Concrete paving stones, slabs and curb stones

The paving stones, slabs and curb stones manufactured in the factories of Rae Kivitehas OÜ are made of concrete and the bonding adhesive used is Portland cement. Sieved sand and crushed granite are used as filling materials, and in addition to that, concrete additives are used for improving the qualities of the concrete mix.

The concrete paving stones produced by Rae Kivitehas OÜ comply with the standard EVS-EN 1338 and paving slabs comply with the standard EVS-EN 1339 and possess certificates of compliance authorised by the Certification Centre of TUT.

The average compressive strength of concrete paving stones is 3.6 Mpa and 3.5 Mpa for paving slabs, which is accomplished within 28 days the latest. Paving stones and slabs are suitable for inside as well as outside use. The technical properties of products, available at the web page of Rae Kivitehas OÜ www.raekivitehas.ee, must serve as the basis of the designing process.

The pavements, roads, courtyards, squares and streets which are laid of concrete paving stones and/or slabs are beautiful and durable. The stones are resistant to weather conditions as well as mechanical and chemical damages.

Paving stones are manufactured in a variety of colours. The main colours include grey, red, brown and black. In addition to that, our product range features a wide choice of stones in different shapes, enabling the creation of unique and interesting patterns.

Paving stones in our product range come in three different thicknesses: 60 mm, 80 mm and 100 mm, paving slabs are 60 mm thick. 60 mm thick stones are suitable for paving squares, pavements and residential drive-ins, 80 mm and 100 mm stones can be used for paving roads. There are 2mm thick projections for joints on the sides of the stones to simplify the process of laying the stones.

The edge of stone pavements is usually supported by curb stones, but the edge can also be finished using gutters. Curb stones are available in three different widths – 60 mm, 80 mm and 150 mm. Narrower stones can be used for separating pavements from greenery, the stones separating pavements and road should be wider.

The concrete curb stones manufactured by Rae Kivitehas OÜ comply with the EVS-EN 1340 standard and possess certificates of compliance authorised by the Certification Centre of TUT. The average flexural strength of curb stones is 3.5 Mpa.

Preparatory work

Measure and mark the area to be paved. Add working out a plan where communications and lines, remaining under the pavement, are going to be positioned. The positions of the curbs surrounding the square or road (pavement curbs) and the position and function of drainage (gutters) must also be considered. In addition to measuring the area and calculating the amount of stones necessary, the colour solution and pattern need to be considered.

In case the traffic area is used by heavy-duty vehicles, it should be kept in mind that a project must be carried out and the soil needs to be constructed according to MaaRYL 2010 and Road Management technological requirements RTL 2004, 65, 1088.

Due to Estonian harsh climate, humidity and rising ground, it is necessary for achieving the full resilience of the pavement to remove the layer of soil prone to rising in cold weather from underneath the pavement. The thickness of the base depends on the type of soil and the purpose of usage of the pavement. The depth of excavation is determined by the combined thickness of slabs, installation sand and layer of crushed stone. Stamp on the base of the area of excavation to make it more solid, when the base is wet, let it dry properly. When the soil is very soft, the base should be allowed to sink throughout the winter and only then the stones should be installed.

All cables and pipes must be installed during working on the base. The final slope of the stone surface must also be determined during working on the base. The base must act as a stabile platform for the subsequent layers and should have a slight slope towards the drainage system. A special net, geotextile or a layer of soil reinforced with cement must be used in case of soil with little load capacity in order to avoid large-scale sinking in later stages.

1) **Capping layer**

In case of previously unevenly congested soil (for example, garage drive-ins as soil roads) a sufficiently thick capping layer must be built of crushed rock, crushed rock with fraction 32/64 mm is suitable. The sufficiently thick layer is compacted using a soil compactor of suitable capacity. Load-bearing capacity must be inspected. Two sub-base layers are installed on top of the capping layer.

2) **Sub-base layer I**: Thickness 100 – 350 mm (the thickness of the layer is determined by the purpose of usage of the pavement).

Crushed stone with fraction 16/32 is a suitable material. The sufficiently thick layer is compacted carefully using a soil compactor of suitable capacity and the result is inspected with proper measurement devices.

During the construction of the capping layer or the sub-base layer the curb stones are also levelled, installed and sealed with concrete. The edge of paving stones is usually supported by curb stones; however the edge can also be finished using a gutter or the so-called hidden supporting. The stones on the edge are laid on concrete bedding or are supported by a treated wooden beam. In the case of the latter, it needs to be taken into account that the layer of crushed stone must partially remain under grass.

Curb stones of roads: these are mainly used in parking lots, streets, highways and larger squares – in places with remarkable vehicular traffic. The top surface of the curb stone remains higher than the road paving during installation.

Pavement curb stones: used in smaller squares and pavements, as well as fencing garden beds and lawns. They can be installed differently, either even with the surface of the road or higher than the surface of the road.

