flagstones) for cycling on, a la Linlithgow Main St.*
45. *Badly maintained, uneven setts are highly unpleasant to cycle over. Your average driver doesn't realise this, of course, and does not alter their behaviour to suit. I would quite happily see all setts removed from Edinburgh, but accept that this isn't going to happen for heritage reasons. In places where they must be retained, they should be well-maintained and smooth, and as little heavy traffic as possible should be allowed in these streets in order to keep the setts in good condition. In some cases money can be saved by removing or tarmacking over setts where the heritage imperative is not so great.*

46. *I understand that we need to encourage more cycling in the city (for environmental and personal health benefits), and would welcome better design of cycle paths and cycle lanes. I am not impressed with current standards.*
47. *Is it possible, on some routes,, to have a strip of tarmac along the side of the road for bikes?*
48. *We should not be investing in infrastructure for the benefit of cars in the city centre. The fewer cars the better. That said, I don't think cobbles are enticing to cyclists either so a strong cycle path system alongside conservation of setts would be ideal.*
49. *Properly maintained and even surface, suitable for most users. Challenge is many are uneven and not easy to cycle on.*
50. *Setted streets create noise pollution for residents in those streets. Setts can be very slippery and a danger to cyclists. Setts are generally very bumpy and often have large gaps between them in which bicycle wheels can get stuck. Properly maintained setts with flat non-slip tops and level pointing should be provided for cyclists on all setted streets. Bristol trials of cutting setts in half and having the flat insides on top have proven successful. Heavy vehicles such as busses should not be on setted streets as they cause too much damage. There are problems with busses using setted streets (eg East London Street) that are not considered to be bus routes. Setts often sink, causing deep depressions with wide gaps again dangerous for cyclists. Some streets in non heritage areas would be better converted to tarmac or modern (flat) setts - it is not necessary to retain all setted streets - consider each location and the residents views. Setts need to be properly maintained and re-instated after repairs. My response re the impact on pedestrians does not include the less able, blind and those pushing or pulling pushchairs, suitcases etc for whom setts are a hazard.*
51. *Although in theory I agree with the need to keep streets setted in historic areas, in the case of my local Street-Brighton Place -I would not be sorry to see them go so that I don't have to cycle over them any more. Maybe the modern setts are a good compromise.*
52. *Considerable improvements needed to many areas to provide smooth, reasonable looking surfaces. I find it particularly hypocritical that the council is so protective of windows in buildings within the world heritage site yet make near permanent fillings with tar. Even setts that appear smooth to cars need upgrading for cycle routes.*
53. *As a cyclist I often find setted streets quite difficult to navigate which is why I believe setts should be well maintained.*
54. *The lengthy works in Howe Street produced finally a very good result - thank you for taking the trouble. It was worth the delays. My impression too is that the relaid setts in that street are a lot smoother, so reducing the problem they cause to cyclists.*

**Respondents raised issue with utility companies, telecommunication companies, contractors and developers who lift setts and do not reinstate them to a satisfactory standard:**

1. *This often happens after public works. These contractors must be kept to a high standard of restoration There is little point in spending large amounts of money on setts if they are soon taken up by contractors and either badly replaced or replaced with tarmac also replacing setts with setts is very expensive -many more streets can be repaired if tarmac is used It might be argued that tarmac is inappropriate in a conservation area or world heritage site but so are rubbish bins and parked or moving motor vehicles !*
2. *They are an integral part of Edinburgh's historic fabric and need better conservation and workmanship. Could companies that disrupt them be compelled to pay for their repair (and that work done to a higher standard)?*
3. *There are several examples of where setted streets have been poorly restored after streetworks - contractors MUST have an obligation to restore setts to their original quality.*
4. *Streets like North Frederick Street, and Charlotte Lane are disgraceful and dangerous. Clancy Dowcra carried out some electrical work on Queensferry Street Lane the other year and while a quality job was done at relaying the setts, they used a different method to the rest of the setts which has resulted in large grouting gaps which are troublesome to walk on, and have altered the look of that part of the street. The issue is that they did not do like for like, which is general issue across town and needs to be addressed.*
5. *When utility contractors lift setts, they should replace them immediately they are finished -- neatly, in an appropriate pattern, and on a properly compacted base so there is no subsequent subsidence -- rather than throwing in blacktop and leaving it. To ensure this happens, a deposit should be paid to the Council for each excavation specifically for sett replacement, so that if the work is not done, or not done to a sufficient standard, the Council can then commission the work themselves.*

6. *Contractors very often replace setts with poor workmanship also a tendency to get the road open asap appears to give contractors the right to dump tarmac in place of setts. See royal mile for this practice.*
7. *Setts are a key part of built heritage in Edinburgh, utility contractors should have to obtain a permit to dig up and replace and the fee cover inspection by the Council to ensure left in proper repair.*
8. *Its fundamental for the council and its developers to maintain setts to the highest standard. To date in Leith contractors such as those laying BT cables have ruined large areas of setts and the council sign off this work with no regard for their quality, presentation, workmanship and aesthetics. This is criminal as we pay rates to have council staff fix private projects. Setts must be kept and investment made in re setting our historic city and not to forget Leith in any programmes.*
9. *It's imperative that the setts are retained, and that setted streets are maintained. They are less likely to pose hazards to cyclists and pedestrians if the setts are correctly laid and maintained as the surface will be smoother and more robust. Utility companies must be forced to relay setts properly and not to pour in tarmac patches.*
10. *Utility companies should ensure any work is carried out to the highest quality. Regular checks and fines should be issued where they take shortcuts.*
11. *Setted streets are visually very important to the cityscape, both in and out of conservation areas. The maintenance of the roads--all roads for that matter--to a high standard is imperative. It would lessen disruption on the roads if utility repairs could be co-ordinated and repairs done promptly and to the highest standard. Setts are beautiful as are setted streets.*
12. *Repairs to setted streets should be inspected after repair and use of tarmac should be avoided for permanent repairs. Too often the utility companies just tarmac over and take too long to carry out permanent repair even allowing for settlement. Quite often the setts are removed and not put back. Will the City Council carry out a survey in the WHS to establish the amount of setts that have been covered in tarmac, something that was done extensively in the late 50s and 60s?*
13. *I think setted streets are an important part of Edinburgh's heritage wherever they are located in the city. Utility companies should be made to replace or repair any damage to setted streets when they undertake works. This unfortunately is not always the case and proper reinstatement of setts is not always undertaken resulting in patches of tarmac in these areas. Council enforcement officers need to ensure that proper reinstatement is undertaken. Our conservation areas greatly benefit from their setted streets which enhance their character.*
14. *I think the council is also seriously remiss in ensuring that utility repairs are carried out with proper respect for sets and the number of tarmac patches that appear post-resetting (Eyre PI for eg) result in uneven surfaces, spreading gaps and general messy appearance.*
15. *It is important to maintain them properly and where there are utility works to replace them skilfully, not create tarmac areas within them.*
16. *They are expensive but if they are retained they need to be repaired properly when necessary so any contractors that dig them up for whatever reason need to know this.*
17. *Utility companies should be forced to replace setts they dig up in the course of accessing their cables/pipes instead of patching the holes with tarmac. It looks dreadful and damages the whole street.*
18. *Utilities companies and agreements - There needs to be stronger agreements in place when utility companies are going in and making repairs to their infrastructure. These kind of agreement in terms of replacement of the surface construction are in place in many London Boroughs and work in controlling haphazard replacement on road surfaces in setted streets.*
19. *Important that settled streets are kept and repaired properly when dug up by utility companies. In some cases streets which were tarred over some years ago should have the tarred surface removed so that the undamaged setts are revealed.*
20. *The first problem for CEC to resolve is that of decent road repairs and reinstatements of the surface by utilities. No point in keeping setts if they are poorly laid, repaired, or reinstated. So that's going to require a lot of agreement and expertise which does not appear to exist at present between CEC and utilities.*
21. *A longer term strategy is required with utility companies to co-ordinate their work so that unnecessary work is avoided. How many times do we see the same stretch of street dug up numerous times for different utility companies.*
22. *It is imperative that any work done which removes setts ensures that setts are replaced. The loop hole that allows contractors to replace temporarily with tarmac never to reappear MUST be outlawed. Tight monitoring and enforcement by the Council is the answer.*
23. *The biggest issue is lack of proper replacement after works and Tarmac being used instead.*

24. *Not convinced that CEC actually care about setted streets: couple of years ago Scottish Water removed some of the setts in Springwell Place, EH11, to undertake work on a water pipe. When they replaced the setted area, some of the setts were bulging up out of the road in comparison to the setted area not affected by the works. Indeed, a few of the setts were sticking out at a circa 20% angle compared to those which were flat. CEC did absolutely nothing to resolve this and it was residents' badgering Scottish Water which resulted in Scottish Water returning to remedy their poor replacement work. Given the heritage importance of setts, I would have expected CEC to visit disturbed setted streets to ensure they are relaid exactly as they were prior to workmen removing them.*
25. *The biggest problem at present is poor maintenance, patching with different materials (tarmac etc) and poor reinstatement after setts are lifted for works / repair.*
26. *The heritage and aesthetic value of setts is undermined by poor repair e.g. tarmac infill. Tarmac infill also impedes cycling by creating an uneven surface, more of an issue than the setts themselves. Planning enforcement should require developers to replace setts, aided by a maintenance manual. Likewise telecom companies should also be required to replace setts (e.g. note the tarmac infill on East London Street in front of the BT Openreach exchange presumably following fibre to cabinet installation).*
27. *We have already lost too many setts, and poorly replaced setts encourage those who argue for their removal. More enforcement is necessary regarding poor reinstatement by contractors working for the utility companies.*
28. *All current streets including Brighton Place, Portobello should continue to be setted to preserve our cultural and architectural heritage. The important thing is to make sure they are maintained properly and utility companies must be forced to replace them properly when lifted for essential maintenance.*
29. *It is extremely important to keep these settled streets. This is Ecinburgh's heritage. Utility firms which dig up the roads should be forced to replace the sets and not leave tarmac patches, even if they have to return once the ground has settled, the council fails to enforce this resulting in a squabble as to who is responsible for repairing the sets.*
30. *All Reinstatement required to done to the same standard as junction at High Street and Bank Street.*
31. *There must be greater supervision and enforcement of standards of repair by the Council when utility companies lift setts.*
32. *When streets need to be dug up for maintenance/repairs to utilities, setts can be reinstated without loss of aesthetics (cf tarmacadamed surfaces, which end up as an unsightly patchwork). This is important when retaining heritage status.*
33. *It's all about maintenance, and especially careful road repairs. Most issue can be directly traced to roadworks where a street hasn't been opened up and then set not carefully returned or soil not carefully compacted before relating the street. The Council should hold the contractors to account if work not done correctly.*
34. *Yes. In Holland they have setts almost everywhere. Ok it's not stones but they manage the cost and skills to do it. AND they coordinate all their utilities to be delivered under the ground - but in a way that never seems to need the roads dug up. Please can we learn how they do it?!!*
35. *If repairs to street surface or sub-street infrastructure need to be made, the surface should be reinstated 'as was'. Patches of bitumen give the worst of both worlds both in appearance and in comfort for road users.*
36. *Should they be damaged by utility companies, then they ought to be returned to previous condition by company involved. They are a very distinctive part of Edinburgh heritage.*
37. *They need to be well looked after and monitored and repaired as and when rather than waiting for a whole street or number of streets to be repaired. It's also important to coordinate utility companies and other digging up the sets to that the same streets aren't being dug up over and over again unnecessarily.*
38. *It seems to me that the contractors who repair the setts don't manage to effect repairs which last well. I'm greatly in favour of retaining the setted streets of Edinburgh but would like to see work done on them lasting better and better maintainance of these historic roads.*
39. *The main problems arise where streets are poorly maintained e.g. subsidence resulting in uneven, unpredictable sett lines, or repairs and reinstatement are badly done and with no consequences in terms of fines, loss of contract etc. Rigorous post-works inspections are needed.*
40. *Keep and maintain all of them . It disgusts me when i see contractors have not replaced them after road works in lanes and roads . e.g. the lane off queensferry st. Do they think no -one will notice. It should be mandatory!*

41. *I am appalled at the way that utilities companies are allowed to dig up setted streets in the World Heritage Site and replace them with huge patches of tarmac. I walk down the Royal Mile every day. It was recently dug up for gas works and has now been dug up again. Last time the setted area was replaced by large patches of dark tarmac which had a detrimental impact on the appearance of the street. The crossroads at the junction of St Mary's Street and Jeffrey Street has had a huge tarmac patch in the middle of it for years. I assume the utilities companies will get away with doing the same thing again. Surely there should be an agreement that they put the setts back exactly as they were when they started work.*
42. *Force utility and other roadwork companies to make proper replacement of setts they dig up (and check their work both when they complete and a year later!*
43. *Maintenance and reinstatement need CEC enforcing, e.g. following work by Utilities. There are obvious long-term examples of this. For example - Walker Street, where years have passed without temporary tarmac patching being replaced - Coates Crescent where temporary protective tarmac cover during tram diversions has not yet been removed.*
44. *Utility services for years have been allowed to carry out inappropriate road repairs to setted roads contributing to present road conditions. Had utility services been forced to comply with appropriate reinstatement then the setted road conditions would be in better condition than presently found.*
45. *we try an place in a quick and efficient manner and any gas works needing to done is replaced correctly.*
46. *Setted streets should be retained wherever possible but strict standards should be imposed on any lifting/replacement/repair work to ensure a uniform surface.*
47. *When disturbed, the organisation disturbing them to replace them at their cost and to the standard acceptable to UNESCO/EWH.*
48. *Uneven surfaces in setted streets mostly arise because of intrusive work by utility companies and the poor consolidation of back-fill. Whilst I accept that the Council cannot stop utilities from carrying out road works, there appears to be little inspection of work during restitution work and no follow on inspections after 6 months to ensure no detrimental settlement has occurred. This is a resource issue for the Council at this time of scarce revenue resources but is a cost that should be borne by the private utility companies and not paid for from the public purse.*
49. *I think utility companies should not be allowed to dig up setts without having them properly reinstated by experts after their work is complete. I think this should be an absolute rule.*
50. *Wherever possible utilities should not be allowed below setted streets -- which seem to be more vulnerable to being dug up and relayed than ordinary streets. I seem to recall Thirlestane Road being 're-setted' a few years ago, to the great credit of the Council and the benefit of the area. It was good to see that such skilled work could still be carried out so effectively.*
51. *Often much damage is caused by contractors installing or working on cables and so on. It is obvious to the observer that there is no real effort made to police such repairs and to demand that when lifted, setts are properly re-laid on the work's completion.*
52. *When setts need to be replaced after road works, they should be put back to the same standards as the original laying. After utility work, the repair work can be very shoddy leading to sinking of setts which then settle to awkward heights and angles, posing a hazard particularly for cyclists.*

**A number of respondents support the reinstatement of setted streets and the removal of tarmac and other materials that has previously been used to cover setts:**

1. *Sections that have been repaired with black tar should be replaced with stone. Black tar destroys the overall image of a setted street.*
2. *Setted streets should be valued and maintained, indeed streets where setts have been covered in tarmac should be repaired to reveal the setts.*
3. *I strongly support the retention and maintenance of settled streets. Restoring setts which have been covered with tarmac would enhance the look and feel of many of our streets including streets outside of the immediate city centre like Bruntsfield, Marchmont and Morningside.*
4. *I think several setted streets in the city have been tarmacked over; it would be good if they could be uncovered in the due course of maintenance.*
5. *Essential for Edinburgh's economic future that CEC maintains setted streets to the highest standards, and, as far as resources permit, works to restore setted streets which have been "tarmacked" to their original condition.*

6. *I find it sad to see where setts have been tarmacked over and the setts peer through - like parts of Easter Road. As Easter Road is pretty congested (i.e. slow-moving) anyway, maybe there could be a case for returning that street to the original setts.*
7. *I believe it is very important for the Local Authority to invest in maintaining existing setts and that serious consideration should be given to reclaiming those below currently degrading tarmac. Our inscription as a World Heritage Site is something to be valued for both it's cultural Kudos and the benefits it brings to the City's world wide reputation and our economy. I strongly believe that the public realm around all of our historic buildings and in all the Conservation Areas should be treated with as much care and attention as the City centre as visitors explore and find accommodation and get aesthetic pleasure from so many areas of our historic City. This also applies to those who aspire to live in Edinburgh. The kudos and economic benefits that come from peoples' appreciation of the authenticity of our historic fabric, including the make up of public realm, should not be underestimated. As such every effort should be made to maintain and re-use setted streets.*
8. *There might be some which are buried under tarmac, it would be nice if they could be restored when the roads are being re-done. Don't believe Transportation people if they say there are not there any more, go and look!*
9. *Please retains setts wherever possible. I'd also like to see streets with buried setts reinstated - tarmac covering rarely lasts, and looks very scruffy.*
10. *There is a case for the restoration of setting streets in historic residential areas (such as the Blacket Conservation Area).*
11. *I think they should replace tarmac in the Old Town Conservation Area, especially on the Canongate.*
12. *The setts should be replaced where they have been removed. This is especially required down the Royal Mile. The tarmac surface has downgraded the character of this important street. The loss of setts anywhere detrimentally changes the character of our historic city.*
13. *I would very much like the tarmac removed in Ainslie Place so that it looks of a piece, and its time Fredrick Street was properly repaired, with the tarmac patches removed.*
14. *Setted surfaces should be returned to all streets where they exist beneath the tarmavadam.*
15. *I have already written to the Council to suggest setted streets currently covered in tarmac should also be restored to their original form. I have seen examples of street repairs being done where setts have been replaced with patches of tarmac and where setts under tarmac have been discarded and replaced with more tarmac. More setted streets would attract more tourists to Edinburgh. We should restore those in the old centres first, eg Old and New Towns, Stockbridge, Leith, Portobello. There could also be apprenticeships in setting to develop a workforce for the purpose and for maintenance.*
16. *It would also be excellent if more stone pavements could be restored and the current unaesthetic concrete slab replacements could be gradually replaced in their turn.*
17. *I would like the Council to remove the tarmac and restore the setts at the junction of Great Stuart Street and Ainslie Place, as they once promised.*
18. *remove the tarmac from the existing ones that have been covered up, now that the city has a ridiculous speed limit we might as well have the town looking attractive.*
19. *Streets that are tarred over but still exist underneath ought to be reinstated wherever possible and safe to do so, particularly in residential/ conservation areas.*
20. *I live in a street (Hart Street) where the setts have been buried under a layer of rather nasaty tar-macadam. It would be nice to think that might reappear one day!*
21. *As before they are a wonderful part of our heritage and I believe as many as possible should be uncovered. In Germany they are proud of their setts and are no impediment to a city's 21st century operations. It's their attractiveness, much appreciated by tourists and natives alike. They are part of the picture of Edinburgh.*
22. *The historic Dalry Colonies present a good example of where - over time - the original setts have almost all been replaced by inferior tarmac and gravel. Their access paths are highly deserving of reinstatement under the original stone setts.*
23. *Setted streets must be cherished and efforts should be made to remove tarmac and revert to setts in areas which were originally setted, for example, including streets in places like Gorgie-Dalry, Portobello and Marchmont.*

# Appendix 2

## Setted Streets

### Cultural Assessment and Principles

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#### 1.0 Introduction

- 1.1 This document draws together knowledge about setted streets, the use of setts in Edinburgh and provides guidance on the conservation of historic setted streets and the application of new setted streets and surfaces in the 21st century.

#### 2.0 Cultural context and Value

##### History

- 2.1 There is evidence of Edinburgh's streets being the "best paved streets with' bowther stones' that had ever been seen" from this quote in 1632. Edinburgh seemed to take steps to improve its roads in line with national priorities and the city was fortunate to have ready access to local stone. Records show that Regent Road and Regent Bridge were constructed with stone blocks created from sources of stone in Holyrood Park. These stone surfaces were preferred as they provided a robust and clean surface. An indication of how and when streets were setted can be established from the stone materials used to make the setts. Basalt from Holyrood and other local quarries and Dolerite was available from quarries at Ratho and Ravelrig etc.
- 2.2 As Edinburgh was fortunate to have good stone supplies it continued with setted street improvements to both new streets and by retrofitting older streets throughout the nineteenth century. Without this ready access to stone, trends elsewhere were for tarmac which was developed in the twentieth century and preferred to setts. Setts had become problematic with the increasing weight of vehicles, displacing the surfaces so that they became bumpy. It was recognised then, as today, that even with the introduction of mortar joints, the use of the reclaimed setts created some difficulties for modern transport.

##### Character and Authenticity

- 2.3 Where setts survive, much like the original sandstone flag paving, kerbs and channels, they have weathered and worn in varied and attractive ways that complement the surrounding buildings. The setted carriageways and accesses that survive help to define the dimensions of the carriageways, contributing to the understanding of the hierarchy of design.
- 2.4 Edinburgh is seen as fortunate in having retained so much of its original buildings, streets and traditional features, resulting in a wealth of original natural stone materials.

## Significance

- 2.5 *Historic streets and their features are important to the historic environment.* Until the twentieth century streets were paved with natural stone. These natural materials are hard wearing and are now seen as more attractive than modern products.
- 2.6 Surviving historic surfaces make a significant contribution to the character and authenticity of an area, and can provide us with interesting historical information about the design, construction and development of the urban environment. Setted surfaces provide a very important part of the identity of the places and streets they survive.
- 2.7 In 1986 a policy of protection and retention of setted surfaces was established. A list of 387 setted streets was identified of which about 174 (nearly 50%) lay in the World Heritage Site.

## World Heritage Site

- 2.8 At an international level the Old and New Towns of Edinburgh are recognised as a World Heritage Site (WHS). The quality of the public realm within the WHS is important in contributing to a quality built environment, particularly in a living city where the heritage site is so heavily used both by pedestrians, cyclists and vehicular traffic. Setted streets are especially significant for the World Heritage Site as they contribute to the outstanding universal values of the site, ‘an outstanding example ... which illustrates significant stages in human history’.
- 2.9 Scheduled Ancient Monuments, Archaeology, Conservation areas, Listed Buildings and their state of repair are all an important part of national and local identity and therefore significant to the WHS. They contribute to our history and education, tourism, sustainability, local distinctiveness, place making and quality of life. It is a finite and non-renewable resource that contains unique information and reflects the lives of people who lived in Scotland over the past 10,000 years.
- 2.10 The Old and New Towns World Heritage Site Management Plan 2011-16 recognises the role the historic fabric of streets, including setts, add to their character and individuality. Their condition will have an impact on the state of conservation of the World Heritage Site which is monitored for UNESCO.

