Introduction

This 2015 report focuses on two common mortar types in Scotland: lime and sand/cement mortars. The study examines the traditional methods of construction, with a particular emphasis on the conservation of traditional buildings and for technical suitability for use with traditional materials. The report aims to provide an overview of the properties and applications of these mortars, as well as their historical significance and modern usage.

A brief history of mortars in Scotland

Scotland has a long tradition of building with natural materials, and this tradition continues today. The use of lime mortars dates back to Roman times, when they were used for the construction of some of the earliest buildings in Scotland. Lime mortars were also used during the medieval period, and were commonly used for the construction of church buildings.

Lime mortars were replaced by sand/cement mortars in the late 19th century, as the latter were considered to be more durable and long-lasting. However, in recent years, there has been a resurgence in the use of lime mortars, due to their lower environmental impact and their ability to work with traditional building materials.

Binders

A binder is a substance that holds particles together, providing the necessary strength and flexibility for a mortar. The type of binder used has a significant impact on the properties of the mortar, both in terms of its strength and its water resistance.

Lime is produced by burning calcium carbonate (limestone or chalk) in an asphalt kiln to produce lime. Historically, this process was used for centuries, as lime has excellent water resistance and is widely available in Scotland.

Sand/cement mortars are produced by mixing sand, cement, and water. The use of sand/cement mortars has increased in recent years, due to their ease of use and their ability to work with modern building materials.

Aggregates

Aggregates are the solid particles that make up the mortar matrix. They are typically made from natural stone, and come in a variety of sizes and shapes.

Additives

Additives are substances that are added to the mortar mixture to improve its properties. These can include materials such as silica fume, fly ash, and polymers.

Mortars in traditional buildings

Unlike modern buildings, which are generally built on a concrete foundation, traditional buildings are often built with a lime or sand/cement mortar. This mortar is typically used for the repair of traditional buildings, and for the construction of new buildings.

Mortars have the ability to perform sacrificially, meaning that they can absorb water and prevent the surrounding environment from deteriorating.

Fig. 2 Limekiln picture from a Digswell, Digswell.

The use of lime mortars has many benefits, including:

- Lower environmental impact
- Better compatibility with traditional building materials
- Lower water absorption rates
- Better flexibility

However, lime mortars also have some drawbacks, including:

- Lower strength
- Longer setting time
- Lower permeability

Modern mortars are often used for the repair of traditional buildings, as they can improve the performance and longevity of the building.

Fig. 6 Moisture management in traditional buildings.

Moisture management is an important aspect of the maintenance and conservation of traditional buildings. The continuous cycle of evaporation and condensation in the building envelope can lead to moisture ingress, which can cause damage to the building.

Fig. 8 Hair in a historic lime plaster. © W. Revie.

The use of lime mortars is essential for the maintenance and conservation of traditional buildings. The properties of these mortars need to be carefully selected, as they can affect the performance and longevity of the building.

Fig. 10 Problem of mortar and brickwork bonding by using incompatible mortar on the exterior.

When incompatible mortars are used with masonry, the ability of the building to breathe is compromised. The use of compatible mortars is essential for the maintenance and conservation of traditional buildings.
Choosing a suitable mortar

When repairs are to be carried out, the most effective approach usually involves the use of materials and techniques that were employed in the original construction. This logic applies to both lime and cement mortars, for original cement mortars are often just as worthy of repair of traditionally built masonry structures. Both lime and cement mortars can perform well when used appropriately. In the majority of cases, lime mortar will be required for the repair of traditionally built masonry structures. The use of compatible mortars can lead to accelerated masonry decay and damp problems. An appropriately skilled buildings consultant may be required. An initial analysis of the original mortar can provide an indication of the original mix proportions (providing the mortar is not extensively weathered). However, simply replicating the mortar mix design is the best course of action, especially if the requirements of the mortar have changed, for example, incorporating a microsand on a once raidy, but now modern, mixture.

Selection of an appropriate repair mortar can be a complex process, and the skills of an experienced buildings consultant may be required. As stated in Section 2, in getting the right specification for materials and techniques will ensure better performance in the longer term, and save on future maintenance and repair costs.

Conclusion

Both lime and cement mortars can perform well when used appropriately. In the majority of cases, lime mortar will be required for the repair of traditionally built masonry structures. The use of compatible mortars can lead to accelerated masonry decay and damp problems. An appropriately skilled buildings consultant or conservator should be involved in the specification of repair materials from an early stage in any conservation works to ensure that the right materials are used, preventing avoidable masonry decay and associated problems.