## Conservation Areas

- 2.11 At a local level, the significance of features of conservation areas is described in the Conservation Area Character Appraisals. Conservation area management is guided by the need to understand the historic context of the area.

*“Physical change in conservation areas does not necessarily need to replicate its surroundings. The challenge is to ensure that all new development respects, enhances and has a positive impact on the area. Physical and land use change in conservation areas should always be founded on a detailed understanding of the historic and urban design context.”* From PAN 71, Conservation Area Management.

- 2.12 The Council's review of conservation area character appraisals has included extensive consultation with local communities which has enabled a shared understanding of the historic significance of surviving materials. In the Grange, for example, Hope Terrace is one of the few streets which retain their original setted surface. There was strong opinion about the poor condition of many road and pavement surfaces; however there was agreement that surviving materials should be considered in situ. It was also recognised that conservation- appropriate new materials should be specified places where surfaces were inferior and in poor condition.
- 2.13 When consulted on a review of the Conservation Area Character Appraisal, the community in Queensferry were asked if there were any additional special characteristics or features that had been missed, issues relating to cobbled streets were referenced as the most common issue. In particular the good quality historic and more recent streetscape and boundary features were noted. Although the community acknowledged that the majority of the traditional, natural stone finishes of the High Street are the result of streetscape enhancement works of the 1990s, they considered that the general design and material palette reflect the historic character of the street and respond to its distinctive features. The Character Appraisal recommended "*Historic surfacing materials, ironwork and detailing should always be retained and repaired where they survive. Lost features should be reinstated where there is evidence. Training and education in specification and maintenance of appropriate materials would assist in protecting these features in the longer term*".

#### Setted Streets Elsewhere

- 2.14 Setted streets are often associated with specific listed buildings, areas of townscape that have remained unchanged, and areas that were originally sites of industry. Industrial areas have often retained setted streets where the buildings are long gone. The Canal is designated a Scheduled Monument. The setted surfaces form an integral part of the recognised industrial heritage, particularly in Fountainbridge, where it passes through old industrial areas. When the communities in the Colonies across the city were asked about their areas with a view to designating them as Conservation Areas, they highlighted the importance of setted streets to the character of the townscape.

#### Public Opinion

- 2.15 The Council has annually sought public opinion on the 'quality of the built environment' through the environmental quality indicators survey. In 2014, one of the projects that was used to find out what people felt about improvements and changes to the built and natural heritage of Edinburgh was Castle Hill, where improvements have been made to the historic setted street, retaining the original setts. The majority of people surveyed felt that the proposals fitted well with its surroundings and considered the street to be attractive.
- 2.15 Public support for traditional surfacing materials, including stone paving and setted streets have been raised in consultations for George Street. The use of setts has been embedded in the design approach for public realm proposals for tram, St Andrew Square and Charlotte Square in the city centre and in town centre projects in Balerno.

### 3.0 Stone supply

- 3.1 The provenance of stone is overseen by The British Geological Survey. It undertook a review of Scotland stone industry which is outlined in a report published in 2016 - '*Scotland's building stone industry: a review*'. This report highlighted the Scottish legacy of building with natural stone. The use of stone had contributed to the rich built heritage and the strong sense of history. The Scottish stone industry has shrunk and is currently very fragile and international trade in natural stone has grown enormously.
- 3.2 Edinburgh has a policy of retaining and storing setts from streets that may have undergone repair or have changed their use. This resource is used to make repairs to existing setted streets. The material is managed under contract for the Council.
- 3.3 Due to procurement requirements, both public and private contracts operate in most Scottish authorities and do not generally specify Scottish stone. The significant impacts from the use of imported stone are environmental costs, often hidden in supplies into the UK, and the visual consistency is often compromised, which may have a longer term impact on community pride. The small indigenous Scottish market is not able to make any impact on this agenda. It is accepted that an improved stone industry, specifically for materials traditionally used for setts could lead to an increase in the use of local stone.
- 3.4 Studies undertaken by Edinburgh World Heritage, the BGS and the City of Edinburgh Council on paving stone, have led to the continued use of stones traditionally used in Edinburgh, Caithness stone and Sandstone being specified from UK quarries in Scotland and England.
- 3.5 We do not have enough information about the properties of imported granites and how they may wear or perhaps retain their colours in the same way as original quarried stone used for setted streets. The Council is working with Edinburgh World Heritage to commission further studies to ascertain a more detailed understanding of materials and their properties in order that we can ensure we are using suitable materials for Edinburgh Streets.

#### New Setted Streets

- 3.6 Investment in public realm in the 1990's brought a renewed investment in the repair of existing setted streets and in reintroducing new setted streets and surfaces in Edinburgh. Funding for public realm improvements was made available to the Council through Scottish Enterprise, which was not previously available. Projects to improve the Royal Mile and Old Town were implemented and included improvements to Cockburn Street and the repair of the setts. The Capital Streets Project included the reintroduction of setts into Castle Street and the repair of setted surfaces in the Grassmarket. The use of new flat topped setts bring additional benefits for walking and cycling across the city and will be an important consideration when considering maintenance, repair and improvements for setted streets.

## 4.0 Historic Stone Setts

### Materials

- 4.2 The type of stone used for setted streets varies. The materials include a range of Gabro, Bassalt and Dolerite, all of which are described as whin (any one of various hard crystalline types of igneous rocks) and granite.
- 4.3 The type of stone sett used in specific streets reflects changing availability. Where the whin stones are used they tend to be of a more uniform colour and tone. The granite setts are more varied in colour and can include grey, red and pinks.

### Size and laying practices

- 4.4 Setts are commonly laid onto a firm base and the joints filled with loose material (stone chips, gravel and/or sand). In more recently improved setted streets and where new setts are installed, the joints are filled with cementitious mortar or a proprietary mix.
- 4.5 Setts are laid in uniform widths at right angles to the street and sizes varied to accommodate bends in the street. In some places setts were laid in long herringbone courses, particularly on steep slopes and at junctions, to assist in increasing resistance to movement.

### Kerbs and Channels

- 4.6 Historic Setted streets are often also associated with original stone kerbs, channels and other stone street features which are intrinsic to the character of the street. Whinstone kerbs have replaced many of the original kerbs. There are some surviving examples of sandstone kerbs and occasionally granite which are grander in proportion and twice the width of the standard whin kerbs. Channels are either created from 2/3 string courses of setts or a dished channel.

## 5.0 Locations

- 5.1 There are 502 streets identified by the Council as retaining historic setts in Edinburgh. The locations are listed in Appendix 1. There may well be more that are overlaid or retain small sections of setts that are not identified.
- 5.2 There are also streets in Edinburgh that have been re-setted. These include key streets in the city centre such as Waverley Bridge, New Street, Castle Street and Cambridge Street.

## 6.0 Policy and Strategy

- 6.1 Setted streets can make it difficult for pedestrians and cyclists to move around easily. The uneven surface and the smoothness of the setts can be problematic. The Edinburgh Street Design Guidance outlines the importance of setted streets. Detailed design guidance will be provided that will outline the different specific features of setted streets including types of stone and sizes etc. A range of specifications will be provided to guide maintenance of existing setts. Specifications for new setted streets will also be included along with treatments to provide solutions for improving surfaces for cycling and walking.

- 6.2 Temporary management arrangements, on occasion, require measures to be put in place to remove (as at Ainslee Place with tram diversions) or overlay setted streets (the latter has been a common practice for many years), as a way of preserving the setted street. In these cases, joint decisions are taken by the Senior Management team or by Committee in the context of the strategy in place for setted streets.

## **7.0 Management and Maintenance**

- 7.1 The World Heritage Site Management Plan has established a number of policies to prevent the erosion of the unique sense of place and outstanding townscape including:

- To manage the streets in a way that respects, promotes and enhances its Outstanding Universal values;
- To encourage the availability and use of traditional materials;
- To promote the retention or re-establishment of traditional materials (especially those which may be in short supply or no longer obtainable);
- To respect the existing palette of traditional materials in new work and in the maintenance of existing historic fabric.

These practices will be applied to the Council's Design Guidance for setted streets and included into the Council's framework contracts for Roads and Transport. They will also be included in the Specification for the Reinstatement of Openings for Roads and the gazetteer of Streets with Special Engineering Difficulty (SAD).

### **Practical Issues**

- 7.2 The assessment of historic setted streets shows that there are a number of setted streets that have been damaged and in disrepair, detracting from their qualities and therefore their setting in the surrounding area.
- 7.3 In order to protect these and the remaining areas they need to be identified in the Council's mapping system and model specifications agreed.
- 7.4 With sources of local stone limited, there is a need to retain sources of reclaimed, historic setts. The Council has secured sources of historic setts along with kerbs and channels etc and arrangements for storing and retaining further quantities of setts. These are available for making repairs.
- 7.5 In the long term, further studies into sources of stone that match the properties of the original materials will be undertaken. In the meantime sources of granite and whinstone are supplied to standard specifications that will form part of the detailed guidance for the Edinburgh Street Design Guidance.
- 7.6 Skills in handling stone have been affected by the downturn in the industry in Scotland, something other countries, such as Poland, have maintained. The improvement of internal maintenance skills is essential to the survival of setted streets. Addressing this shortage will be taken forward once the Roads Asset Management Plan (RAMP) is developed in detail.

## 8.0 Principles

- 8.1 Historic streets and their features are important to the historic environment. Providing good information on the historic and cultural importance of setted streets will help inform changes and interventions.
- 8.2 Stone setted streets have been a part of Edinburgh's character since the end of the eighteenth century. Unlike many other parts of the UK, the practice of using stone for paving streets was more extensive, probably due to the availability of stone such as basalts, granites and whinstone etc in Scotland.
- 8.3 Streets have traditionally been laid out with a central carriageway, paved with setts, and bounded with kerbs and a simple paved footway.
- 8.4 Setted streets and stone paved footways and the details such as kerbs, channels and special features such as mounting stone, lighting plinths, bollards and honoring are all intrinsic features that are unique to the character of Edinburgh's built environment and public realm. Retaining these features as well as introducing new high quality stone materials is prioritised in areas that are recognised for their historic importance (including the World Heritage Site, Conservation Areas and the setting to listed buildings).
- 8.5 The City of Edinburgh Council is also committed to encouraging the greater use of walking and cycling for everyday journeys and it is recognised that traditional setted surfaces are not always suited to this. This can be compounded if they are badly maintained. It is also recognised that setts can raise specific issues for some users.
- 8.6 As such, it is important that setted streets are designed in ways which enable and encourage day to day walking and cycling.
- 8.7 In the above context, the following principles outline the importance and significance of setted streets and provide recommendations towards an approach for the future protection and management of setted streets in Edinburgh.

### **The Significance of setts**

1. Historic streets and their features are important to the historic environment. Setted streets, and the use of natural stone paving and features, are an intrinsic part of the cultural heritage of Edinburgh. They are finite resource, containing unique information that reflects the lives of people who lived in Scotland. Edinburgh's use of setts prevailed where trends elsewhere were for replacement with modern materials;
2. Setted streets and setted surfaces make a significant contribution to the character and authenticity of an area and are an important part of national and local identity including the setting of individual or groups of listed buildings, streets and village, town and city centres;
3. Public support has been expressed for retaining setted streets and for the appropriate introduction of new stone materials;
4. The use of local stone is a significant aspect of the character of the setts.

### **Protection of setted streets**

1. Setted streets that fall within the WHS and/or are in a conservation area will be protected;
2. Those setted streets that provide an integral part of the setting to a listed building, or are integral to the identity of the townscape arrangement in other parts of the city, will also be protected (and will be judged on their own merit).

### **Setted Streets and Active Travel**

1. The promotion of active travel is an important commitment of the Council. The design of setted street renewals will take into consideration the needs of walking, especially where there is a high level of pedestrian use at crossing points.
2. The design process should also consider cycle use on setted streets, which could pose different issues to walking.
3. As such, any construction or re-construction of setted streets in Edinburgh which is regularly used by cyclists and pedestrians should use setts in a way that facilitates active travel. This may mean using the sawn edge on the upward facing side or, especially at crossing points for walking and, where possible, design features, such as strips of flat-top setts to aid cycling. Details of this will be established in the Street Design Guidance factsheet on setted streets

**Edinburgh Setted Street Survey**

Street Name	Usage	Bus Use	World Heritage Site (WHS)	Conservation Area (CA)	Comments
Abbey Lane	Cway Type 4	No Bus Use	No	No	
Academy Park	Cway Type 4	No Bus Use	No	No	
Academy Street	Cway Type 4	No Bus Use	No	Yes	
Adelphi Place	Cway Type 4	No Bus Use	No	Yes	
Admiralty Street	Cway Type 4	No Bus Use	No	Yes	
Ainslie Place	Cway Type 1	No Bus Use	Yes	Yes	
Albany Lane	Cway Type 4	No Bus Use	Yes	Yes	
Albany Street Lane	Cway Type 4	No Bus Use	Yes	Yes	
Albert Street	Cway Type 2	No Bus Use	No	Part	Leith Walk to Murano Place
Albert Terrace	Cway Type 4	No Bus Use	No	Yes	
Allan Street	Cway Type 4	No Bus Use	No	Yes	
Anderson Place	Cway Type 4	No Bus Use	No	No	
Ann Street	Cway Type 4	No Bus Use	Yes	Yes	
Annandale Street Lane	Cway Type 4	No Bus Use	No	Yes	Boundary for Conservation Area runs down middle of street
Annfield	Cway Type 4	No Bus Use	No	Yes	
Annfield Street	Cway Type 4	No Bus Use	No	Part	Boundary for Conservation Area runs down middle of street
Argyle Street	Cway Type 4	No Bus Use	No	Yes	
Assembly Street	Cway Type 4	No Bus Use	No	Yes	
Atholl Crescent Lane	Cway Type 4	No Bus Use	Yes	Yes	
Avondale Place	Cway Type 4	No Bus Use	No	Yes	
Bakehouse Close	Cway Type 4	No Bus Use	Yes	Yes	
Baker's Place	Cway Type 1	Low Bus Use	Yes	Yes	
Balmoral Place	Cway Type 4	No Bus Use	No	Yes	
Bangor Road	Cway Type 4	No Bus Use	No	Yes	East side of a small part is in Conservation Area only
Barony Place	Cway Type 4	No Bus Use	Yes	Yes	

Barony Street	Cway Type 4	No Bus Use	Yes	Yes	
Bath Road	Cway Type 4	No Bus Use	No	No	
Bathfield	Cway Type 4	No Bus Use	No	No	
Belford Mews	Cway Type 4	No Bus Use	Yes	Yes	
Belford Park	Cway Type 4	No Bus Use	Yes	Yes	
Belgrave Crescent	Cway Type 4	No Bus Use	Yes	Yes	
Belgrave Crescent Lane	Cway Type 4	No Bus Use	Yes	Yes	
Belgrave Mews	Cway Type 4	No Bus Use	Yes	No	
Belgrave Place	Cway Type 4	No Bus Use	Yes	Yes	
Bell Place	Cway Type 4	No Bus Use	No	Yes	
Bellevue Terrace	Cway Type 4	No Bus Use	No	Part	
Bell's Brae	Cway Type 4	No Bus Use	Yes	Yes	
Bingham Crossway	Cway Type 4	No Bus Use	No	No	
Bingham Place	Cway Type 4	No Bus Use	No	No	
Blacket Avenue	Cway Type 4	No Bus Use	No	Yes	
Blackfriars Street	Cway Type 4	No Bus Use	Yes	Yes	
Blair Street	Cway Type 4	No Bus Use	Yes	Yes	
Bonnyhaugh Lane	Cway Type 4	No Bus Use	No	No	
Boroughloch	Cway Type 4	No Bus Use	No	Yes	
Borthwick's Close	Cway Type 4	No Bus Use	Yes	Yes	
Bowmont Place	Cway Type 4	No Bus Use	No	Part	Boundary for Conservation Area runs down middle of street
Boyd's Entry	Cway Type 4	No Bus Use	Yes	Yes	
Braehead Crescent	Cway Type 4	No Bus Use	No	Part	Part of boundary for Conservation Area runs down middle of part of street
Braehead Grove	Cway Type 4	No Bus Use	No	No	
Braehead Road	Cway Type 4	No Bus Use	No	No	
Braid Road	Cway Type 3	No Bus Use	No	Part	Cluny Gdns south to No.69a
Brandfield Street	Cway Type 4	No Bus Use	No	No	
Bread Street Lane	Cway Type 4	No Bus Use	Yes	Yes	
Brighton Place	Cway Type 2	Low Bus Use	No	Yes	
Brighton Street	Cway Type 4	No Bus Use	Yes	Yes	
Broad Wynd	Cway Type 4	No Bus Use	No	Yes	
Broomyknowe	Cway Type 4	No Bus Use	No	Yes	

Broughton Market	Cway Type 4	No Bus Use	Yes	Yes	
Broughton Place	Cway Type 4	No Bus Use	Yes	Yes	
Broughton Place Lane	Cway Type 4	No Bus Use	Part	Yes	Entirely in Conservation Area & partly in World Heritage Site
Broughton Street Lane	Cway Type 4	No Bus Use	Yes	Yes	
Bruce Street	Cway Type 4	No Bus Use	No	No	
Brunswick Road	Cway Type 2	No Bus Use	No	No	
Brunswick Street Lane	Cway Type 4	No Bus Use	No	Yes	
Bruntsfield Avenue	Cway Type 4	No Bus Use	No	Yes	
Bruntsfield Gardens	Cway Type 4	No Bus Use	No	Yes	
Buccleuch Place	Cway Type 4	No Bus Use	No	Yes	
Buccleuch Place Lane	Cway Type 4	No Bus Use	No	Yes	
Buckingham Terrace	Cway Type 4	No Bus Use	Yes	Yes	
Burgess Street	Cway Type 4	No Bus Use	No	Yes	
Burlington Street	Cway Type 4	No Bus Use	No	No	
Cadiz Street	Cway Type 4	No Bus Use	No	Part	Boundary for Conservation Area runs down middle of street
Calton Hill	Cway Type 4	No Bus Use	Yes	Yes	
Calton Hill	Cway Type 4	No Bus Use	Yes	Yes	
Calton Road	Cway Type 4	No Bus Use	Yes	Yes	
Campbell's Close	Cway Type 4	No Bus Use	Yes	Yes	
Canon Lane	Cway Type 4	No Bus Use	No	Yes	
Canon Street	Cway Type 4	No Bus Use	No	Part	Boundary for Conservation Area runs down middle of street
Canongate	Cway Type 2	Low Bus Use	Yes	Yes	
Carberry Place	Cway Type 4	No Bus Use	No	Yes	
Carlton Street	Cway Type 4	No Bus Use	Yes	Yes	
Carlton Terrace	Cway Type 4	No Bus Use	Yes	Yes	
Carlton Terrace Brae	Cway Type 4	No Bus Use	Yes	Yes	
Carlton Terrace Lane	Cway Type 4	No Bus Use	Yes	Yes	
Carlton Terrace Mews	Cway Type 4	No Bus Use	Yes	Yes	
Carmichael Place	Cway Type 4	No Bus Use	No	No	
Carpet Lane	Cway Type 4	No Bus Use	No	Yes	
Castle Street	Cway Type 2	No Bus Use	Yes	Yes	

Castlehill	Cway Type 3	No Bus Use	Yes	Yes	
Cathcart Place	Cway Type 4	No Bus Use	No	No	
Charlotte Lane	Cway Type 4	No Bus Use	Yes	Yes	
Cheyne Street	Cway Type 4	No Bus Use	No	Part	Part of boundary for Conservation Area runs down middle of part of street
Chuckie Pend	Cway Type 4	No Bus Use	No	Yes	
Church Hill	Cway Type 4	No Bus Use	No	Yes	
Circus Gardens	Cway Type 4	No Bus Use	Yes	Yes	
Circus Lane	Cway Type 4	No Bus Use	Yes	Yes	
Circus Place	Cway Type 1	Low Bus Use	Yes	Yes	
Claremont Grove	Cway Type 4	No Bus Use	No	Part	
Clarence Street	Cway Type 4	No Bus Use	Part	Yes	
Clinton Road	Cway Type 4	No Bus Use	No	Yes	
Coates Crescent	Cway Type 4	No Bus Use	Yes	Yes	
Coates Gardens	Cway Type 4	No Bus Use	Yes	Yes	
Coburg Street	Cway Type 3	No Bus Use	No	Yes	
Cochran Terrace	Cway Type 4	No Bus Use	No	Yes	
Cockburn Street	Cway Type 4	No Bus Use	Yes	Yes	
Collins Place	Cway Type 4	No Bus Use	No	Yes	
Colville Place	Cway Type 4	No Bus Use	No	Yes	
Comely Bank Avenue	Cway Type 3	No Bus Use	Part	Part	Short section at south end included in both
Comely Bank Place	Cway Type 4	No Bus Use	No	No	
Comely Bank Place Mews	Cway Type 4	No Bus Use	No	No	
Comely Bank Terrace	Cway Type 4	No Bus Use	No	No	
Connaught Place	Cway Type 4	No Bus Use	No	No	
Constitution Street	Cway Type 1	Low Bus Use	No	Yes	
Cooper's Close	Cway Type 4	No Bus Use	Yes	Yes	
Cornwall Street	Cway Type 4	No Bus Use	Yes	Yes	
Cornwallis Place	Cway Type 3	No Bus Use	Yes	Yes	
Couper Street	Cway Type 4	No Bus Use	No	Yes	
Cramond Road North	Cway Type 3	Low Bus Use	No	Part	Very small part at north end included in Conservation Area

Cranston Street	Cway Type 4	No Bus Use	Yes	Yes	
Cromwell Place	Cway Type 4	No Bus Use	No	Yes	
Cumberland Street North East Lane	Cway Type 4	No Bus Use	Yes	Yes	
Cumberland Street North West Lane	Cway Type 4	No Bus Use	Yes	Yes	
Cumberland Street South East Lane	Cway Type 4	No Bus Use	Yes	Yes	
Cumberland Street South West Lane	Cway Type 4	No Bus Use	Yes	Yes	
Dalmeny Street	Cway Type 2	No Bus Use	No	Part	
Damside	Cway Type 4	No Bus Use	Yes	Yes	
Danube Street	Cway Type 4	No Bus Use	Yes	Yes	
Darnaway Street	Cway Type 4	No Bus Use	Yes	Yes	
Davie Street	Cway Type 4	No Bus Use	No	Yes	
Dean Park Crescent	Cway Type 3	Low Bus Use	Yes	Yes	
Dean Park Mews	Cway Type 4	No Bus Use	No	No	
Dean Path	Cway Type 4	No Bus Use	Yes	Yes	
Dean Street	Cway Type 3	No Bus Use	No	Part	Part of boundary for Conservation Area runs down middle of part of street
Dean Terrace	Cway Type 4	No Bus Use	Part	Yes	Entirely in Conservation Area & partly in World Heritage Site
Devon Place	Cway Type 4	No Bus Use	No	No	
Dewar Place Lane	Cway Type 4	No Bus Use	No	Yes	
Dickson Street	Cway Type 4	No Bus Use	No	No	
Dock Street	Cway Type 4	No Bus Use	No	Yes	
Doune Terrace	Cway Type 4	No Bus Use	Yes	Yes	
Downfield Place	Cway Type 4	No Bus Use	No	No	
Drummond Place	Cway Type 2	Low Bus Use	Yes	Yes	
Drummond Street	Cway Type 4	No Bus Use	Yes	Yes	
Dryden Terrace	Cway Type 4	No Bus Use	No	No	
Dublin Meuse	Cway Type 4	No Bus Use	Yes	Yes	
Dublin Street Lane North	Cway Type 4	No Bus Use	Yes	Yes	
Dublin Street Lane South	Cway Type 4	No Bus Use	Yes	Yes	
Dudley Avenue South	Cway Type 4	No Bus Use	No	No	
Dudley Bank	Cway Type 4	No Bus Use	No	No	
Duff Street	Cway Type 4	No Bus Use	No	No	

Dumbiedykes Road	Cway Type 3	No Bus Use	No	No	
Dunbar's Close	Cway Type 4	No Bus Use	Yes	Yes	
Dundonald Street	Cway Type 3	No Bus Use	Yes	Yes	
Dunedin Street	Cway Type 4	No Bus Use	No	No	
Dunrobin Place	Cway Type 4	No Bus Use	No	Yes	
Durham Place Lane	Cway Type 4	No Bus Use	No	No	
East Adam Street	Cway Type 4	No Bus Use	Part	Yes	South f/w not included in WHS
East Brighton Crescent	Cway Type 4	No Bus Use	No	Yes	
East Claremont Street	Cway Type 2	No Bus Use	No	Part	
East Cromwell Street	Cway Type 4	No Bus Use	No	Yes	
East London Street	Cway Type 3	No Bus Use	No	Part	Boundary for Conservation Area runs down middle of most of street
East Market Street	Cway Type 4	No Bus Use	Yes	Yes	
East Montgomery Place	Cway Type 4	No Bus Use	No	No	
East Preston Street Lane	Cway Type 4	No Bus Use	No	Yes	
East Silvermills Lane	Cway Type 4	No Bus Use	No	Yes	
Eastfield	Cway Type 1	Low Bus Use	No	No	
Eden Lane	Cway Type 4	No Bus Use	No	Yes	
Eglinton Crescent	Cway Type 4	No Bus Use	Yes	Yes	
Egypt Mews	Cway Type 4	No Bus Use	No	Yes	
Elbe Street	Cway Type 4	No Bus Use	No	Part	
Elcho Terrace	Cway Type 4	No Bus Use	No	Yes	
Elgin Street	Cway Type 4	No Bus Use	No	No	
Ellen's Glen Loan	Cway Type 4	No Bus Use	No	No	
Elm Row	Cway Type 4	No Bus Use	No	Part	Just on boundary with WHS
Eyre Crescent	Cway Type 4	No Bus Use	No	Yes	
Eyre Place	Cway Type 2	Low Bus Use	No	Yes	
Fettes Row	Cway Type 4	No Bus Use	Part	Yes	Boundary for WHS runs along middle of road
Fishmarket Square	Cway Type 4	No Bus Use	No	Yes	
Forres Street	Cway Type 4	No Bus Use	Yes	Yes	
Forrest Hill	Cway Type 4	No Bus Use	Yes	Yes	
Fort House	Cway Type 4	No Bus Use	No	No	
Forth Street	Cway Type 4	No Bus Use	Yes	Yes	

Fox Street	Cway Type 4	No Bus Use	No	No	
Galloway's Entry	Cway Type 4	No Bus Use	Yes	Yes	
Gayfield Close	Cway Type 4	No Bus Use	Yes	Yes	
Gayfield Place Lane	Cway Type 4	No Bus Use	Yes	Yes	
Gayfield Square	Cway Type 4	No Bus Use	Part	Yes	Entirely in Conservation Area & mostly in World Heritage Site
Gayfield Street	Cway Type 4	No Bus Use	Yes	Yes	
Gayfield Street Lane	Cway Type 4	No Bus Use	Yes	Yes	
Gentle's Entry	Cway Type 4	No Bus Use	Yes	Yes	
George IV Bridge	Cway Type 1	Low Bus Use	Yes	Yes	
George Square	Cway Type 4	No Bus Use	No	Yes	
George Square Lane	Cway Type 4	No Bus Use	No	Yes	
George Street	Cway Type 1	Low Bus Use	Yes	Yes	
Gibb's Entry	Cway Type 4	No Bus Use	No	Yes	
Giles Street	Cway Type 4	No Bus Use	No	Yes	
Gilmour Street	Cway Type 4	No Bus Use	No	Yes	
Glen Street	Cway Type 4	No Bus Use	No	No	
Glenfinlas Street	Cway Type 4	No Bus Use	Yes	Yes	
Glenisla Gardens Lane	Cway Type 4	No Bus Use	No	No	
Gloucester Lane	Cway Type 4	No Bus Use	Yes	Yes	
Gloucester Place	Cway Type 4	No Bus Use	Yes	Yes	
Gloucester Square	Cway Type 4	No Bus Use	Yes	Yes	
Gloucester Street	Cway Type 4	No Bus Use	Part	Part	Boundary for WHS runs along middle of road
Gordon Street	Cway Type 4	No Bus Use	No	No	
Graham Street	Cway Type 4	No Bus Use	No	No	
Grange Court Lane	Cway Type 4	No Bus Use	No	Yes	
Grassmarket	Cway Type 2	Low Bus Use	Yes	Yes	
Great King Street	Cway Type 3	Low Bus Use	Yes	Yes	
Great Michael Close	Cway Type 4	No Bus Use	No	Yes	
Great Stuart Street	Cway Type 1	No Bus Use	Yes	Yes	
Greenlaw Rig	Cway Type 4	No Bus Use	No	No	
Greenside Lane	Cway Type 4	No Bus Use	Yes	Yes	
Greenside Row	Cway Type 4	No Bus Use	Yes	Yes	

Grindlay Street	Cway Type 4	No Bus Use	Yes	Yes	
Grindlay Street Court	Cway Type 4	No Bus Use	Yes	Yes	
Grosvenor Gardens	Cway Type 4	No Bus Use	Yes	Yes	
Gullan's Close	Cway Type 4	No Bus Use	Yes	Yes	
Halmyre Street	Cway Type 4	No Bus Use	No	No	
Hampton Place	Cway Type 4	No Bus Use	No	Yes	
Hardwell Close	Cway Type 4	No Bus Use	No	Yes	
Haugh Street	Cway Type 4	No Bus Use	No	Yes	
Hawthornbank Lane	Cway Type 4	No Bus Use	Yes	Yes	
Henderson Street	Cway Type 3	Medium Bus Use	No	Yes	
Heriot Place	Cway Type 4	No Bus Use	Yes	Yes	
Heriot Row	Cway Type 3	No Bus Use	Yes	Yes	
Heriothill Terrace	Cway Type 4	No Bus Use	No	No	
Hermand Crescent	Cway Type 4	No Bus Use	No	No	
High Riggs	Cway Type 4	No Bus Use	No	Part	Small section in CA
High School Wynd	Cway Type 4	No Bus Use	Yes	Yes	
High School Yards	Cway Type 4	No Bus Use	Yes	Yes	
High Street	Cway Type 2	Low Bus Use	Yes	Yes	
High Street SQ	Cway Type 1	No Bus Use	No	Yes	
Hill Place	Cway Type 2	Low Bus Use	Yes	Yes	
Hill Square	Cway Type 4	No Bus Use	Yes	Yes	
Hill Street	Cway Type 3	No Bus Use	Yes	Yes	
Hill Street North Lane	Cway Type 3	No Bus Use	Yes	Yes	
Hill Street South Lane	Cway Type 3	No Bus Use	Yes	Yes	
Hope Lane North	Cway Type 4	No Bus Use	No	Yes	
Hope Terrace	Cway Type 4	No Bus Use	No	Yes	
Hopefield Terrace	Cway Type 4	No Bus Use	No	Yes	
Hopetoun Crescent	Cway Type 3	No Bus Use	No	No	
Howden Street	Cway Type 4	No Bus Use	No	Yes	
Howe Street	Cway Type 2	Low Bus Use	Yes	Yes	
Hugh Miller Place	Cway Type 4	No Bus Use	No	Yes	
Hunter Square	Cway Type 4	No Bus Use	Yes	Yes	
Hunter's Close	Cway Type 4	No Bus Use	Yes	Yes	

India Place	Cway Type 4	No Bus Use	Part	Yes	
India Street	Cway Type 4	No Bus Use	Yes	Yes	
Inverleith Place Lane	Cway Type 4	No Bus Use	No	Yes	
Inverleith Terrace Lane	Cway Type 4	No Bus Use	No	Yes	
Iona Street	Cway Type 2	No Bus Use	No	Part	
Jamaica Street	Cway Type 4	No Bus Use	Yes	Yes	
Jamaica Street North Lane	Cway Type 4	No Bus Use	Yes	Yes	
Jamaica Street South Lane	Cway Type 4	No Bus Use	Yes	Yes	
James Street Lane	Cway Type 4	No Bus Use	No	Yes	
Jane Street	Cway Type 4	No Bus Use	No	Part	Small part of south-east end is in Conservation Area
John Street Lane	Cway Type 4	No Bus Use	No	Yes	
John Street Lane West	Cway Type 4	No Bus Use	No	Yes	
John's Lane	Cway Type 4	No Bus Use	No	Yes	
John's Place	Cway Type 4	No Bus Use	No	Yes	
Johnston Terrace	Cway Type 2	No Bus Use	Yes	Yes	
Joppa Park	Cway Type 4	No Bus Use	No	Yes	
Junction Place	Cway Type 4	No Bus Use	No	Part	
Keir Street	Cway Type 4	No Bus Use	Yes	Yes	
Kemp Place	Cway Type 4	No Bus Use	No	Yes	
King Street	Cway Type 4	No Bus Use	No	Yes	
King's Stables Lane	Cway Type 4	No Bus Use	Yes	Yes	
King's Stables Road	Cway Type 3	No Bus Use	Yes	Yes	
Lady Wynd	Cway Type 4	No Bus Use	Yes	Yes	
Lapicide Place	Cway Type 4	No Bus Use	No	No	
Largo Place	Cway Type 4	No Bus Use	No	Yes	
Lauderdale Street	Cway Type 4	No Bus Use	No	Yes	
Laurel Terrace	Cway Type 4	No Bus Use	No	Part	CA - <b>not</b> including the section on Slateford Road
Laverockbank Terrace	Cway Type 4	No Bus Use	No	Yes	
Laverockdale Park	Cway Type 4	No Bus Use	No	No	
Lawnmarket	Cway Type 2	No Bus Use	Yes	Yes	
Learmonth Gardens Lane	Cway Type 4	No Bus Use	No	No	
Learmonth Gardens Mews	Cway Type 4	No Bus Use	No	No	

Learmonth Terrace	Cway Type 4	Low Bus Use	Yes	Yes	
Learmonth View	Cway Type 4	No Bus Use	Part	Part	South half in both
Lee Crescent	Cway Type 4	No Bus Use	Yes	Yes	
Lennox Street Lane	Cway Type 4	No Bus Use	Yes	Yes	
Leslie Place	Cway Type 3	Low Bus Use	Part	Yes	
Lochend Close	Cway Type 4	No Bus Use	Yes	Yes	
London Street	Cway Type 2	Low Bus Use	Yes	Yes	
Lorne Street	Cway Type 2	No Bus Use	No	Part	
Lynedoch Place Lane	Cway Type 4	No Bus Use	Yes	Yes	
Mackenzie Place	Cway Type 4	No Bus Use	Yes	Yes	
Madeira Place	Cway Type 4	No Bus Use	No	Yes	
Madeira Street	Cway Type 4	No Bus Use	No	Yes	
Main Street, Balerno	Cway Type 3	No Bus Use	No	Yes	
Malta Terrace	Cway Type 4	No Bus Use	No	Yes	
Manderston Street	Cway Type 4	No Bus Use	No	Part	Short section at west end included in CA
Marchmont Street	Cway Type 4	No Bus Use	No	Yes	
Maritime Lane	Cway Type 4	No Bus Use	No	Yes	
Maritime Street	Cway Type 4	No Bus Use	No	Yes	
Marshall's Court	Cway Type 4	No Bus Use	Yes	Yes	
Meadow Lane	Cway Type 4	No Bus Use	No	Yes	
Melville Street Lane	Cway Type 4	No Bus Use	Yes	Yes	
Merchant Street	Cway Type 4	No Bus Use	Yes	Yes	
Merchiston Grove	Cway Type 4	No Bus Use	No	No	
Merchiston Mews	Cway Type 4	No Bus Use	No	No	
Meuse Lane	Cway Type 4	No Bus Use	Yes	Yes	
Middleby Street	Cway Type 4	No Bus Use	No	Yes	
Middlefield	Cway Type 4	No Bus Use	No	Part	Most of this road is in CA
Mill Lane	Cway Type 4	No Bus Use	No	Yes	
Mitchell Street	Cway Type 4	No Bus Use	No	Part	
Monmouth Terrace	Cway Type 4	No Bus Use	No	Yes	
Montgomery Street Lane	Cway Type 4	No Bus Use	No	Yes	
Moray Place	Cway Type 3	No Bus Use	Yes	Yes	

Mound Place	Cway Type 4	No Bus Use	Yes	Yes	
Murieston Lane	Cway Type 4	No Bus Use	No	No	
Myrtle Terrace	Cway Type 4	No Bus Use	no	Yes	
Nelson Place	Cway Type 4	No Bus Use	Yes	Yes	
Nelson Street	Cway Type 3	No Bus Use	Yes	Yes	
New Arthur Place	Cway Type 4	No Bus Use	No	No	
New Broughton	Cway Type 4	No Bus Use	Yes	Yes	
New Skinner's Close	Cway Type 4	No Bus Use	Yes	Yes	
Newhaven Main Street	Cway Type 4	No Bus Use	No	Yes	
Newhaven Road	Cway Type 2	Low Bus Use	No	Part	Newhaven Main Street to Ferry Road only is included in CA
Newton Street	Cway Type 4	No Bus Use	No	No	
Niddry Street	Cway Type 4	No Bus Use	Yes	Yes	
Niddry Street South	Cway Type 4	No Bus Use	Yes	Yes	
North East Circus Place	Cway Type 4	No Bus Use	Yes	Yes	
North Fort Street	Cway Type 3	No Bus Use	No	Part	
North Leith Mill	Cway Type 4	No Bus Use	No	Yes	
North West Circus Place	Cway Type 1	Low Bus Use	Yes	Yes	
Northumberland Place Lane	Cway Type 4	No Bus Use	Yes	Yes	
Northumberland Street	Cway Type 3	No Bus Use	Yes	Yes	
Northumberland Street North West Lane	Cway Type 4	No Bus Use	Yes	Yes	
Northumberland Street South East Lane	Cway Type 4	No Bus Use	Yes	Yes	
Northumberland Street South West Lane	Cway Type 4	No Bus Use	Yes	Yes	
Old Fishmarket Close	Cway Type 4	No Bus Use	Yes	Yes	
Old Tolbooth Wynd	Cway Type 4	No Bus Use	Yes	Yes	
Orchardfield Lane	Cway Type 4	No Bus Use	No	Yes	
Palmerston Place Lane	Cway Type 4	No Bus Use	Yes	Yes	
Parkside Street	Cway Type 4	No Bus Use	No	Part	Boundary for CA runs down middle of road
Parliament Square	Cway Type 4	No Bus Use	Yes	Yes	
Pattison Street	Cway Type 4	No Bus Use	No	Part	Small section in CA
Peacock Court	Cway Type 4	No Bus Use	No	Yes	
Pembroke Place	Cway Type 4	No Bus Use	No	Yes	
Perth Street	Cway Type 4	No Bus Use	No	Yes	

Pirrie Street	Cway Type 4	No Bus Use	No	Part	North end of CA only
Pitt Street	Cway Type 4	No Bus Use	No	No	
Poplar Lane	Cway Type 4	No Bus Use	No	Part	Boundary for CA runs down middle of part of road
Portland Street	Cway Type 4	No Bus Use	No	Part	
Primrose Terrace	Cway Type 4	No Bus Use	No	Yes	
Quarry Close	Cway Type 4	No Bus Use	No	Yes	
Quayside Street	Cway Type 4	No Bus Use	No	Yes	
Queen Charlotte Lane	Cway Type 4	No Bus Use	No	Yes	
Queen Street Gardens West	Cway Type 1	Low Bus Use	Yes	Yes	
Queensferry Street Lane	Cway Type 4	No Bus Use	Yes	Yes	
Raeburn Street	Cway Type 4	No Bus Use	No	Yes	
Ramsay Garden	Cway Type 4	No Bus Use	Yes	Yes	
Ramsay Lane	Cway Type 4	No Bus Use	Yes	Yes	
Randolph Crescent	Cway Type 1	No Bus Use	Yes	Yes	
Randolph Lane	Cway Type 4	No Bus Use	Yes	Yes	
Randolph Place	Cway Type 4	No Bus Use	Yes	Yes	
Ravelrig Wynd	Cway Type 4	No Bus Use	No	Yes	
Reekies Court	Cway Type 4	No Bus Use	No	Yes	
Regent Terrace	Cway Type 4	No Bus Use	Yes	Yes	
Regent Terrace Mews	Cway Type 4	No Bus Use	Yes	Yes	
Register Place	Cway Type 4	No Bus Use	Yes	Yes	
Reid Terrace	Cway Type 4	No Bus Use	No	Yes	
Richmond Lane	Cway Type 4	No Bus Use	No	Yes	
Richmond Place	Cway Type 4	No Bus Use	Part	Yes	South end not included in WHS
Richmond Terrace	Cway Type 4	No Bus Use	No	No	
Riego Street	Cway Type 4	No Bus Use	No	No	
Rintoul Place	Cway Type 4	No Bus Use	No	Yes	
Robertson's Close	Cway Type 4	No Bus Use	Yes	Yes	
Robertson's Court	Cway Type 4	No Bus Use	Yes	Yes	
Rose Street North Lane	Cway Type 3	No Bus Use	Yes	Yes	
Rose Street South Lane	Cway Type 4	No Bus Use	Yes	Yes	
Rosebery Crescent Lane	Cway Type 4	No Bus Use	Yes	Yes	

Roseburn Cliff	Cway Type 4	No Bus Use	No	Yes	
Rothesay Mews	Cway Type 4	No Bus Use	Yes	Yes	
Roxburgh Place	Cway Type 4	No Bus Use	Yes	Yes	
Roxburgh Street	Cway Type 4	No Bus Use	Yes	Yes	
Royal Circus	Cway Type 4	No Bus Use	Yes	Yes	
Royal Crescent	Cway Type 3	No Bus Use	Yes	Yes	
Royal Terrace	Cway Type 4	No Bus Use	Yes	Yes	
Royston Terrace	Cway Type 4	No Bus Use	No	Yes	
Rutland Street	Cway Type 4	No Bus Use	Part	Yes	south-east f/w o/s Caley not included in WHS boundary
Salamander Place	Cway Type 3	No Bus Use	No	Part	short section at south end included in CA
Sandford Gardens	Cway Type 4	No Bus Use	No	Yes	
Sandport Place	Cway Type 3	No Bus Use	No	Yes	
Scotland Street	Cway Type 4	No Bus Use	Yes	Yes	
Seaport Street	Cway Type 4	No Bus Use	No	Yes	
Shaftesbury Park	Cway Type 4	No Bus Use	No	Yes	
Shaw's Place	Cway Type 4	No Bus Use	No	Yes	
Shaw's Terrace	Cway Type 4	No Bus Use	No	Yes	
Shore	Cway Type 3	Medium Bus Use	No	Yes	
Shore Place	Cway Type 4	No Bus Use	No	Yes	
Simon Square	Cway Type 4	No Bus Use	No	Yes	
Smithfield Street	Cway Type 4	No Bus Use	No	Yes	
South College Street	Cway Type 4	No Bus Use	Yes	Yes	
South East Circus Place	Cway Type 1	Low Bus Use	Yes	Yes	
South Fort Street	Cway Type 4	No Bus Use	No	Yes	
South Gayfield Lane	Cway Type 4	No Bus Use	Yes	Yes	
South Gray's Close	Cway Type 4	No Bus Use	Yes	Yes	
South Learmonth Avenue	Cway Type 4	No Bus Use	Part	Part	
South Learmonth Gardens	Cway Type 4	No Bus Use	No	No	
South Oxford Street	Cway Type 4	No Bus Use	No	Yes	
Spey Street	Cway Type 4	No Bus Use	No	Yes	
Spey Street Lane	Cway Type 4	No Bus Use	No	Yes	

Spier's Place	Cway Type 4	No Bus Use	No	Part	
Spittal Street Lane	Cway Type 4	No Bus Use	Yes	Yes	
Spottiswoode Road	Cway Type 4	No Bus Use	No	Yes	
Springfield Crescent	Cway Type 4	No Bus Use	No	No	
Springwell Place	Cway Type 4	No Bus Use	No	No	
Spylaw Park	Cway Type 4	No Bus Use	No	Yes	
St Bernard's Crescent	Cway Type 4	Low Bus Use	Yes	Yes	
St Bernard's Row	Cway Type 4	Low Bus Use	No	Yes	
St Colme Street	Cway Type 1	No Bus Use	Yes	Yes	
St David's Place	Cway Type 4	Low Bus Use	No	Yes	
St David's Terrace	Cway Type 4	No Bus Use	No	Yes	
St Giles Street	Cway Type 4	No Bus Use	Yes	Yes	
St Margaret's Place	Cway Type 4	No Bus Use	No	Yes	
St Mary's Place Lane	Cway Type 4	No Bus Use	No	Yes	
St Mary's Street	Cway Type 4	Low Bus Use	Yes	Yes	
St Ninian's Row	Cway Type 4	No Bus Use	Yes	Yes	
St Patrick Square	Cway Type 4	No Bus Use	No	Yes	
St Stephen Street	Cway Type 4	No Bus Use	No	Yes	
St Vincent Street	Cway Type 3	No Bus Use	Yes	Yes	
Stafford Street Lane	Cway Type 4	No Bus Use	Yes	Yes	
Stanhope Street	Cway Type 4	No Bus Use	No	Yes	
Stanwell Street	Cway Type 4	No Bus Use	No	No	
Steel's Place	Cway Type 4	No Bus Use	No	No	
Stevenlaw's Close	Cway Type 4	No Bus Use	Yes	Yes	
Suffolk Road Lane	Cway Type 4	No Bus Use	No	Yes	
Sugarhouse Close	Cway Type 4	No Bus Use	Yes	Yes	
Summerbank	Cway Type 3	No Bus Use	Yes	Yes	
Sunbury Mews	Cway Type 4	No Bus Use	Yes	Yes	
Sunbury Street	Cway Type 4	No Bus Use	Yes	Yes	
Teviotdale Place	Cway Type 4	No Bus Use	No	Yes	
The Paddockholm	Cway Type 4	No Bus Use	No	No	
The Quilts	Cway Type 4	No Bus Use	No	No	
Thirlestane Lane	Cway Type 4	No Bus Use	No	Yes	

Thirlestane Road	Cway Type 4	No Bus Use	No	Yes	
Thistle Street	Cway Type 3	No Bus Use	Yes	Yes	
Thistle Street North East Lane	Cway Type 4	No Bus Use	Yes	Yes	
Thistle Street North West Lane	Cway Type 4	No Bus Use	Yes	Yes	
Thistle Street South East Lane	Cway Type 4	No Bus Use	Yes	Yes	
Thistle Street South West Lane	Cway Type 4	No Bus Use	Yes	Yes	
Thorntree Street	Cway Type 4	No Bus Use	No	No	
Thornybark	Cway Type 4	No Bus Use	No	No	
Timber Bush	Cway Type 4	No Bus Use	No	Yes	
Tolbooth Wynd	Cway Type 4	No Bus Use	No	Yes	
Torphichen Place Lane	Cway Type 4	No Bus Use	Yes	Yes	
Tower Street	Cway Type 4	No Bus Use	No	Part	Boundary for CA runs along middle of section east of Constitution St
Trafalgar Street	Cway Type 4	No Bus Use	No	No	
Trinity Road	Cway Type 4	No Bus Use	No	Yes	East side of road at No.56-68 not included in CA
Tron Square	Cway Type 4	No Bus Use	Yes	Yes	
Tynecastle Lane	Cway Type 4	No Bus Use	No	No	
Union Street	Cway Type 4	No Bus Use	Yes	Yes	
Upper Bow	Cway Type 4	No Bus Use	Yes	Yes	
Upper Dean Terrace	Cway Type 4	No Bus Use	Yes	Yes	
Victoria Street	Cway Type 4	No Bus Use	Yes	Yes	
Walker Street	Cway Type 4	No Bus Use	Yes	Yes	
Warden's Close	Cway Type 4	No Bus Use	Yes	Yes	
Warrender Park Road	Cway Type 3	No Bus Use	No	Yes	
Warrender Park Terrace	Cway Type 4	No Bus Use	No	Yes	
Washington Lane	Cway Type 4	No Bus Use	No	No	
Water Street	Cway Type 4	No Bus Use	No	Yes	
Well Court	Cway Type 4	No Bus Use	Yes	Yes	
Wellington Place	Cway Type 4	No Bus Use	No	Yes	
Wemyss Place Mews	Cway Type 4	No Bus Use	Yes	Yes	
West Adam Street	Cway Type 4	No Bus Use	Part	Yes	north f/w only in WHS
West Bow	Cway Type 4	No Bus Use	Yes	Yes	
West Bowling Green Street	Cway Type 4	No Bus Use	No	No	

West College Street	Cway Type 4	No Bus Use	Yes	Yes	
West Cromwell Street	Cway Type 4	No Bus Use	No	Yes	
West Crosscauseway	Cway Type 4	No Bus Use	No	Yes	
West End Place	Cway Type 4	No Bus Use	No	No	
West Mill Lane	Cway Type 4	No Bus Use	No	Yes	
West Nicolson Street	Cway Type 4	No Bus Use	No	Yes	
West Park Place	Cway Type 4	No Bus Use	No	No	
West Register Street	Cway Type 4	No Bus Use	Yes	Yes	
West Register Street Lane	Cway Type 4	No Bus Use	Yes	Yes	
West Relugas Road	Cway Type 4	No Bus Use	No	No	
West Scotland Street Lane	Cway Type 4	No Bus Use	Yes	Yes	
West Silvermills Lane	Cway Type 4	No Bus Use	No	Yes	
West Stanhope Place	Cway Type 4	No Bus Use	No	Yes	
Westbank Street	Cway Type 4	No Bus Use	No	No	
Wheatfield Place	Cway Type 4	No Bus Use	No	No	
Wheatfield Street	Cway Type 4	No Bus Use	No	No	
Wheatfield Terrace	Cway Type 4	No Bus Use	No	No	
William Street	Cway Type 4	No Bus Use	Yes	Yes	
William Street North East Lane	Cway Type 4	No Bus Use	Yes	Yes	
William Street North West Lane	Cway Type 4	No Bus Use	Yes	Yes	
William Street South East Lane	Cway Type 4	No Bus Use	Yes	Yes	
William Street South west Lane	Cway Type 4	No Bus Use	Yes	Yes	
Windmill Lane	Cway Type 4	No Bus Use	No	Yes	
Windsor Street Lane	Cway Type 4	No Bus Use	No	Yes	
Yardheads	Cway Type 4	No Bus Use	No	Yes	
York Lane	Cway Type 4	No Bus Use	Yes	Yes	
York Road	Cway Type 4	No Bus Use	No	Yes	
Young Street	Cway Type 3	No Bus Use	Yes	Yes	
Young Street North Lane	Cway Type 3	No Bus Use	Yes	Yes	
Young Street South Lane	Cway Type 3	No Bus Use	Yes	Yes	

## Footway Materials and Surfacing

## Setts

## Existing Streets

Setts are important features of historic and cultural significance for the city.

There is a presumption in favour of retaining all setted streets within conservation areas. General protection is now provided within conservation area character appraisals and conservation policy as part of the Local Development Plan.

## Repairs

Temporary repair will be used where an annual inspection has identified a trip hazard or other health and safety issues. These repairs are undertaken with a tarmac infill.

Comprehensive repairs will be carried out as part of the capital renewals programme.

Edinburgh World Heritage (EWH) in conjunction with the British Geological Survey (BGS) prepared a research paper "**Setts in the City**" which sought to fill a gap in the understanding of these important features.

The report concludes with recommendations on how setted road surfaces may be repaired and conserved.



Well laid setts within carriageway



Temporary tarmac repairs to setted street



Sett deformation: Problems like this can arise from channelized flow and a lack of adequate substructure (Source, Marshalls 2012)



Cocburn Street, Edinburgh. Street re-laid in the 1990's reusing original setts. (Setts in the City)

## Footway Materials and Surfacing - Setts

## New Streets

Careful consideration is needed when specifying setts for a footway or carriageway. To determine whether setts are appropriate for a particular street it is important to address the context, use, and users of the street.

**Key considerations for choosing setts:**

- Consider the qualities of different setts in relation to walking and cycling surfaces they provide.
- Consider the long-term maintenance required for setts.
- Consider specifying flat-top setts to create a smooth surface for cyclists, wheelchairs and pedestrians.
- To avoid un-natural, regular laying, setts should not have sawn vertical edges.

**Colour and Depth of setts**

Different colours of stone often corresponds to different properties at a practical level, i.e. the porosity and loading capacity of each sett. Therefore specific depths are required for each colour of sett:

- Greys (granite) 150-250mm
- Black (whin) 200-250mm

It is important to consider nearby building materials when specifying setts and carefully design how the scheme will link to surrounding materials.

Sett widths should be within the range 90mm to 140mm though it is recommended that variation within a single street is kept to less than this. In general full size setts should be approximately 2.5 to 3.5 times longer than they are wide.

**Granite setts**

- Granite setts can be used in certain locations to delineate an area, such as on level loading bays or drainage channels in footway build-outs.
- They can also be used to change surface texture in carriageway such as on the ramps of raised entry treatments or areas where walking is discouraged.
- A flush surface must be achieved where people are likely to walk on the granite setts, using a fine picked finish with flush pointing.
- Cropped granite setts can be used in the carriageway as a slight traffic calming effect, as well as in areas where walking is discouraged.
- Choose granite sett colours by following local precedent.
- Traditionally, granite setts have been laid in random sizes and courses.
- The use of random sized reclaimed setts is preferred.
- For new setts, the most common size is 200x100x100mm, laid with a half bond.
- Cubed setts (100x100x100mm) can be used to match local use.



Flush, fine picked granite setts suitable for walking



New Cropped granite setts



Old Granite setts



Setts in level loading

## Footway Materials and Surfacing - Setts

**Setts Special Requirements****Laying Details**

- The straightness and accuracy of the sides is crucial to the performance of the product.
- The setts shall be laid to the specified crossfalls and in straight transverse lines with particular emphasis on the uniformity of width of setts in each row and the relative positions of the joints.
- Joints shall be as described in BS 7533-7:2010 according to the type of sett.
- Refer to standard drawing 11087 for details of rigid jointing.
- Within each course, setts shall be hand selected to maintain average widths along the face of the joints.
- In order to achieve high quality work, setts must be selected and graded as follows: -
- Cleanliness and regularity
- Clean setts, removing yellow paint markings, bituminous material, etc. and reject setts that are chipped on the top surface or are excessively mis-shapen.
- Setts shall be laid to a regular stretcher bond with broken joints at right angles to the direction of the street.
- The minimum overlap of joints between courses shall be 1/3rd the length of the sett.
- Cutting of setts must be kept to a minimum.
- Setts shall be split, if required, at tie ins around manhole covers, valves and any similar obstacle such that gaps do not exceed 10mm.
- Setts to be watered in with a fine spray after laying.
- Joints shall be filled, after 'wetting', with suitable Specialized Mortar in accordance with manufacturer recommendations.
- Do not lay paving if the temperature is below 3°C on a falling thermometer or below 1°C on a rising thermometer.
- Channel courses shall be retained and protected where they exist at present and only introduced for sound engineering or practical reasons. Where used they shall be installed laid parallel to the kerb.
- Natural setts will be laid on bituminous base with compacted sub-base as detailed in BS 7533-10:2010, and specified by an engineer, taking in to account anticipated loadings, traffic levels and ground conditions.
- No grout staining of setts to occur. Clean off with a stiff brush and sawdust.
- Each sett must be clearly defined by neat lines of jointing material, giving a consistent appearance.
- Each completed panel will be protected from frost by a double insulated layer of hessian and polythene, alternatively in warm weather the hessian is to be watered.
- All pedestrian traffic to be kept off newly grouted setts until the mortar has reached a strength sufficient for vehicular traffic.
- Radial areas of setts must be constructed by the movement in the joints or the selection of varying width of setts.
- The specification for material below the sub-grade is as for flexible construction.

The City of Edinburgh Council may provide setts or whin kerb if there is a shortfall. The developer or his agent should contact the relevant RCC officer or inspector to enable them to order these materials.

There may be a charge for these materials. Any works that are to be undertaken on a public road will require a permit from the council, Area Managers.

Any existing setts in areas of new work should be carefully retained and reclaimed for repair purposes.



**British  
Geological Survey**  
NATURAL ENVIRONMENT RESEARCH COUNCIL

# A review of the style and performance of traditional and new setted streets in Edinburgh

Minerals and Waste Programme

Commissioned Report CR/18/008





BRITISH GEOLOGICAL SURVEY

MINERALS AND WASTE PROGRAMME

COMMISSIONED REPORT CR/18/008

# A review of the style and performance of traditional and new setted streets in Edinburgh

Martin Gillespie and Paul Everett

## *Keywords*

Report; setts; setted street; traditional; new; modern; performance; guidance; specification; Edinburgh.

## *Front cover*

Traditional (left) and recently created (right) setted street style in Edinburgh.

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**Summary**

Historic Environment Scotland and Edinburgh World Heritage Trust have commissioned BGS to conduct a review of setted streets in Edinburgh, with a particular focus on (i) the attributes of traditional setts and setted streets, and (ii) performance aspects of modern setts and setted streets. This report presents the outcomes of that review. The report will inform updated ‘street design guidance’ and a revised strategy for setted streets being prepared by City of Edinburgh Council.

# 1 Introduction

Stone setts were used to form new carriageway surfaces in Edinburgh for several centuries, and setted streets consequently are a key component of ‘traditional’ Edinburgh streetscape. However, during the twentieth century many setted street surfaces were concealed beneath, or replaced by, modern road-forming materials (mainly tarmac), leading to a gradual loss of traditional street character in the city.

Today, City of Edinburgh Council (CEC), Edinburgh World Heritage Trust (EWHT) and Historic Environment Scotland (HES) all take the view that setted streets are an important part of the traditional / historical environment in Edinburgh, and should be retained where possible and reinstated where practicable. This is particularly the case in the central part of the city that is designated a UNESCO World Heritage site (*Old and New Towns of Edinburgh World Heritage Site*). CEC therefore wishes to review and update its current ‘street design guidance’ for setted streets, and develop a revised strategy for setted streets.

A key goal for CEC is to ensure that newly formed setted streets, and historical setted streets that are repaired, are as far as possible ‘in keeping’ with the traditional style. However, lack of clarity about what constitutes an authentic ‘traditional style’ for setted streets means it is not clear if this goal is being achieved.

Another goal is to ensure that the practical implications of using setted streets (instead of tarmac) are taken into consideration in the new guidance and revised strategy. These include cost-effectiveness; setted street surfaces are expensive to create (compared to tarmac), so demonstrating that they can be cost effective (requiring minimal maintenance) over long periods is important.

Imported stone has been used almost exclusively in recent decades to form new setted streets (because, unlike Scottish stone, it is readily available as prepared setts and blocks, and is relatively cheap). However, the extent to which streets formed of imported stone can be visually ‘in keeping’ with traditional streets, and whether imported stone will perform as it should over the expected lifespan of a new setted street, are not well understood and need to be evaluated.

With these goals in mind, HES and EWHT have commissioned BGS to conduct a review of setted streets in Edinburgh with a particular focus on (i) the attributes of traditional setts and setted streets, and (ii) performance aspects of modern setts and setted streets. This report, which describes the outcomes of the review, will inform the updated guidance and strategy being prepared by CEC.

The report is organised as follows.

- A short review of the geological background to setts – describing the geological properties that underpin sett performance and introducing some of the terminology that features later in the report – is presented in section 2.
- The terms used to refer to the different components of setted streets are described in section 3.
- The key attributes of traditional setted streets in Edinburgh are described in section 4. The information in section 4 is based very largely on *Setts in the City*, an unpublished report compiled in 2004 by EWHT (with input from BGS).
- A list of proposed attributes that new setted streets should display in order to be ‘in keeping’ with the traditional style is presented in section 5; the list is based largely on information in section 4.
- An assessment of how well recently created areas of setted street replicate the traditional style, based on examination of five sites in central Edinburgh, is presented in section 6.
- The same five sites form the subject of an evaluation of the performance of recently created areas of setted street, which is described in section 7.
- Key performance indicators for setted streets, and details of the various tests that can be used to evaluate performance, are described in section 8.
- The report concludes with a brief summary of key conclusions and recommendations.

## 2 Geological background to setts

There are many different types of rock, and each has a set of attributes (e.g. hardness, durability, propensity to split, permeability, colour) that make it more or less suited to a range of uses in the built environment. Over time, people have learned to select and use different rock types for different purposes, such as walling, roofing, paving and decorative objects, according to their attributes. In this section we briefly review the geological background to setts and introduce some of the geological concepts and terminology that appear later in the report.

### 2.1 THE MAIN ROCK CLASSES AND THEIR GEOLOGICAL ATTRIBUTES

Virtually all rocks can be divided into three main classes.

- *Igneous rocks* form by solidification of magma (molten rock). Magma can solidify below the ground surface (forming intrusions) or it can erupt into the air or onto the ground (forming pyroclastic deposits and lava flows, respectively). Common types of igneous rock include *granite* and *gabbro* (which always occur as intrusions), and *basalt* and *andesite* (which commonly are erupted, but can form intrusions).
- *Sedimentary rocks* form when layers of particulate matter (e.g. sand, mud, gravel) accumulate on the ground or on the sea floor and are then buried to considerable depth where heat and pressure combine to convert them into rock. Common types of sedimentary rock include *sandstone*, *conglomerate*, *siltstone* and *limestone*.
- *Metamorphic rocks* are former igneous rocks and sedimentary rocks that have been subjected to high temperature and pressure within Earth's crust, such that their mineral and textural character changes and in effect they become new rocks. Common types of metamorphic rock include *gneiss*, *schist* and *slate*.

Metamorphic rocks and most igneous rocks are *crystalline* (formed entirely of tightly interlocking crystals), whereas most sedimentary rocks are *granular* (formed of loosely to tightly packed grains, typically with pore spaces between them). In general, granular rocks are more permeable, less cohesive, and less durable than crystalline rocks.

Any rock used to form setts must be very durable and not prone to parting along planes of weakness. Most sedimentary rocks are not particularly durable, and many have a tendency to part along the boundaries between layers of deposited matter. Some metamorphic rocks are not particularly durable and display a tendency to part, while others are very durable and lack planes of weakness; however, the most durable metamorphic rocks in general are restricted to remote, thinly populated parts of Scotland and as such have not been quarried for building purposes. By contrast, igneous rocks in general are very durable (being hard, dense and essentially impermeable), not prone to parting, and are common throughout Scotland. For these reasons, virtually all setts in Edinburgh and elsewhere in Scotland consist of igneous rock. The remaining information in this section therefore focusses on igneous rocks.

### 2.2 TYPES OF IGNEOUS ROCK

Igneous rocks are classified and named according to two criteria: the minerals they contain and their grain-size (i.e. the typical size of the constituent crystals).

- The mineral assemblage of an igneous rock is determined by the chemical composition of the magma. *Silica* (silicon dioxide or SiO<sub>2</sub>) is the main constituent in all magmas, and therefore plays a key role in controlling the mineral content of igneous rocks. For example, the mineral *quartz* will only crystallise from a *silica-rich* magma, and the mineral *olivine* will only crystallise from a *silica-poor* magma. Most igneous rocks contain around ten different minerals, though the bulk (>90%) of each rock usually is

formed of only three or four minerals. *Feldspar* is the commonest mineral, and is the dominant constituent in virtually all igneous rocks.

- The grain-size of an igneous rock is determined by the rate at which the magma cooled and solidified. Coarse-grained rocks (composed of large crystals) are produced when magma cools slowly, whereas fine-grained rocks (composed of small crystals) are produced when magma cools quickly. Some magmas undergo two or more distinct stages of cooling, and this produces a distinctive character - known as *porphyritic texture* - in which prominent larger crystals are enclosed in a 'matrix' of smaller crystals.

The very wide range of possible magma compositions and magma cooling histories means that geologists distinguish hundreds of different types of igneous rocks, each of which has a different name. However, many of these are rare, and most of the igneous rock globally consists of a relatively small number of rock types.

The names assigned to some of the commonest igneous rocks, and their key characteristics, are summarised in Table 1.

**Table 1 Names for common igneous rocks**

Rock attributes		Composition		
		Silica-rich	Intermediate	Silica-poor
Grain-size	Coarse-grained	<i>granite</i>	<i>diorite</i>	<i>gabbro</i>
	Medium-grained	<i>microgranite</i>	<i>microdiorite</i>	<i>dolerite</i>
	Fine-grained	<i>rhyolite</i>	<i>andesite</i>	<i>basalt</i>

Thus, *granite* is coarse-grained igneous rock that crystallised from silica-rich magma, and *microgranite* and *rhyolite* are medium-grained and fine-grained rocks respectively that also crystallised from silica-rich magma. Likewise, *gabbro* is coarse-grained igneous rock that crystallised from silica-poor magma, and *dolerite* (sometimes known as *microgabbro*) and *basalt* are medium-grained and fine-grained rocks respectively that also crystallised from silica-poor magma.

Table 1 shows the names of some of the commonest types of igneous rocks, but each category actually encompasses multiple rock types. For example, *granite*, *granodiorite* and *tonalite* are all coarse-grained, silica-rich igneous rocks, which are distinguished by different proportions of feldspar minerals.

Among non-geologists, it is common practice to use a single well-known name to refer to a range of broadly similar igneous rocks. For example, the name *granite* typically is used to refer collectively to 'granite and granite-like rocks'. This is convenient and practical, but it does mean that in some (possibly many) cases the name used to refer to an igneous rock used for building purposes may not be accurate or appropriate in a geological sense. For example, 'Black Granite', a relatively common trade name in the building stone industry, in most cases is probably gabbro or dolerite rather than granite, and as such is geologically very different from granite and will have rather different properties and attributes.

The name *whin* (or *whinstone*) in the past has been used by geologists and others as a general term for dark igneous rocks (which can be difficult to classify accurately without microscope analysis, because the dark colour makes it difficult to distinguish the different minerals in them). In practice,

most of the rocks formerly described as whin are likely to be basalt or dolerite, but in some instances the term has been used to encompass gabbro and even dense, dark sedimentary rock such as sandstone from the Southern Uplands region of Scotland. Geologists no longer use the term.

### 2.3 MINERALS IN IGNEOUS ROCKS

Silica-rich igneous rocks (including granite, microgranite and rhyolite) consist mainly of the minerals *quartz*, *alkali feldspar* and *plagioclase feldspar* (usually shortened to *plagioclase*) in roughly equal proportions. A small proportion of *biotite* or *muscovite* (minerals from the mica family) is usually present.

Silica-poor igneous rocks (including gabbro, dolerite and basalt) consist mainly of the mineral *plagioclase* and one or more of the minerals *pyroxene*, *amphibole* and *olivine*. Plagioclase is a light-coloured mineral while pyroxene, amphibole and olivine are dark. Thus, gabbro and dolerite are usually grey overall, but they can be light grey, medium grey or dark grey depending on the relative proportions of plagioclase and other minerals.

Quartz is a particularly hard, durable mineral, so igneous rock with a large component of quartz (e.g. granite) in general should be harder wearing and more durable than those lacking quartz (e.g. gabbro, dolerite).

### 2.4 THE EFFECT OF SECONDARY PROCESSES ON IGNEOUS ROCKS

The original (primary) minerals and texture in an igneous rock can be changed by events that happen to the rock later in its geological history. For example, the rock might be subjected to strong physical alteration (*deformation*), in which case the crystals within it can become stretched and aligned. An igneous rock that lacks any obvious preferred alignment of crystals is said to be *massive*, while a rock in which some or all of the crystals have become aligned through deformation is said to be *foliated*. During deformation, the larger crystals in a porphyritic rock can become lenticular (eye-shaped), producing a texture known as *augen texture*. Some rocks might be subjected to chemical alteration, which causes *primary* minerals to be replaced by one or more *secondary* (new) minerals. Chemical alteration usually acts to weaken the rock and usually produces rock with a pronounced colour (e.g. pink or green). Virtually all igneous rocks are chemically altered to some degree because they remain hot and chemically active for a long time after they have solidified.

Igneous rocks can crack if they are subjected to geological forces, producing *fractures*. Minerals usually crystallise from water that enters the fractures, producing *veins* (mineral-filled fractures). Some veins are as strong as the rock around them, while others are less strong and therefore prone to breaking. Some veins are formed of minerals that are chemically inert, while others are formed of minerals that dissolve readily. For these reasons, veins can be a source of weakness in igneous rocks and a cause of cracking and deterioration in setts.

### 2.5 OTHER TERMS USED IN THIS REPORT

The term *variant* is used (mainly in section 5 and later sections) to refer to visually distinct forms of one rock type. For example, the setts in one street might all be granite, but more than one variant can be present (e.g. massive grey granite and pink foliated granite).

The terms *rock* and *stone* to some extent are interchangeable, but in general the term *stone* is used here to refer to rock that is quarried for use in the built environment.

### 3 Terms used to describe setted streets

The terms used to refer to the constructed elements of a setted street and features that contribute to its visual style are introduced below (in italics) and used throughout the remainder of this report.

A typical setted street consists of four layers:

- a *surface course*, which includes the setts;
- a *bedding course* (into which the setts are laid), which can be aggregate and/or mortar;
- a *base*, which usually will be macadam or aggregate with a mortar of cement or bitumen;
- a *sub-base*, which usually will be a granular material with a mortar of cement or bitumen.

The surface course, which is the only visible layer in a finished street, forms the main subject of this report. The composition and character of the other layers is determined mainly by engineering considerations (which are beyond the scope of this report). A new setted street typically is laid in *panels* – discrete, relatively small sections, the first of which is completed before the next is begun – to maximise stability (and therefore durability) of the setts and layers.

The visual ‘style’ of a setted street is determined by the surface layer, which includes the following features.

- The *setts*, which are characterised by the *material* (stone) used to form them, their *dimensions* (width, length, aspect ratio [i.e. length:width] and depth), and their *finish* (i.e. the character of their surfaces – sawn, cropped, textured etc).
- The *laying pattern* of the setts. Relevant terminology refers to the geometrical relationship between setts (e.g. *stretcher bond*, *herringbone bond*) and the uniformity of row width (e.g. *regular gauged width* [all rows are the same width] and *multiple gauged width* [width varies from row to row]). In the latter case, there usually is a limited number of widths, for example 90 mm, 95 mm and 100 mm.
- The *joints* (spaces between the setts), which are characterised by their width (*joint width*) and by the material used to fill them (*joint filling*).
- The *surface profile* of the street (e.g. flat or cambered crossfall, and flat or inclined longitudinal profile).
- Whether or not a *kerb* (and therefore pavement) is present; the kerb can be considered part of the setted street, so the material, dimensions, finish and prominence (height above the street surface) of the kerb stone contribute to the street style.
- Whether or not a *channel* is present; the channel can be considered part of the setted street, so the material, dimensions, finish and shape (e.g. flat or dished) of the channel stone contribute to the street style.

Photographs to illustrate some of the typical features of traditional setts are presented in Figure 1 and Figure 2.

## 4 Traditional setted streets: styles and materials

### 4.1 INTRODUCTION

*Setts in the City* (EWHT, 2004), an unpublished report describing the outcomes of a project that set out to “investigate Edinburgh’s setted road surfaces and associated kerbs and details to identify those factors that most contribute to the unique character and local ‘Sense of Place’ ...”, is probably the most detailed and comprehensive modern review of setted streets in Edinburgh. The work included a survey of all the major setted streets within Edinburgh World Heritage Site, and production of a photographic record of setted surfaces. According to the report: “Since 1986 there has been a list of [about 387] protected setted streets in Edinburgh ... of which about 174 lie wholly or partly within the World Heritage Site”. The major setted streets examined as part of the survey amounted to fewer than half of the 174 protected setted streets within Edinburgh World Heritage Site. However, the unexamined streets had only small sections of setted carriageway or were back lanes or similar. The survey also drew on *Edinburgh World Heritage Site Streetscape Survey 1999*, an unpublished document produced by EWHT.

Most of the information presented below is a summary, in the form of bulleted lists, of the key observations, conclusions and recommendations contained in *Setts in the City*. In most cases, the relevant passages in that report have been re-worded to some extent before being incorporated in the lists, but every effort has been made to retain the original meaning. Some additional information, based on observations made for the present study, is added in places to expand upon a particular point or fill a gap.

### 4.2 SETT DIMENSIONS AND FINISH

- Sett size varies from street to street and within discrete sections of road.
- In general, later setts are more uniform in size than earlier setts.
- Most setts are between 120 and 140 mm wide, but sett width ranges from roughly 60 to 160 mm.
- Setts in later or more prestigious streets tend to be wider and of a standard width, though there are many exceptions.
- Locally sourced, traditional Edinburgh setts were relatively long in proportion to their width, the largest being 3 to 3.5 times longer than they are wide.
- Some imported setts (brought to Edinburgh from other parts of Scotland), which began to appear in the second half of the nineteenth century, had smaller length to width ratios, of as little as 1.5 to 1. However, most granite setts (all of which were brought to Edinburgh from other parts of Scotland) continued to be of ‘traditional’ proportions.
- Measurements of salvaged setts suggest traditional setts typically had a depth of around 175 mm. Shorter, later setts often seem to be 10-15 mm shallower than earlier, longer setts.
- Earlier setts had a ‘rough-hewn’ top surface (still visible in, for example, the less worn parts of the western end of Regent Terrace). Over time, setts were finished with increasing precision and with smoother, flatter top surfaces. Many later, less trafficked, road surfaces still show evidence of a picked or droved finish to the setts.

### 4.3 SETT MATERIALS

- Virtually all the traditional setts in Edinburgh are formed of just three rock types – basalt, dolerite and granite.

- The basalt typically is very dark grey to black, very fine grained and has a plain, uniform texture. It was quarried in many places locally, including quarries to the north of Salisbury Crags, and probably was used only on the earliest New Town streets to be setted. Compared to dolerite, the basalt seems to have been relatively difficult to work with, being prone to breaking off in flakes when worked; consequently, basalt setts may have been more expensive than dolerite setts. Today, basalt setts are the least common of the three, and were recorded on just a handful of streets – notably Great King Street, Northumberland Street and Regents Terrace – which generally lie outside the central part of the World Heritage Site. Great King Street and Northumberland Street, built around 1820, are paved in basalt and may represent some of the oldest surviving examples of setted surfaces in central Edinburgh.
- The dolerite typically is dark grey to mid grey, medium-grained, and usually has uniform colour and texture (dolerite from some sources can have red or ochre ‘hints’, and some dolerites are reddish or brownish, but these have not been used commonly in Edinburgh). It is clear from the surviving setted streets that dolerite has always been used in greater quantity than other stones to form setts. It was used in the earliest periods of Edinburgh New Town expansion, and subsequently through to the twentieth century. With basalt, it was quarried from local sources from at least the early nineteenth century, and was won from an ever-increasing number of quarries as the century progressed. In a 1905 survey of quarries, 18 working quarries producing basalt and/or dolerite were recorded in Midlothian alone. Today, dolerite setts are by far the most common and most widespread of the three, and form the carriageway surface of numerous streets throughout the World Heritage Site.
- Edinburgh does not have a local source of granite (or granite-like rock), so the earliest setted streets were not formed of granite setts. From the mid-nineteenth century (essentially coincident with the rapid expansion of the rail network) granite setts were imported from different parts of Scotland; known sources include Aberdeenshire (Corrennie and Kemnay quarries), Dumfries-shire (Dalbeattie and Creetown quarries), and Argyllshire (Bonawe quarries). As a result, granite setts display a range of characteristics: those from Aberdeenshire can be foliated, and they can be grey (e.g. Kemnay) or pink (e.g. Corrennie); those from Dumfries-shire and Argyllshire are massive and typically grey. In some instances, granite setts would have been selected as the material of choice for newly laid-out streets (e.g. East Market Street, constructed around 1870), but most granite-setted streets probably represent repaving schemes, where granite setts were used to replace earlier basalt or dolerite setts. Today, granite setts are a major component of several streets in the central part of Edinburgh World Heritage Site, including St Colme Street (the western extension of Queen Street), Thistle Street, George Street, Lawnmarket, High Street, Market Street and St Mary’s Street.
- There is no evidence that stone from more than one quarry was used to create new streets or new street panels (i.e. there was no deliberate mixing of stones to achieve a particular aesthetic style). Two or more rock types, or variants of a single rock type, tend to appear only where new or recycled setts have been used to repair a setted street.

#### 4.4 LAYING

- There is little or no evidence for a consistent policy in the laying of setts.

- The earliest setts apparently were laid on any available firm base (even directly onto soil) and joints were filled with any loose material available, although stone chips, gravel and/or sand seem to have been most commonly used and most satisfactory.
- Laying typically involved the following steps:
  - the setts were sorted by width, since uniform width in any row is critical unless the carriageway curves (in gently curving sections, skilled layers accommodated the bend by laying narrower setts on the inside and wider setts on the outside);
  - after sorting, setts were bedded into a layer of crushed stone or gravel, with their long axis at right angles to the direction of travel (for a time, some parties advocated long herringbone rows on gradients to aid drainage and grip);
  - after laying, the joints were filled, typically by brushing-in whin sand, gravel, finely crushed rock or (least effectively) plain coarse sand.

#### 4.5 KERBS & CHANNELS

- Since at least the eighteenth century, Edinburgh has consistently used ‘whinstone’ (overwhelmingly dolerite) to form kerbs and channels. The high quality of this building stone means that much of the original stone used to form kerbs and channels is still in place today (including nearly every carriageway in Edinburgh World Heritage Site). Basalt forms a very small proportion of all kerbing, but the central part of the World Heritage site has a few substantial areas of granite kerbing (e.g. Princes Street).
- Traditional kerbing stone has fairly standard dimensions: 125-150 mm wide and 250 mm high, with an exposed kerb face of 100-125 mm.
- During the twentieth century, granite kerbs were installed in a few of the more prestigious or busy streets. These are often double the width of normal kerbs, being roughly 250 mm wide on their top surface.
- Many streets have dished channels running alongside the kerb. Such channels may be particularly associated with streets that, in the past, had stone macadam surfacing, although this is far from clear. Channel and special details are historically important but they are not sufficiently common to be considered universal and therefore should not be seen as important elements in defining the unique historic character of Edinburgh streets.

#### 4.6 RECOMMENDATIONS (FROM *SETTS IN THE CITY*) FOR RETAINING AND PROTECTING SETTED STREETS

##### 4.6.1 General recommendations

- Streets should be laid-out with a central carriageway, paved with setts and bounded by kerbs with simple paved footways and a minimum of ‘clutter’.
- In the New Town, the pattern of laying-out streets geometrically with kerb lines parallel to building lines should be preserved.
- Setts should be laid at right angles to the direction of the street in a *stretcher bond*<sup>1</sup> pattern. They may or may not have channels or special detail at their edge adjacent to the kerb.

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<sup>1</sup> This is sometimes referred to as a *running bond*, *half bond*, or *brick pattern*.

- Sett width should be within the range 90-140 mm, though the variation within a single street should be less than this. In general, full-size setts should be approximately 2.5 to 3.5 times longer than they are wide.
- The number of sawn surfaces should be kept to a minimum on new setts. Where setts are supplied with two opposing sides sawn, the sawn surfaces should be used to form the top and bottom surfaces of the laid setts.
- Sawn top surfaces should be tooled to roughen the surface.
- New work should be carried out with new (rather than re-used) setts. Setts that are replaced or otherwise recovered should be retained to use in repairs.
- New setts ideally should be from an indigenous Scottish source producing the same, or similar-looking, stone as the original stone. Where this is impossible or presents great financial difficulties then alien stone of an exact visual and petrological match (as determined by BS EN 12407:2000 'Natural stone test methods – Petrographic examination) may be acceptable.
- Dolerite should be used to form new kerbs. New kerbs should be approximately 150 mm wide and 300 mm deep, with an exposed face of 150 mm. Broader kerbs and kerbs formed of granite can be considered in the most prestigious and major streets, such as those in the southern part of the First New Town.
- Channels adjacent to kerbs should be retained and protected for their historic value. Where they do not already exist, they should only be introduced for sound engineering or practical reasons.

#### **4.6.2 Protecting existing surfaces**

- Historic surfaces should be retained and any repair work or new work within such an area should seek to match the materials, module and laying practice of the original. In particular, where it is necessary to lift or relay a section of setted carriageway, it should be re-laid with setts of the same stone type, size and colour as the original setts.
- Joints should be filled, as far as is technically feasible, to match the joints in the surrounding area. For example, if the surrounding area has loose fill in the joints the joints of the re-laid section should also have loose fill. Where joints are to be refilled with mortar, great care should be taken to leave the surface of the setts completely mortar free.
- Where historic elements such as channels, string courses or special features exist, they should be retained and any repair should match the existing materials, module and construction.

#### **4.6.3 New surfaces**

- Dolerite (or a similar dark, cool grey stone) should be used to form new setted surfaces within the 'outer cordon' of the World Heritage site.
- Grey stone of a cool or neutral tone, which is as similar as possible to native stone already used for setts in the area, should be used to form new setted surfaces within the 'inner cordon' of the World Heritage site. Warm grey or other 'warm' colours are considered inappropriate.
- The palette of colours should be restricted to the variation provided by a single stone (i.e. a mix of different stones should not be used).



**Figure 1 Typical character of a traditional setted street in Edinburgh**

Both images show roughly shaped dolerite setts (top wet, bottom dry) at the east end of Boyds Entry (a lane off St Mary's Street in the Old Town). Note the variation in colour (light grey to dark grey) and the high length:width ratio of many setts. Units on scale bar are 1 cm.



**Figure 2 Typical character of a traditional setted street in Edinburgh**

Top image shows roughly shaped dolerite setts at the lower end of Cranston Street. One sett is badly cracked (possibly because the rock has been weakened by chemical alteration as evidence by the patches of pink colouration) and another is cut by two thin black lines (these are a common feature in some Edinburgh dolerite and probably are very thin basalt dykes). Units on the scale bar are 1 cm. Bottom image shows a panel of granite setts on Cranston Street. The setts are cropped on all sides (with ‘rough-hewn’ top surfaces) and are of regular width and varying length. The panel of granite setts was almost certainly inserted into Cranston Street later than the dolerite setts (i.e. as a repair).

## 5 Future setted streets: proposed attributes

Setted streets were created over a long period in Edinburgh, and inevitably their character changed during that time to reflect, for example, changes in availability of materials, carriageway design, and construction methods. Furthermore, some of the ‘traditional’ streets that survive today will include sections that were repaired or replaced long ago using materials and styles that did not match the original street, though this might not now be obvious. Thus, it is not possible to produce a succinct, simple definition of ‘traditional style’ that takes into account the full range of characteristics that we see today. In preparing proposals for how setted streets should be formed in future (to be ‘in keeping’ with traditional ones), we have identified a set of ‘key attributes’ and a range of ‘flexibilities’ (Table 2). The key attributes are those features we consider to be most typical of the traditional style, and which should be employed whenever it is possible and practicable to do so. The ‘flexibilities’ allow other materials or styles, which are less typical but still broadly ‘in keeping’, to be employed when it is not possible or not practicable to use a key attribute. These proposals are based on EWHT (2004), as described in section 4 of this report, and our own observations.

From section 4 it is clear that traditional setted streets in Edinburgh display a uniformity of character at a general level (e.g. a very restricted range of rock types, and a consistent laying pattern) but in detail display a modest degree of variability (e.g. sett size typically varies from street to street). The list of proposed attributes in Table 2 attempts to replicate these characteristics while recognising that some compromises will be necessary to meet modern standards of engineering, design and cost-effectiveness.

The proposals in Table 3 relate primarily to newly created areas of setted street. Any repair to an existing street in general should seek to replicate the materials, character and style of the original setts in areas adjacent to the repair.

**Table 2 Proposed attributes of new setted streets in Edinburgh**

Features		Key attributes	Flexibilities
Setts	Material	<p>Mid grey to dark grey, massive dolerite and grey or pink, massive or foliated granite should be the only rock types used to form setts.</p> <p>Setts should be sourced from the same Scottish quarries as the traditional setts (or other Scottish quarries that produce similar-looking stone).</p> <p>Most new setted streets should use dolerite setts (to maintain the relative proportions of dolerite and granite displayed in traditional streets).</p> <p>Dolerite setts should be used to form principal streets, junctions, side streets and lanes in all parts of the city.</p> <p>Some new setted streets should use granite setts (to maintain the relative proportions of dolerite and granite displayed in traditional streets).</p> <p>Granite setts should be used primarily to form principal streets and important junctions in the central part of the World Heritage site.</p> <p>In any one street or panel, the setts should be of broadly consistent geological character (i.e. the variation in rock colour, rock composition and rock texture should be limited to that in the stone produced at the source quarry); two or more stone types, or variants of a stone type, should not be incorporated in one street or panel.</p>	<p>Basalt setts can be used occasionally to maintain the relative proportions of dolerite, granite and basalt displayed in traditional streets. However, basalt may be less robust than dolerite and visually is similar to dolerite, so arguably it is not essential.</p> <p>Imported setts of dolerite and granite that are a good match (in terms of stone character, dimensions, finish and performance) for Scottish stone in traditional Edinburgh setts can be used instead of Scottish stone, if the latter is not available or is significantly more expensive. (But see comment in section 5 about why it would be preferable in future to use the same Scottish stone that was used historically, instead of imported stone).</p> <p>Granite setts can be used sparingly to form side streets and lanes in any part of the city if there is a compelling design-led reason for doing so (e.g. to be visually in-keeping with surroundings, or to improve the visibility of a safety feature).</p>
	Dimensions	<p>Setts should be between 120 and 140 mm wide, and full-size setts should be 2.5 to 3.5 times as long as they are wide.</p> <p>Sett dimensions (width and/or length) should vary from street to street (to maintain the variability in character displayed in traditional streets).</p> <p>Sett depth should be around 175 mm.</p>	<p>In a minority of cases, sett width can be as little as 60 mm or as much as 160 mm (ideally, there should be a good design-based reason for this).</p> <p>Sett depth can be larger or smaller than 175 mm if there is a compelling engineering-based reason (e.g. to reduce the possibility of sett displacement in areas subject to unusually heavy traffic).</p>
	Finish	<p>All side surfaces should be cropped.</p> <p>Only the top and bottom surfaces can be sawn.</p> <p>A finish appropriate to traffic safety considerations (e.g. flame textured<sup>2</sup> to improve slip resistance) can be applied to the top surface<sup>3</sup>, but should not significantly change the visual character of the carriageway surface.</p>	None

<sup>2</sup> 'Flame-textured' refers to a regular, textured (roughened) finish to sett surfaces achieved by subjecting the stone surface briefly to intense heat ('flaming') so that small fragments spall.

<sup>3</sup> Textured surfaces probably form stronger bonds with joint fillings and bedding substrates, so it may be beneficial for the bottom surface to have a textured finish too.

Features		Key attributes	Flexibilities
Laying pattern		<p>Setts should be laid in a stretcher bond pattern, with rows at right angles to the direction of the street.</p> <p>The pattern should not be uniform (nor should it be too variable): in individual rows, setts should be of even width but varying length (while maintaining the stretcher bond character); and adjacent rows should be, to some extent, of different width (i.e. multiple gauge width).</p>	<p>Patterns incorporating a single gauge width or setts of uniform dimensions can be used sparingly if there is a good design-based reason for doing so.</p> <p>Herringbone bond can be used sparingly if there is a good engineering-based reason for doing so (herringbone bond has higher interlocking strength than stretcher bond, so may be a more durable [cost-effective] laying pattern in areas likely to be subjected to unusually heavy loading).</p>
Joints	Filling material	The filling material will depend on the engineering design. There is no requirement to replicate traditional materials, though the filling colour should not clash with, or detract from, the overall colour and visual character produced by the setts.	None
	Width	Joint width will depend on the engineering design, though in general it is expected that joint width will not exceed 20 mm and will be the same (within an acceptable tolerance range) on all sides of a sett.	None
Kerbs		<p>Most new setted streets should include kerbs formed of blocks 125-150 mm wide and 250 mm high of locally sourced, mid grey to dark grey, massive dolerite.</p> <p>The exposed face of each kerb should be 100-125 mm high.</p>	<p>New streets formed of granite setts can include kerbs formed of granite. These should normally be wider than (up to double the width of) normal kerbs (i.e. the top surface can be up to c.250 mm wide).</p> <p>Imported blocks of dolerite and granite that are a good match (in terms of stone character, dimensions, finish and performance) for Scottish stone in traditional Edinburgh kerbs could be used instead of Scottish stone, if the latter is not available or is significantly more expensive (but see comment in section 5 about the benefits of using Scottish stone).</p> <p>The exposed face of a kerb can be a different height or shape (e.g. tapered) if there is a good design-based reason for doing so.</p>
Channels		New setted streets can include channels formed of blocks roughly 300 mm wide of locally sourced, mid grey to dark grey, massive dolerite.	<p>New streets formed of granite setts can include channels formed of granite.</p> <p>Imported blocks of dolerite and granite that are a good match (in terms of stone character, dimensions, finish and performance) for Scottish stone in traditional Edinburgh channels could be used instead of Scottish stone, if the latter is not available or is significantly more expensive (but see comment in section 5 about the benefits of using Scottish stone).</p> <p>Different channel shapes (e.g. flat or dished) can be used.</p>

## 6 Recently created setted streets: character

Five examples of recently created (up to 15 years old) areas of setted street in central Edinburgh were examined for this project, and aspects of their character and performance were recorded. The character of the street at each site is described in Table 3 and illustrated in figures 3 to 7. Key observations are summarised below. Comments on performance of the recently setted areas are presented in section 7.

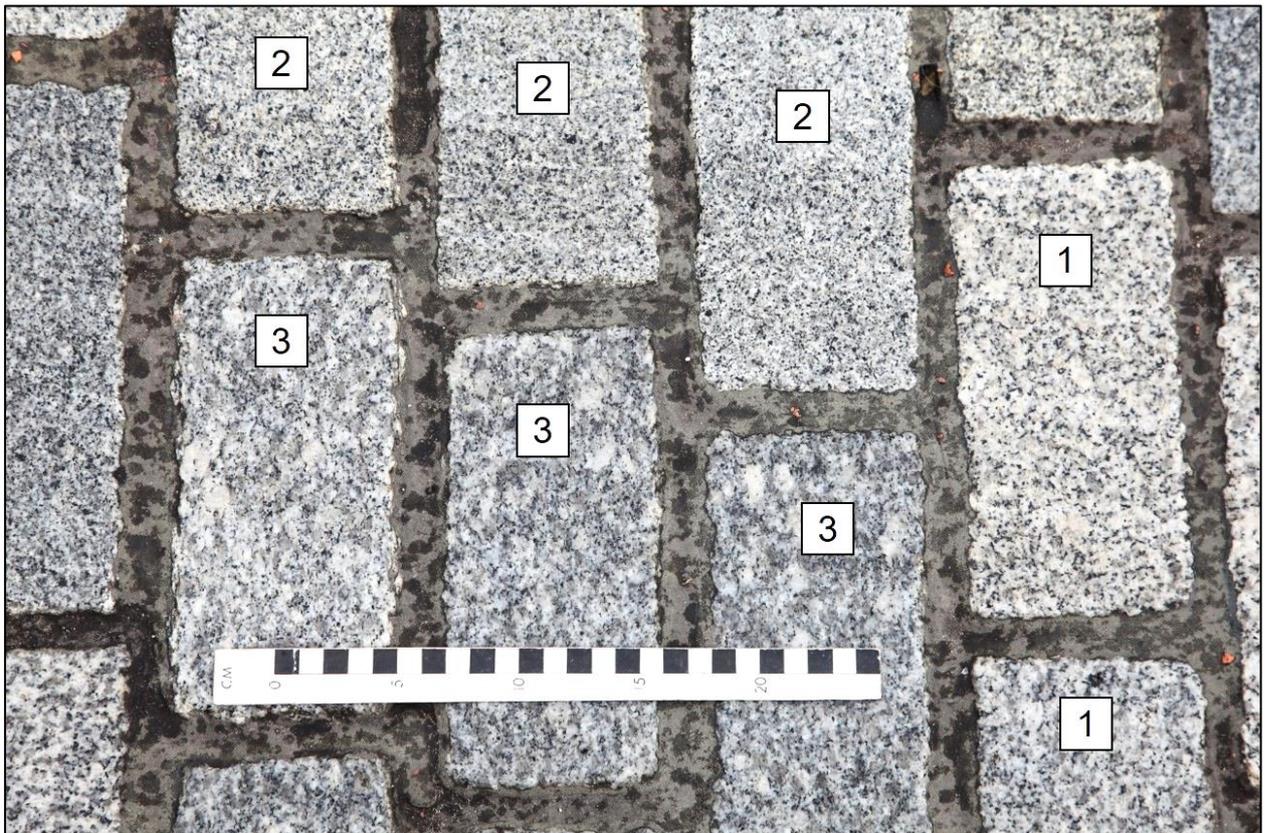
**Table 3 Summary of carriageway character in areas of recently created setted street**

Location	Setts			Joints		Laying pattern	Comment
	Material	Dimensions*	Finish	Filling	Width		
Junction of George IV Bridge and Royal Mile	Three variants: <i>Light grey, massive granite</i> <i>Mid grey, massive microgranite</i> <i>Dark grey, weakly augen-textured, foliated granite</i> The three are in roughly equal proportions, and distributed randomly.	93 mm wide 170-220 mm long Average aspect ratio is roughly 2:1.	All sides cropped. Top surface is flat and slightly rough (flame-textured?).	'Sika Trojan joint filling grout' (resin-based, without obvious aggregate, mid to dark grey, slightly soft).	20 mm on all sides.	The junction is divided into four panels that meet at the central point. Each panel is stretcher bond with rows at 45° to the direction of arriving traffic, and at 90° to setts in adjacent panels. All rows are of essentially identical width.	Very heavily trafficked ** Consistent sett size produces a uniform character. Dolerite blocks 780 x 300 mm in plan form kerbs 150 mm high and dished channels 300 mm wide. Three rows of kerb-parallel granite setts separate the main sett panels from the channels. Dolerite blocks bound the edge of the re-laid carriageway; presumably partly design (visual contrast) and partly function (preventing setts from becoming dislocated).
Junction of South Bridge / North Bridge and Royal Mile	Three variants: <i>Light to mid grey, massive microgranite</i> <i>Red, feldspar-phyric granite</i> <i>Greenish and pinkish grey, massive granite</i> The three are in roughly equal proportions, and distributed randomly.	100 mm wide 200 mm long Average aspect ratio is roughly 2:1.	All sides sawn. Top surface is slightly rough but distinctly curved / rounded.	Probably resin-based with aggregate of pink gravel and sand.	Somewhat variable, typically 10-15 mm.	Essentially the same as at the junction of George IV Bridge and Royal Mile (see above).	Very heavily trafficked. The design and materials used to separate the main sett panels and adjacent pavements are essentially the same as at the junction of George IV Bridge and Royal Mile (see above).

Location	Setts			Joints		Laying pattern	Comment
	Material	Dimensions*	Finish	Filling	Width		
St John Street at junction with Holyrood Road	Three variants: <i>Light grey massive granite</i> <i>Dark grey massive granite</i> <i>Greenish grey, massive granite</i>	150 mm wide 260-370 mm long Average aspect ratio is roughly 2:1.	All sides sawn. Top surface is flat and moderately rough.	Cementitious mortar with aggregate of sand. Pale grey when dry, dark grey when wet.	Very regular, 12 mm on all sides.	Regular stretcher bond at right angles to direction of travel. All rows are of essentially identical width. The same three variants laid in a herringbone bond pattern have been used in the middle part of St John Street, and on adjacent side streets.	Moderately trafficked. The three granite variants are closely similar and may have come from the same source. Compared to the light grey variant: dark grey has more dark minerals and greenish grey is more altered (epidote has replaced feldspar). A kerb of dolerite is separated from the main sett panel by a 'channel' of one row of granite setts laid at right angles to the kerb.
Top end of New Street (~50 metres of roadway leading to the junction with Royal Mile)	Two variants: <i>Light to mid grey, weakly feldspar-phyric, massive granite</i> <i>Yellowish mid grey, locally weakly foliated, microgranite</i> The two are in roughly equal proportions, and distributed randomly.	90-110 mm wide 190-250 mm long Average aspect ratio is roughly 2.2:1.	All sides cropped. Top surface is flat but quite rough (possibly sawn then flamed).	Cementitious mortar, with aggregate of sand and gravel. Light grey when dry, dark grey when wet.	Very regular, ~15 mm on all sides.	Regular stretcher bond at right angles to direction of travel. Sett width in any one row is consistent but adjacent rows are of slightly varying width.	Moderately trafficked. Kerbs 300 mm wide and typically 800 mm long of mid grey dolerite with a rough-textured surface rise 20-70 mm above the setts. Flat (not dished) channels of mid-grey dolerite blocks 300 mm wide and typically 800 mm long (same stone as kerbs) dip gently towards the kerbs.
Waverley Bridge (~30 metres of new setted street, and two c. 4x4 metre side streets leading off Waverley Bridge to the station)	Two variants: <i>Mid grey feldspar-phyric, massive granite</i> <i>Light grey, locally pegmatitic and locally foliated granite</i> The two are in roughly equal proportions, and distributed randomly.	95-120 mm wide 170-230 mm long Average aspect ratio is roughly 2:1.	All sides sawn. Top surface is flat but quite textured / rough.	Cementitious mortar, with aggregate of coarse sand.	Very regular, ~15 mm on all sides.	Regular stretcher bond at right angles to direction of travel. Sett width in any one row is consistent but adjacent rows are of slightly varying width.	Heavily trafficked (street) and lightly trafficked (side streets). Kerbs 290-300 mm wide of dark grey dolerite rise 0-110 mm above the setts. Dolerite blocks bound the edge of the carriageway; presumably partly design (visual contrast) and partly function (preventing setts from becoming dislocated).

\* Does not include setts cut to meet edges or maintain the geometric character of the laying pattern.

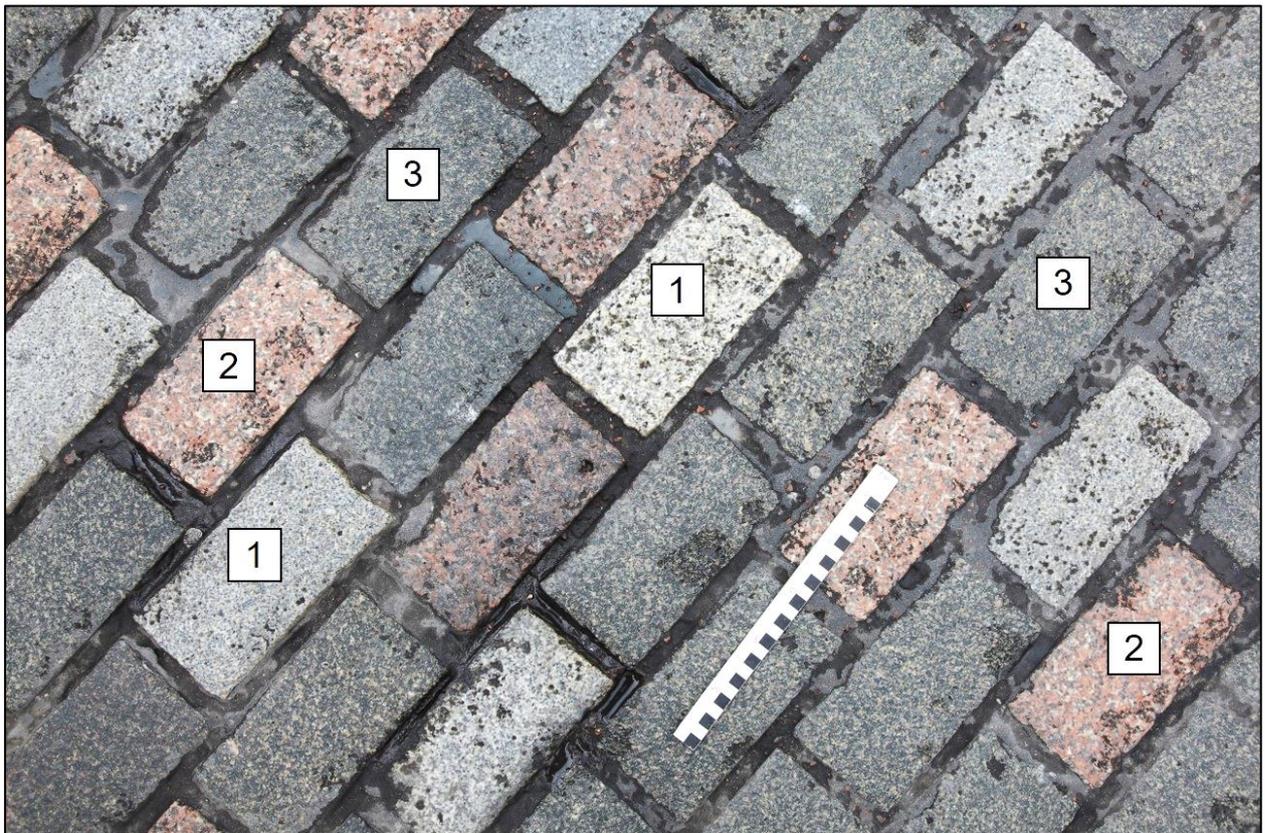
\*\* Terms such as *very heavily trafficked* and *lightly trafficked* are subjective and based on a brief assessment of vehicular and pedestrian traffic at the time each site was visited.



**Figure 3 Modern setted street at junction of George IV Bridge / Bank Street and Royal Mile**

Top: looking west across the junction.

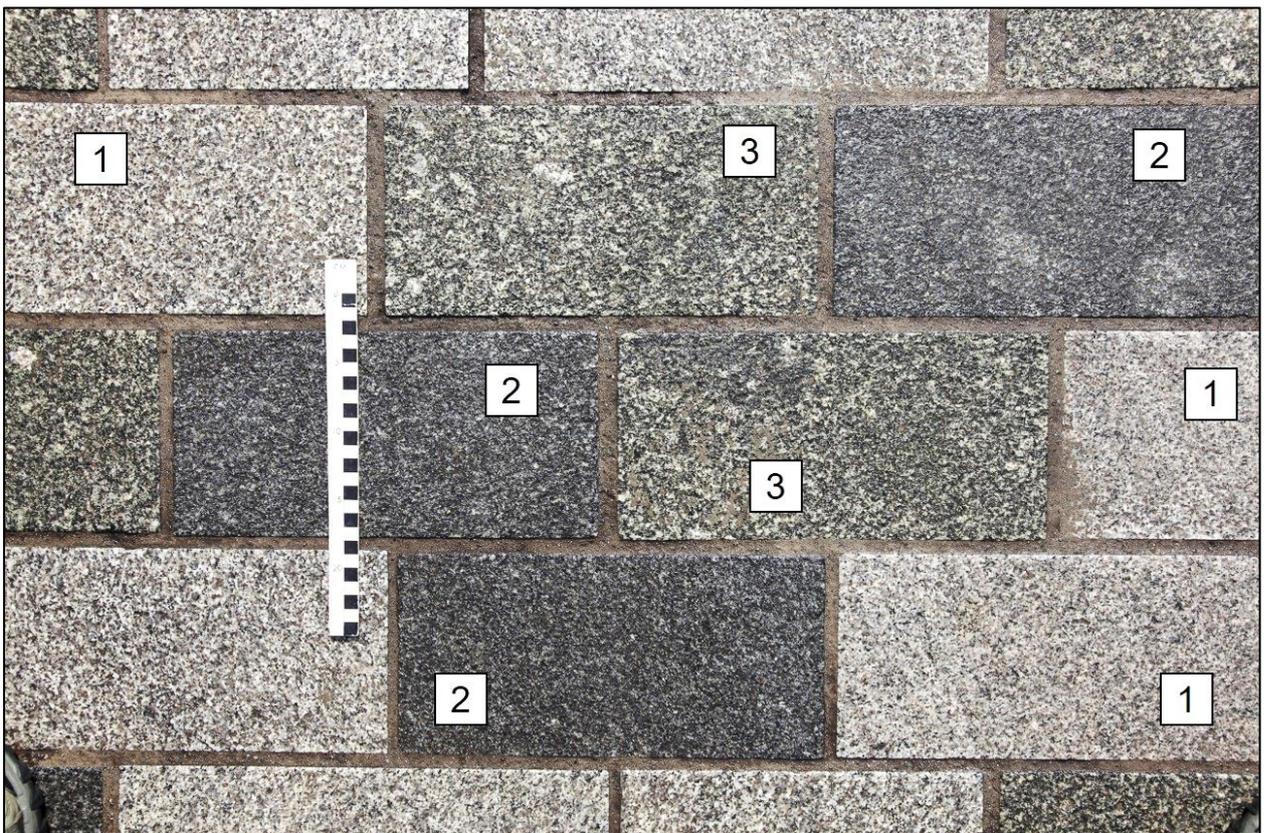
Bottom: typical character of setts. 1 = light grey, massive granite; 2 = mid grey, massive microgranite; 3 = dark grey, weakly augen-textured, foliated granite. Units on scale bar are 1 cm.



**Figure 4 Modern setted street at junction of North Bridge / South Bridge and Royal Mile**

Top: looking east across the junction.

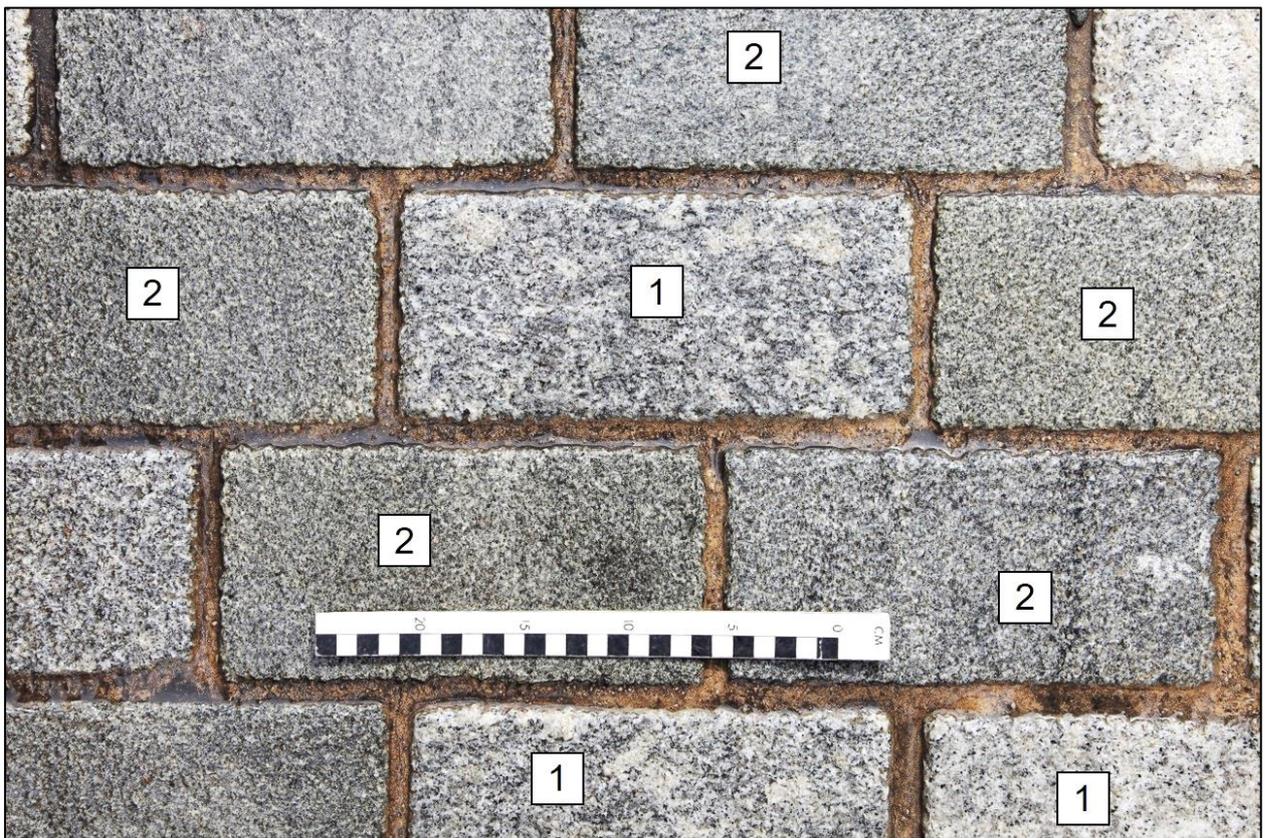
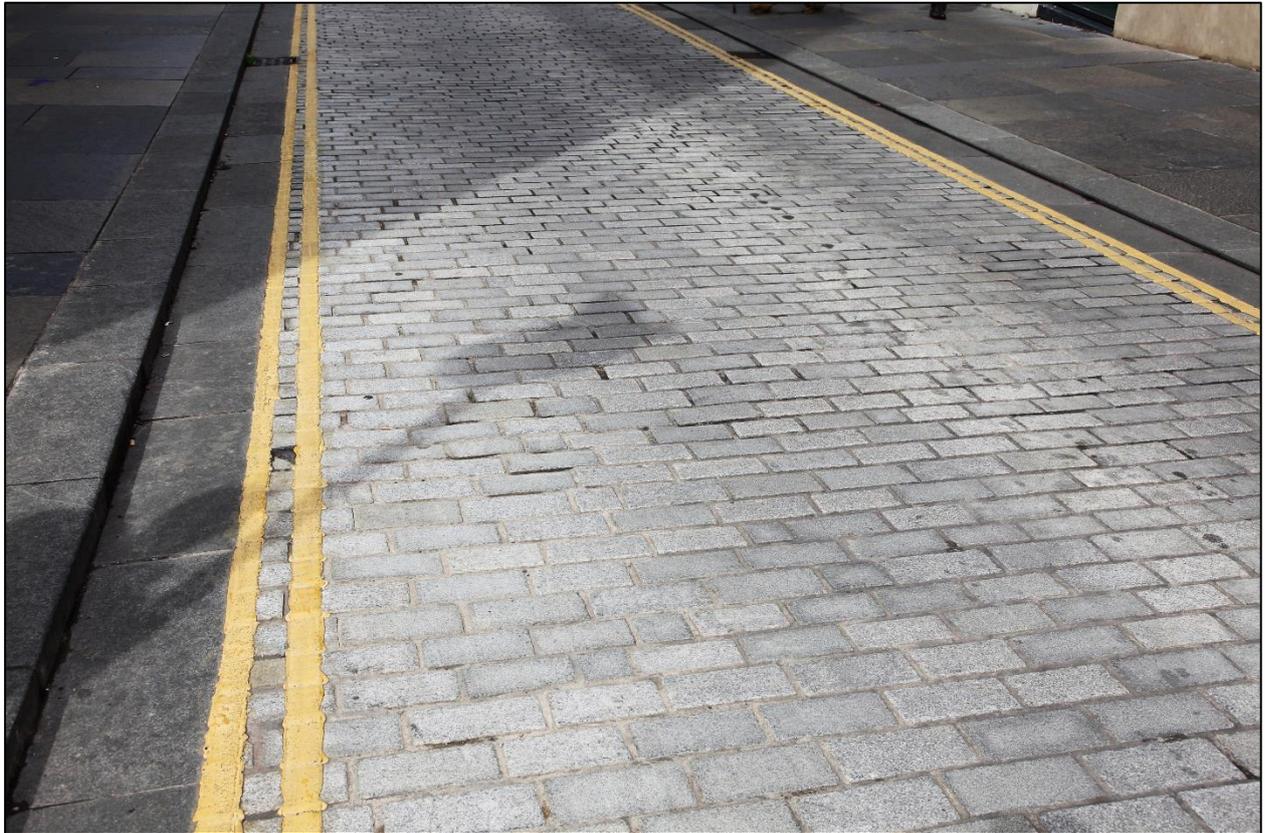
Bottom: typical character of setts. 1 = light to mid grey, massive microgranite; 2 = red, feldspar-porphyritic granite; 3 = greenish and pinkish grey granitic-rock. Units on scale bar are 1 cm.



**Figure 5 Modern setted street at junction of St John Street and Holyrood Road**

Top: looking east across the junction.

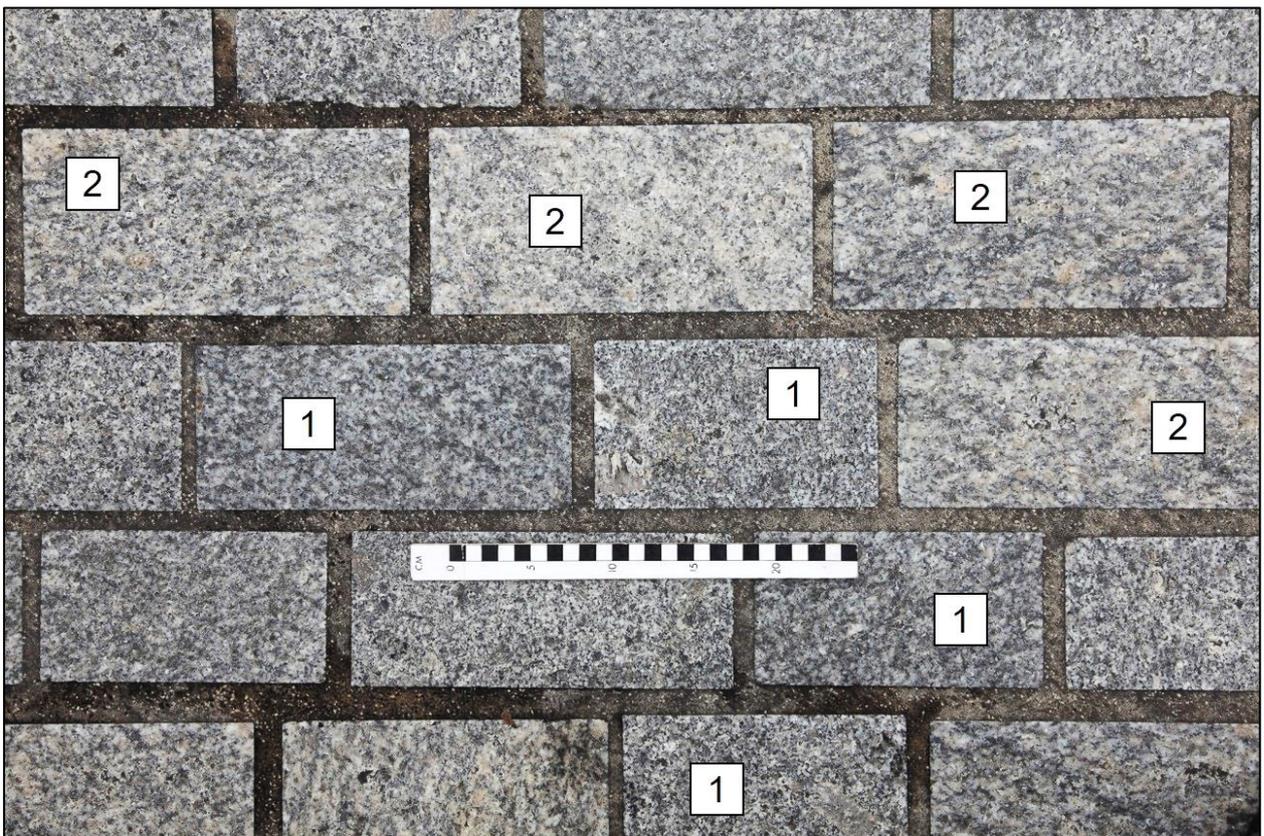
Bottom: typical character of setts. Sawn blocks of [1] light grey granite, [2] dark grey granite and [3] greenish grey granite are distributed randomly. Units on scale bar are 1 cm.



**Figure 6 Modern setted street at junction of New Street and Royal Mile**

Top: looking north along New Street from Royal Mile.

Bottom: typical character of setts. 1 = light to mid grey, locally feldspar-porphyritic granite; 2 = mid grey (slightly yellowish), locally weakly foliated, microgranite. Units on scale bar are 1 cm.



**Figure 7 Modern setted street on Waverley Bridge**

Top: looking southeast across a typical area of modern setts.

Bottom: typical character of setts. 1 = mid grey granite with pink phenocrysts of alkali-feldspar; 2 = light grey, locally pegmatitic and locally foliated granite. Units on scale bar are 1 cm.

This is a small sample of the recently created setted streets in Edinburgh, so is unlikely to be wholly representative; nevertheless, it is considered to provide a reasonable insight to the character of recently created areas of setted street in central Edinburgh.

The following observations (based on the descriptions presented in Table 3) can be made.

- In all cases, granite setts have been used to form the carriageway surface. Dolerite has been used in some cases to form kerbstones and channels. No other rock types are used.
- At each site, two or three granite variants have been used (i.e. in no case has just one granite variant been used).
- Different granite variants have been used at each site (i.e. up to twelve different granite variants are represented at the five sites).
- In all cases, setts formed of the different granite variants have been used in roughly equal proportions and are distributed randomly in the carriageway.
- Much of the granite has a character that is broadly similar (though not identical) to the Scottish granite used in traditional setts (in terms of colour and mineral-textural features). However, some does not: notably rock that has a greenish or yellowish tinge.
- Setts of different dimensions (length and width) have been used at each site. Taking all sites together, sett width ranges from 90 to 150 mm and sett length ranges from 170 to 370 mm (shorter lengths have been used in places to maintain the stretcher bond pattern). In most cases, the average aspect ratio (length:width) of setts is approximately 2:1.
- Setts of consistent length have been used at just one site; at all other sites setts of varying length have been used.
- Setts of consistent width have been used at three sites; this means sett rows at these sites are of consistent width (single gauge width), producing a regular pattern. At two sites, setts of varying width have been used (though the setts in any one row are of consistent width); this means sett rows are of inconsistent width (multiple gauge width), producing a somewhat irregular pattern.
- Sett 'finish' is variable; in two cases setts have cropped sides and in three cases the sides are sawn. In four cases the top surface is flat and slightly to moderately rough (textured, possibly involving a flame finish), and in one case the top surface is distinctly curved / rounded (unclear if this is due to wear or design).
- The joint filling material is variable. In two cases, a resin-based filling has been used; in one of these there appears to be no aggregate, and in the other one there is an aggregate of pink gravel and sand. In three cases, a cementitious mortar has been used with an aggregate of sand ± gravel. The resin-based fillings have been used in very heavily trafficked carriageways whereas the cementitious fillings have been used in moderately trafficked to lightly trafficked carriageways; it is unclear whether or not this is deliberate.
- Joint width generally is consistent at any one site but varies between sites, from 10 to 20 mm. There appears to be no consistent relationship between joint width and either joint filling (resin-based vs cementitious) or sett finish (cropped vs sawn).
- The same laying pattern – regular stretcher bond – is used at all sites (though it was noted that herringbone bond has also been used in an area adjacent to one of the sites). At major intersections (e.g. George IV Bridge and Royal Mile), sett rows generally are laid at 45° to the direction of travel, whereas on one-way or two-way streets sett rows are laid at right angles to the direction of travel.

The most obvious ways in which recently created areas of setted street (based on the five areas described earlier in this section) depart from traditional character (as described in section 4) are summarised in Table 4.

**Table 4 Comparison of the character of recently created and traditional setted streets**

Recently created streets	Traditional streets
In all cases, granite setts have been used.	Streets formed of dolerite setts are more common than streets formed of granite setts, particularly in less prestigious streets (side roads, lanes etc).
Some granite setts have a green or yellow tinge.	All granite setts are grey or pink.
In every case, a mixed palette of stones (multiple granite variants) in roughly equal proportions has been used.	Individual streets or panels are constructed using stone from a single source; stone from multiple sources (creating a 'mixed palette') was not used.
In several cases, setts with sawn sides have been used.	Setts always have cropped sides.
In some cases, all the setts (and therefore sett rows) are the same width.	In most cases, setts (and therefore sett rows) are of varying width.
Joints are filled with resin-based or cementitious material.	Joints are filled with loose sand or gravel.
In some areas, setts have been laid in a herringbone bond pattern.	Essentially all setts are laid in a stretcher bond pattern.
In all cases, channels are formed of granite setts, and not dished.	Channels are formed of dolerite, and usually dished.
In one case, the channels consist of a single row of 'normal size' setts laid parallel to adjacent setts.	Channels typically are formed of dolerite blocks that are much larger than adjacent setts and laid at right angles to them.

The following general comments can also be made.

- The exclusive use of setts formed of granite is atypical of Edinburgh's traditional setted streets (where setts formed of dolerite are more common), but strictly speaking not out of keeping. However, ensuring that some (ideally most) new streets are formed of dolerite setts would be more in-keeping with traditional proportions.
- Most of the imported granite is broadly similar to the Scottish granite that was used traditionally to form setts, and could be considered a reasonable (though not perfect) visual match; however, granite with a yellow or green tinge is not typical, and such stone should be avoided.
- There are several reasons why it would be preferable in future to use the same Scottish stone that was used historically, instead of imported stone. For example: (i) the Scottish stone naturally will provide the closest match to existing setts in terms of visual appearance and performance; (ii) the Scottish stone has a proven pedigree, whereas imported stones commonly do not (and therefore may not perform as well as expected); (iii) it might be easier to control (or influence) long-term security of supply of Scottish stone, whereas the availability and character of imported stone may change frequently and without notice; and (iv) it might be easier when dealing with local suppliers, to specify setts with features that are in-keeping with traditional style (e.g. in terms of dimensions and finish). Setts formed of dolerite are now available commercially in Scotland, and there is an opportunity to work with the recently formed Scottish Stone Group to make setts formed of Scottish granite commercially available again.

## 7 Recently created setted streets: performance

The performance of recently created areas of setted street was assessed at the five sites described in section 6 and Table 3. The main observations are summarised below.

### 7.1 JUNCTION OF GEORGE IV BRIDGE / BANK STREET AND ROYAL MILE

- Virtually all of the granite setts are intact (not broken). A small proportion are cut by thin, dark veins, which probably are formed mainly of the minerals chlorite and quartz. Most of these veins are intact, but one or two show signs of incipient parting (i.e. the sett may be near to cracking into two pieces along the vein). One sett has cracked vertically and normal to its long axis; the cause is not clear, but it may have parted along a very thin vein of chlorite and quartz.
- Many setts show signs of incipient cracking within 2–5 mm of, and parallel to, their sides (Figure 8). The cracks seem to be more common and/or better developed parallel to the long sides of setts. Natural outcrops of granite commonly display ground-parallel fractures (known as *sheet joints*), which form because the rock ‘relaxes’ (expands) as the weight of overlying rock is removed by uplift and erosion. The cracks in these granite setts may result from a similar process; i.e. the rock may have expanded slightly after being cut into setts (this might happen if the stone comes from a part of the world where the ground is experiencing geologically rapid uplift). Alternatively, the cracks may be developing as a result of physical damage incurred adjacent to cropped surfaces during cropping. Whatever their origin, the cracks are likely to lead to progressive disintegration of sett edges and development of rounded top surfaces.
- The top surfaces of setts may display signs of very minor granular disintegration. This is where abrasion is likely to be most significant, so some deterioration is to be expected. Treatments such as ‘flaming’, which are used to create a textured surface, may make the affected surface somewhat more prone to granular disintegration. Top surfaces are not obviously developing a polish (surfaces are still slightly rough).
- The resin-based joint filling in general appears to be in good condition. However, it is cracking / disintegrating locally, and in places the top surface of the filling is relatively ‘deep’ with the result that water tends to pond in (and takes longer to dry from) these places and detritus tends to gather in them. It is not clear if these areas were deeper at the time the filling was created or if the filling has worn more here. Either way, the fact that water is ponding here and detritus is gathering means these areas are now likely to wear and disintegrate more quickly than other areas.
- There are no signs of setts becoming dislocated, and the sett–filling bonds appear to be tight in most cases. However, lingering wetness along some sett–filling contacts after rain suggests incipient cracks may be developing along the contacts. Water and debris will enter any such cracks and accelerated decay can then be expected.
- Patches of orange-brown staining are developing on granite setts within a few centimetres of iron manhole covers (Figure 8). A joint with resin-based filling always separates the stained sett from the manhole cover, so the stone and the likely source of iron appear not to be in direct contact (at least at the carriageway surface). The iron staining seems to be forming where the joint fillings are deepest / most decayed. The iron might be moving by capillary action from the manhole cover to the sett across the top surface of the filling, or the transfer may be happening beneath the filling (i.e. below the

ground surface). The discolouration probably affects only the surface of the setts, and is unlikely significantly to reduce stone durability.

## **7.2 JUNCTION OF SOUTH BRIDGE / NORTH BRIDGE AND ROYAL MILE**

- Virtually all of the granite setts are intact (not broken).
- Cracks developed near to, and parallel to, sett sides (see section 7.1) are not obviously developed, but conchoidal (curved) fractures are developed locally, notably in several adjacent setts close to the west edge of the junction (Figure 9).
- The (?resin-based) joint filling is in relatively poor condition, being quite badly decayed in places and unevenly preserved (Figure 9). Rainwater tends to pond in joints where the filling is most decayed. As at the previous site (section 7.1), the fact that water is ponding here means these areas are now likely to wear and disintegrate more quickly than other areas.
- The carriageway surface has suffered subsidence locally, notably around manhole covers, and is distinctly uneven.
- There is no evidence that setts are becoming iron-stained near to manhole covers.

## **7.3 ST JOHN STREET AT JUNCTION WITH HOLYROOD ROAD**

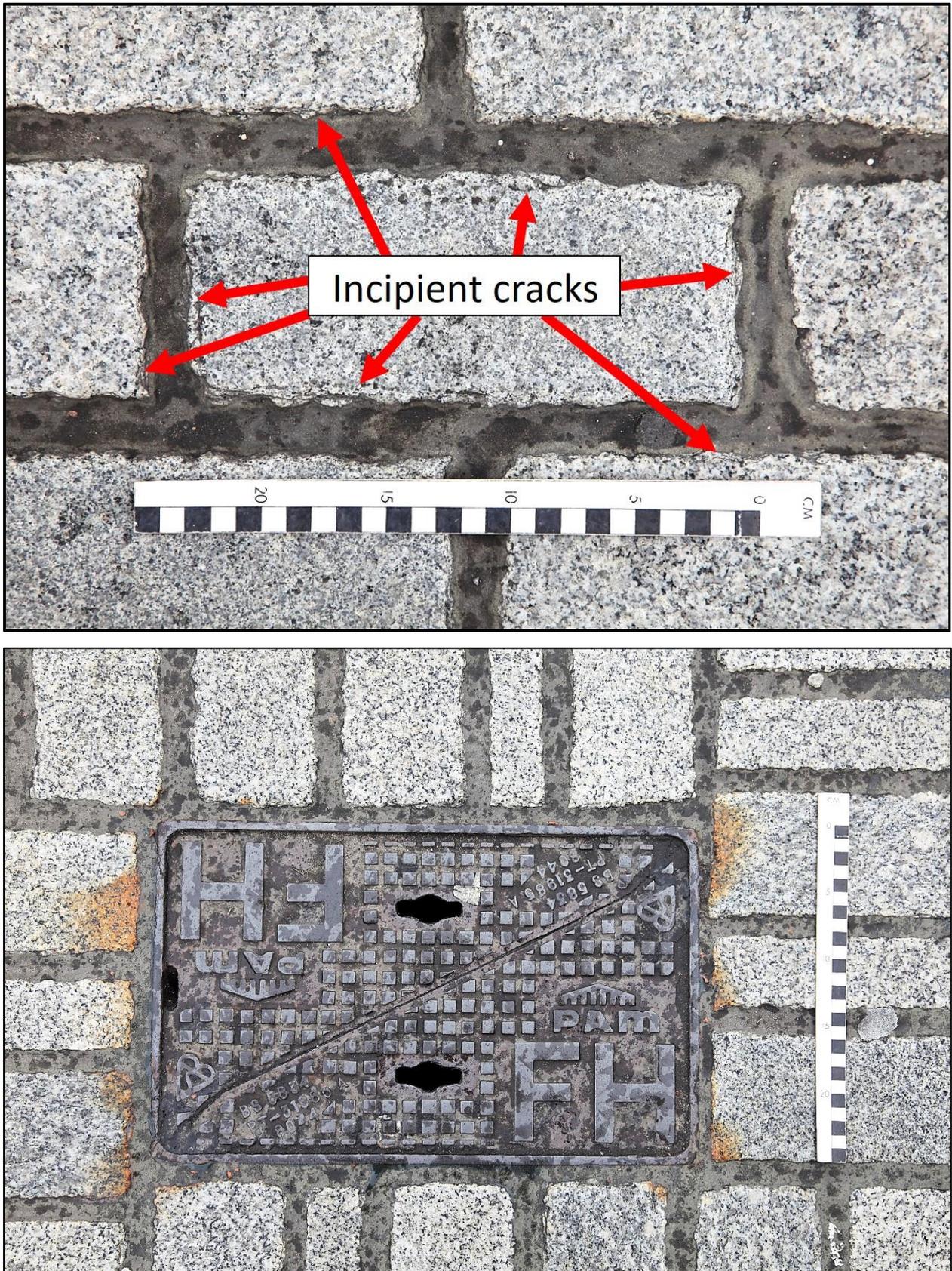
- Setts show no sign of cracking, polishing, dislocation or discolouration.
- The surface of the cementitious joint filling in places appears to be deeper than normal and stays wetter for longer after rain; the filling therefore seems to be decaying faster locally, possibly due to localised loading and accelerated wear.
- Hairline cracks along sett–filling contacts become apparent as the carriageway surface dries out after rain (Figure 10). These cracks, which are common at this site, may be due to stress as the surface is repeatedly loaded and unloaded by passing traffic, but they may also or alternatively be due to shrinkage of the cementitious mortar. The smooth, flat surfaces presented by sawn setts (such as these ones) probably produce a weaker bond with joint filling than do the irregular surfaces presented by cropped setts. Thus, sett–filling contacts in panels formed of setts with sawn sides may be more prone to cracking when subjected to loading/unloading forces or shrinkage.

## **7.4 TOP END OF NEW STREET**

Setts and joint filling appear to be in good condition, with no sign of cracking, polishing, dislocation or discolouration (Figure 10). This may reflect the newness of the carriageway, but the cropped sides of the setts may mean the sett–filling contacts are less prone to cracking than where setts with sawn sides have been used (see section 7.3).

## **7.5 WAVERLEY BRIDGE**

- Most setts are in good condition, showing no sign of cracking, polishing, dislocation or discolouration. However, a few setts show signs of incipient cracking close to, and parallel to, their sides (Figure 11).
- Hairline cracks along sett–filling contacts become apparent as the carriageway surface dries out after rain (Figure 11). These may be forming for the same reasons proposed in section 7.3.



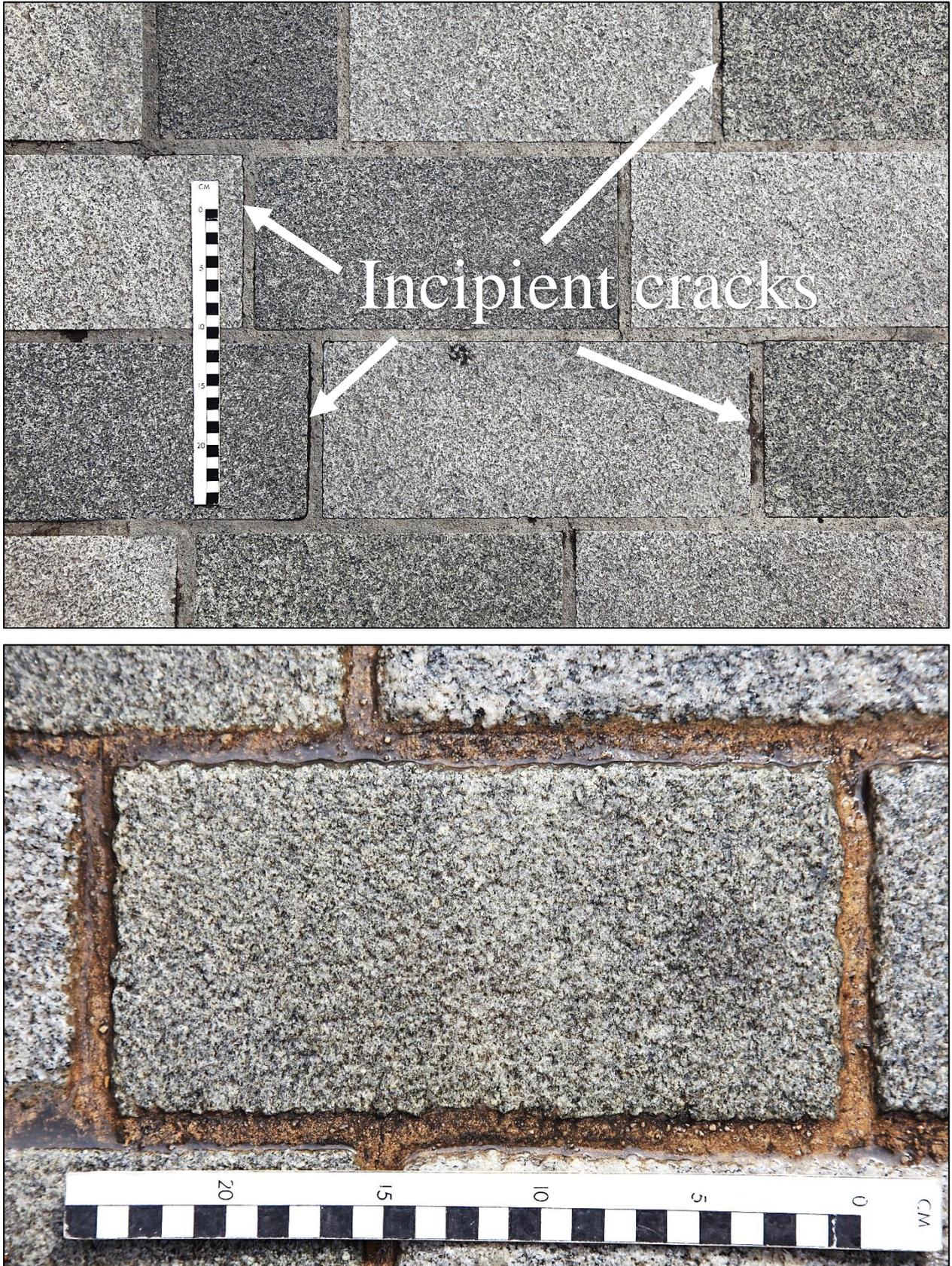
**Figure 8 Performance issues in a recently setted area at the juncton of George IV Bridge / Bank Street and Royal Mile**

Top: incipient thin cracks developing near to, and parallel to, the cropped sides of setts. Bottom: orange-brown iron staining developed locally on setts adjacent to a manhole cover. See text for details. Units on scale bar are 1 cm.



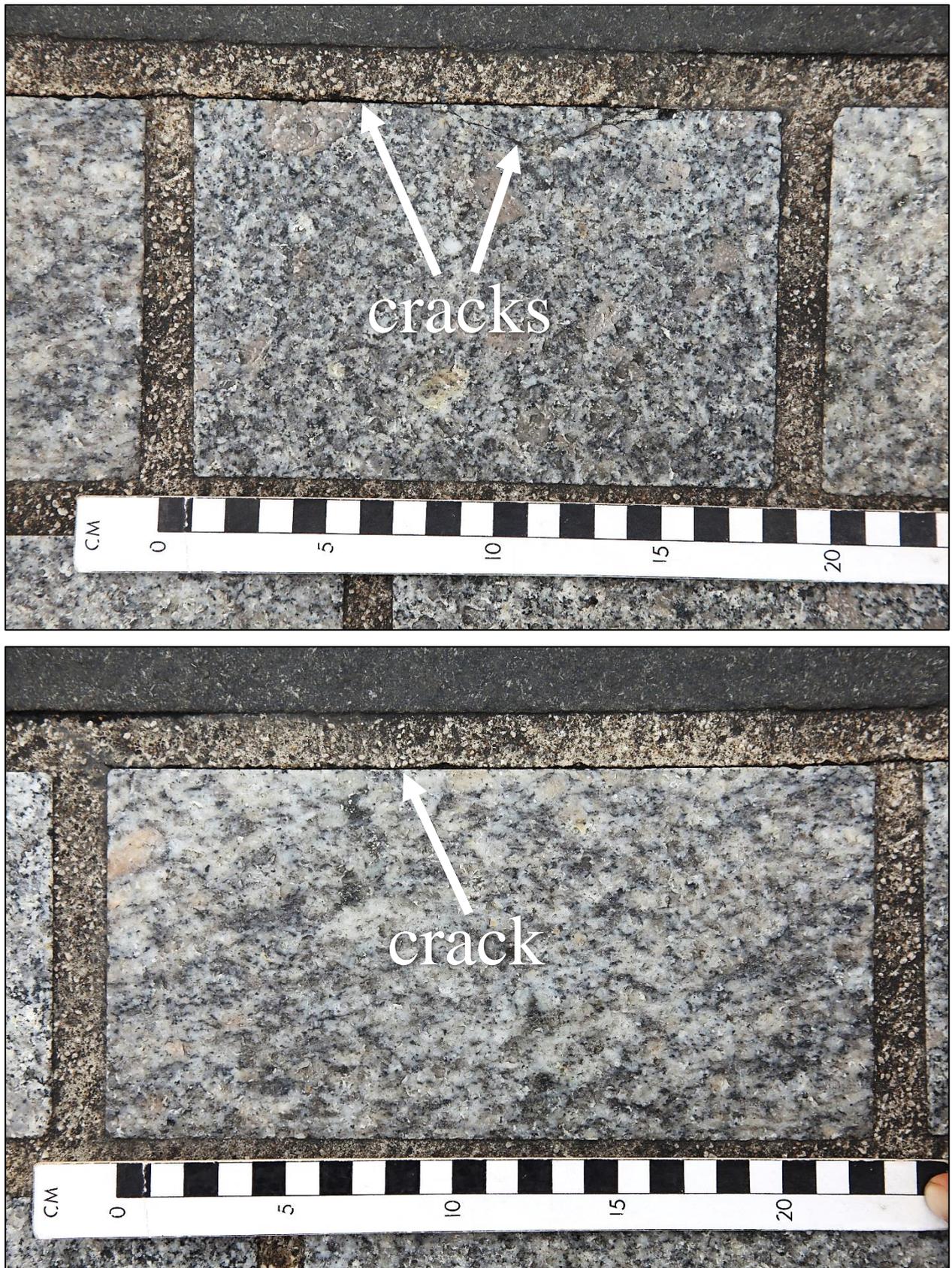
**Figure 8 Performance issues in a recently setted area at the junction of South Bridge / North Bridge and Royal Mile**

Top: Conchoidal (curved) fractures developed in adjacent sets. Bottom: numerous cracks and evidence for uneven wear developed in resin-based joint filling. See text for details. Units on scale bar are 1 cm.



**Figure 9 Performance issues in recently setted areas at St John Street and New Street**

Top: carriageway surface at St John Street showing hairline cracks (highlighted by dark residues of drying rainwater) developed along the contacts between sawn setts and cementitious joint filling. Bottom: carriageway surface at New Street showing cropped setts and cementitious joint filling, both of which are in good condition. See text for details. Units on scale bar are 1 cm.



**Figure 10 Performance issues in a recently setted area at Waverley Bridge**

Top: hairline crack developed in granite next to the long edge of a sett, and a hairline crack developed along the contact between sawn setts and cementitious joint filling. Bottom: hairline crack developed along the contact between sawn setts and cementitious joint filling. See text for details. Units on scale bar are 1 cm.

## 8 Performance indicators for setts and setted streets

Setted streets should be aesthetically pleasing and they should meet the practical needs of street users, but the ideal setted street should also be safe, durable and cost-effective (requiring minimal maintenance during its projected lifespan). To an extent, all these attributes can be controlled by appropriate design and good quality construction, but in some cases tests are required to indicate material performance characteristics. To be safe, the stone should be resistant to polishing and uneven wear; to be durable, the stone should be resistant to granular disintegration (i.e. breaking into its constituent crystals) and cracking; and to be cost-effective, setts should be both safe and durable (reducing the need for costly intervention). No material can ever be completely resilient in these respects, but optimising performance should be a key aim when specifying materials for constructing or repairing a setted street. However, cost-effectiveness also depends on the performance of the setted street as a whole, rather than just the individual setts. This section of the report therefore considers performance indicators for setts and setted streets separately.

### 8.1 PERFORMANCE INDICATORS FOR SETTS

Performance indicators for natural stone setts can be divided into two types: *geological performance indicators* and *geotechnical performance indicators*. Table 5 presents summary details for a set of ‘desirable natural properties’ that can be evaluated using these indicators.

#### 8.1.1 Geological performance indicators

These are observable geological features that have the potential to improve or diminish the performance of a stone when used as a sett. Features with the potential to diminish performance typically are distributed unevenly in a stone and therefore may not be represented in geotechnical tests or observed in a casual visual assessment. Such features include: chemical alteration and physical alteration of the stone, which could make it susceptible to granular disintegration; fractures, veins and dykes, which may make the stone susceptible to cracking under load or through mineral dissolution; and nodules and other localised features that may weather and abrade more slowly than the enclosing rock (ultimately standing proud and presenting a possible trip hazard) or more quickly than the enclosing rock (creating pits in which water and debris can accumulate). An assessment of geological performance indicators usually requires an examination of the stone by a geologist using the unaided eye (visual examination) or a microscope (petrographic analysis).

The type of stone used to form a building stone product is usually indicated by the supplier in the trade name of the product or in product specification details, but the geological terms used by suppliers are sometimes applied inaccurately or inconsistently (as indicated in section 2.2). It can make sense, therefore, to have the stone type verified independently by a geologist if stone of a particular type or character is required for a project.

#### 8.1.2 Geotechnical performance indicators

These are measurable attributes used to determine how well a stone is likely to perform in a given circumstance (e.g. when subjected to a heavy load or repeated freeze / thaw cycles). Many such attributes are intrinsic properties of the stone and therefore can be evaluated by subjecting a representative sample of the stone to a standard laboratory test.

The British and European standard *BS EN 1342:2012: Setts of natural stone for external paving. Requirements and test methods* defines the dimensional requirements, methods of measurement, permissible deviations, conformity and acceptance criteria for the man-made properties of a sett, and specifies the appropriate performance indicator tests that should be used to evaluate the intrinsic natural properties of a stone. However, it does not define threshold values or other criteria for judging ‘acceptability’ for most of the tests that assess intrinsic natural properties, because

these will vary depending on the setting and function of the street (e.g. projected traffic loading) and its intended lifespan; the designer / road engineer must set these on a case-by-case basis. Suggested ‘acceptance limits’ for most of the relevant geotechnical tests of natural properties (including compressive strength, water absorption, freeze / thaw resistance, Magnesium Sulphate Soundness, abrasion resistance, and resistance to polishing) are provided in chapter 3 of the report *Natural stone surfacing - good practice guide* (Society of Chief Officers of Transportation in Scotland, 2004; referred to hereafter as ‘the SCOTS report’). Most (perhaps all) of the igneous rocks that have been commonly used as setts in traditional and new setted streets in Edinburgh probably exceed the suggested minimum acceptance limits for these natural properties.

Slip resistance is the property that, arguably, is most likely to degrade significantly over time, and as such has implications for both the safety and cost-effectiveness of a setted street. Slip resistance is controlled by the texture of the top surface of a sett, which depends on man-made factors (i.e. how the sett was produced [e.g. sawn, cropped] and finished [e.g. flame-textured]), and an intrinsic natural property (resistance to polishing). Slip resistance is the only geotechnical test described in *BS EN 1342:2012* that is not determined wholly by an intrinsic natural property. In this instance, the standard advises a limit for slip resistance (USRV >35) that is generally considered safe. One geotechnical test, which produces a measure called the Polished Stone Value (PSV), gives an indication of resistance to polishing, but the rate at which in-service slip resistance will degrade cannot be assumed from a PSV. Monitoring and periodic testing is the only way to assess whether or not the slip resistance of in-service setts remains acceptable. The top surface of setts can be re-textured if slip resistance falls below acceptable limits, but using new stone setts with high initial USRV and PSV in the first instance will reduce (and possibly eliminate) the need for intervention, thereby improving cost-effectiveness.

Stone suppliers generally provide a set of geotechnical test data for their product, but it is important to check that these have been conducted in full accordance with the methodologies described in *BS EN 1342:2012* (or whatever document succeeds it).

**Table 5 Desirable natural properties of setts, associated performance indicators and tests**

Desirable natural property	Possible cause of poor performance	Performance indicator	Appropriate test	Sources of further information
Resistance to granular disintegration	Constituent crystals are insufficiently cohesive	Altered minerals and minerals prone to weathering are rare or absent	Petrographic analysis	Seek advice from a geologist, and/or assurances from supplier
		Mechanical durability is sufficient for intended function	Freeze / thaw resistance	Refer to BS EN 1342:2012 and guidance in the SCOTS report
			Magnesium Sulphate Soundness (MSS)	
Resistance to water penetration	The stone is permeable (i.e. water can penetrate it, promoting decay) due to open fractures and/or connected pores	Stone permeability and porosity are low	Water absorption	Refer to BS EN 1342:2012 and guidance in the SCOTS report
			Determination of open porosity	
Resistance to cracking	The stone is brittle and/or The stone contains natural or fractures or incipient fractures due to blasting	Stone strength is sufficient for intended function	Compressive strength	Refer to BS EN 1342:2012 and guidance in the SCOTS report
		Fractures are absent ... or ...	Visual examination & petrographic analysis	Seek advice from a geologist, and/or assurances from supplier
		Fractures are present but are geologically healed and do not contain minerals susceptible to weathering	Compressive strength	Refer to BS EN 1342:2012 and guidance in the SCOTS report
Resistance to slip *	Surface texture is insufficiently rough to provide adequate traction	Resistance to slip is sufficient for intended function	Unpolished Slip Resistance Value	Refer to BS EN 1342:2012 and guidance in the SCOTS report
Resistance to polishing	Lack of hard minerals in the stone allow its surface to become polished	Resistance to polishing is sufficient for intended function	Polished Stone Value (PSV)	Refer to BS EN 1342:2012 and guidance in the SCOTS report
Resistance to uneven wear	The stone has unevenly distributed geological features that differ from the host rock, such as nodules and cavities	Features that might cause uneven wear are absent	Visual examination & petrographic analysis	Seek advice from a geologist, and/or assurances from supplier
Resistance to discolouration	The stone contains iron-bearing minerals that are susceptible to weathering (e.g. pyrite and calcite)	Iron-bearing minerals that are susceptible to weathering are absent	Visual examination & petrographic analysis	Seek advice from a geologist, and/or assurances from supplier

\* Strictly speaking, this is influenced primarily by man-made properties (the 'finish' applied to sett surfaces) but it is included here as a 'desirable natural property' because the natural texture (e.g. crystal size) of a stone will affect the roughness (and thereby slip resistance) of cropped surfaces.

## 8.2 PERFORMANCE INDICATORS FOR SETTED STREETS

There are no recognised performance indicators for joint fillings or for setted streets as a whole. However, the long-term durability, and therefore cost-effectiveness, of a setted street depends on how all the component parts (setts, joint filling, and support layers) perform, individually and collectively. The observations presented in section 7 of this report suggest that maintaining the bonds between sett surfaces and the joint filling is more important in determining the overall durability (and therefore cost-effectiveness) of a modern setted street than any other aspect. The evidence suggests that the bond is stronger and will last for longer when setts have cropped (rough) sides rather than sawn (smooth) sides, but the durability and influence of different joint filling materials is more difficult to gauge and predict. When cracks form along the bond (or in any other place), water, salt and granular debris will enter them at which point processes such as freeze-thaw cycles, dissolution, salt crystallisation, and abrasion will occur within the crack, leading to an ever-greater rate of deterioration. It is suggested, therefore, that crack development in joint filling should be considered a key performance indicator for the surface layer of modern setted streets. Currently, there is no quantitative measure of crack development (as far as we know), so setted streets should be monitored regularly (perhaps annually) for cracks and associated issues (such as sett displacement and subsidence), and a strategy should be put in place for dealing with problems in the most cost-effective manner. New streets and new repairs should be designed and constructed in such a way as to minimise crack development. The best means of achieving this can be learned through trial and error, but in the interests of improving cost-effectiveness as quickly as possible it would be worth reviewing experiences elsewhere (including other local authorities in the UK and overseas) and initiating formal tests and monitoring of different combinations of sett finish, filling material and construction method.

The British standard *BS 7533: Pavements constructed with clay, natural stone or concrete pavers* (BSI 2009, 2010) provides specifications for constructing paved streets. The standard is divided into several parts, presented as separate documents, each dealing with different materials and pavement types. Parts 7, 10 and 13 are relevant to setted streets. The relevant parts of *BS 7533* specify the methods and materials to be used for designing and laying the setted street as a whole. The SCOTS report also provides information on this process, and includes informative commentary on *BS 7533*.

## 9 Summary and recommendations

Setted streets were created over a long period in Edinburgh, and inevitably their character changed during that time to reflect, for example, changes in availability of materials, carriageway design, and construction methods. Some of the ‘traditional’ streets that survive today will include sections that were repaired or replaced long ago using materials and styles that did not match the original street, though this might not now be obvious. Thus, it is not possible to produce a succinct, simple definition of ‘traditional style’ that takes into account the full range of characteristics that we see today. However, it is possible to identify a set of ‘key attributes’ of traditional setted streets – features that are most typical of the traditional style – and use these to inform how new setted streets should appear, if they are to be ‘in keeping’ with traditional streets. The key attributes of traditional setted streets in Edinburgh are listed in Table 2 of this report, and can be summarised as follows. To be ‘in keeping’ with traditional streets, the setts used to form any new area of setted street should:

- be formed of mid- to dark grey dolerite (though similarly coloured gabbro and basalt would also be acceptable) or grey to pink granite; the stone should be visually similar to the Scottish stones used to form the surviving traditional streets;
- consist of one rock type (i.e. they should be all dolerite or all granite, not a mix), and usually just one variant of that rock type;
- be between 120 and 140 mm wide, and 2.5 to 3.5 times as long as they are wide;
- have cropped sides and textured tops;
- be laid in a stretcher bond pattern, with rows at right angles to the direction of the street; in individual rows, setts should be of even width but varying length (while maintaining the stretcher bond character), and adjacent rows should be, to some extent, of different width.

Blocks 125-150 mm wide and 250 mm high of mid- to dark grey dolerite should be used to form new kerbs and channels, though granite can be used on streets formed of granite setts; granite kerbs typically would be wider than normal kerbs (the top surface can be up to c.250 mm wide).

Some compromises obviously will be necessary to meet modern standards of engineering and design, and any new street design guidance should identify a range of permissible ‘flexibilities’ that allow other materials or styles, which are less typical but still broadly ‘in keeping’, to be employed when it is not possible or not practicable to reproduce one of the ‘key attributes’. Proposed flexibilities are summarised in Table 2 of this report.

To maintain the character of Edinburgh’s historic streetscape at a citywide scale, CEC should aim to ensure that:

- setted streets in general display a uniformity of character (e.g. in using a very restricted range of rock types and a consistent laying pattern) but in detail display a modest degree of variability (e.g. in varying sett dimensions from street to street);
- most setted streets are formed of dolerite, with a subordinate proportion (mainly prestigious streets and junctions) formed of granite.

Any repair to an existing street in general should seek to replicate the materials, character and style of the original setts in areas adjacent to the repair.

Recently created setted streets (based on a sample of five sites examined for this study) to an extent follow the traditional style, notably in using setts formed of granite and dolerite, and in generally employing a stretcher bond pattern. However, they depart from the traditional style in a number of respects, and as such arguably could do better in replicating the appearance and character of traditional setted streets. Perhaps most notably:

- granite setts have been used exclusively (whereas traditional streets formed of dolerite setts are more common than streets formed of granite setts);
- some of the granite (notably rock with a yellow to green tinge) is not a good visual match for traditional Scottish granite;
- a mixed palette of stones (multiple granite variants) in roughly equal proportions has been used at every site (whereas individual traditional streets typically were formed using a single variant of one stone type);
- in some cases, all the setts (and therefore sett rows) are the same width, which creates a rigidly uniform pattern (unlike traditional streets where adjacent sett rows typically are of varying width, which ‘softens’ the visual character);
- the length to width ratio of full-size setts typically is around 2:1, whereas in traditional setts it is 2.5 to 3.5;
- sett sides are always sawn (not cropped);
- non-traditional joint fillings, notably resin-based and cementitious fillings, have been used in all cases; however, this is clearly necessary to meet modern standards of engineering and durability, as many setted streets experience substantially greater traffic volume and loading in the 21<sup>st</sup> century than they did historically.

Virtually all of the setts used to form new areas of setted street in recent decades have been imported, partly because imported setts are widely available and relatively cheap, and partly because setts prepared from indigenous Scottish stone generally have not been available commercially. There are several reasons why it would be beneficial to use the same Scottish stone that was used historically to create new setted streets and repair existing streets. For example, stone from the original quarry sources obviously would provide the closest match to existing setts in terms of visual appearance and performance, and has a proven pedigree whereas imported stones commonly do not (and therefore may not perform as well as expected). Furthermore, it might be easier to control (or influence) long-term security of supply of indigenous stone, whereas the availability and character of imported setts may change frequently and without notice. It should also be easier to encourage local suppliers to produce setts with features that are ‘in keeping’ with the traditional style (e.g. in terms of dimensions and finish). Setts formed of Scottish dolerite are now available commercially, but Scottish granite setts are not. However, growing interest in re-establishing a strong Scottish stone industry, and in re-instating setted streets, means there is an opportunity for CEC to work with other local authorities, conservation organisations (including HES and EWHT), and Scottish quarriers (notably the recently formed Scottish Stone Group) to make Scottish granite setts commercially available again.

Performance indicators for natural stone setts can be divided into two categories. *Geological performance indicators* are observable geological features that have the potential to improve or diminish the performance of a stone. They include structural weaknesses (e.g. cracks and veins) and minerals with the potential to weaken or discolour the stone, and in general should be assessed by a geologist. *Geotechnical performance indicators* are measurable attributes used to determine how well a stone is likely to perform in a given circumstance. They include stone strength, resistance to disintegration and resistance to polishing, and in general should be assessed using geotechnical tests. Most (perhaps all) of the igneous rocks that have been commonly used as setts in traditional and new setted streets in Edinburgh probably exceed minimum acceptance limits for most performance indicators.

A brief review of sett performance in recently created setted streets (based on the same five sites described above) showed that the setts in general appear to be performing well, though at one site cracks have developed within some setts, near to and essentially parallel to their sides. In time, these will cause the setts to become rounded, which will reduce slip resistance. The most common, and potentially the most serious, performance issue is hairline cracks developing in the joint filling, and particularly along the contacts between setts and joint fillings. The cracks are most common in cementitious fillings, and may be a result of shrinkage in the mortar and/or repeated loading and unloading stress. Cracks were observed most commonly along the contacts between joint fillings and setts with sawn (smooth) sides, which probably form a weaker bond than setts with cropped sides.

Setted street surfaces are expensive to create (compared to tarmac), so demonstrating that they can be cost effective (requiring minimal maintenance) over long periods is important if they are to attain the support of both the public and planning committees. The long-term durability of a setted street (which is a key determinant of its cost-effectiveness) depends on how all the component parts (setts, joint filling, and support layers) perform, individually and collectively. A key conclusion of this review is that the bonds between sett surfaces and the joint filling is more important in this respect than any other aspect of the surface layer in a setted street. The evidence suggests that the bond is stronger and will last for longer when setts have cropped (rough) sides rather than sawn (smooth) sides, but the durability and influence of different joint-filling materials is more difficult to gauge and predict. When cracks form along the bond (or in any other place), water, salt and granular debris will enter them at which point processes such as freeze-thaw cycles, dissolution, salt crystallisation, and abrasion will occur within the crack, leading to an ever-greater rate of deterioration. As such, crack development in joint filling should be considered a key performance indicator for the surface layer of modern setted streets. Currently, there is no quantitative measure of crack development (as far as we know), so setted streets should be monitored periodically for cracks and associated issues (such as sett displacement and subsidence), and a strategy should be put in place for dealing with emerging problems in the most cost-effective manner. New streets and new repairs should be designed and constructed in such a way as to minimise crack development. The best means of achieving this can be learned through trial and error, but it would be worth reviewing experiences elsewhere (including other local authorities in the UK and overseas) and if necessary initiating formal tests and monitoring of different combinations of sett finish, filling material and construction method.

Setted streets that are well designed, well engineered and well constructed using durable materials should require little or no maintenance over several decades and therefore have the potential to be both sustainable and cost-effective. Measures should be put in place to limit the degree to which utility companies need to access infrastructure beneath setted streets, and to mitigate the impact on the long-term visual and structural integrity of setted street surfaces when they do.

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