For installing the curb stones it firstly needs to be outlined where the stones are going to be placed and calculate how much higher of the level of the square the stones are going to be. About 10 cm of crushed stone should be installed as the sub-base layer, which needs to be compacted using a soil compactor. Further installation employs concrete marked B 10/15, the thickness of which must be about 5 cm under the stone.

Curb stones should be installed using a water level and following a rope. The stones must be secured from the front and behind in joints, which can be done with the help of concrete bedding. It needs to be observed that the concrete would not be higher than the capping layer of the future road (the usual recommendation is the thickness of stone paving + 2 cm). The ditch around the stones must be filled with crushed stone and compacted. It cannot be done on the same day, however, because the concrete has not hardened yet. The waiting time should be at least 24 hours. It is recommendable to leave a space of about 2 mm between the stones (using a piece of cardboard, for example).

3) **Sub-base layer II**: Thickness 50-100 mm. Crushed stone with fraction 4/16 mm is suitable. The sufficiently thick layer is compacted carefully using a soil compactor of suitable capacity. Crushed stone with fine fraction is important because it helps to stabilise the paved area and will not let water or rain to wash away the sand.

The materials used in constructing the sub-base can be adhered using cement or lime. The sub-base must be built layer by layer. A thorough inspection of the sub-base must be conducted before starting work on the sand bedding.

4**) Sand bedding**: Sublayers are covered by a layer of sand, 30-40 mm thick. Fine sand with fraction 0/3 mm is suitable. The layer is levelled using a screed board, compacted and smoothed. The layer of installation sand must be level because the result of the finished surface depends on it. The surface of the levelled sand must not be walked on.

Laying the stones

The paving process is made significantly easier by good tools. You could use the following tools: a shovel, wooden cross beams or steel pipes with a diameter of 20-30 mm, guide rope and posts, a surface plate and a cross beam. For levelling the sand bedding you need markers, a soil compactor, a water level, a cutter for stones, a large wooden or rubber hammer, a broom and of course suitable working gloves. **After the stones have been brought to the construction site, the plastic around them needs to be removed as quickly as possible in order to avoid efflorescence.** Each pallet with stones has to be put on a lever surface. In addition to that, all safety requirements have to be followed and all the necessary personal protective equipment has to be used (protective footwear, respirator).

After constructing the base layers, the starting point of paving is determined and the area is divided into smaller units paved together at once. The best way for marking the excavation area is to tighten a 2-4 mm capron string between posts, which have been inserted in the corners. Leave the string 5-10 mm above the edges of the stones so that the string would not be pushed out of place when the stones are put to place. The string needs to be installed carefully to ensure that the area to be paved would be in the right place.

The stones are laid on a levelled sand layer, laying the stones is started from the wall of the building. It is not recommended to start laying the stones from two edges of the square at once. It is not allowed to install the stones straight on plastic or concrete without a layer of drainage. Paving stones and slabs are laid in the order of laying following the rope one row at a time. During laying it needs to be observed that the joints would be straight. It is not recommended to place stones without joint projections right next to each other because later they may easily break or shatter around the edges. The recommended width between joints is 2-4 mm; the paving stones and slabs manufactured by Rae

Kivitehas OÜ have the corresponding projection joints on the sides. The joints may be wider in case of slabs.

When there are permanent obstacles on the area to be paved (such as sewerage wells), then these areas are left unpaved when a whole stone does not fit between the obstacle and the previous stone. The paving is continued with a whole stone after passing the obstacle and holes are filled after the paving has been completed.

The stones may be cut using a guillotine cutter, electric saw or by hitting a cutting recess into the stone using a chisel and a hammer, and later cut the stone in half with a hammer at the cutting recess. The paving should be planned keeping in mind that stones should be cut as little as possible. Pieces of paving stones, which form less than 25% of the original size of stones should not be used because these may dislocate easily. Such holes should be filled using concrete mix.

Finishing

The stones should be sprayed with water during a few days before compaction, especially when the weather is warm and dry.

Finally dry sand (fine fraction of 0.63 mm or less) is poured onto the pavement and brushed into the joints. The surface of the pavement is compacted using an 80-100 kg vibrating device. It is recommended to use a rubber sole when compacting the surface of the pavement.

Before starting compaction of the pavement it is recommended to check the date of manufacture on the packaging of the stones and take into account that the stones achieve their durability within 28 days of manufacture.

The surface of the pavement must not be influenced mechanically (for example, scratching) or chemically (etching) when cleaning the pavement. It is reasonable to first try out the chosen measure of cleaning on a smaller area or on a more hidden spot. The recommended procedure of cleaning the pavement is sweeping it and washing it with water. After it has been raining or the paved area has been washed, the joints must be checked to determine that they are still filled with sand and refill them, if necessary. Properly filled joints will not let the stones tilt.

Snow and ice are removed from the pavement mechanically, using a shovel, scraper, broom or a snow blower. It is recommended to avoid using metal objects (metal brooms) since these may damage the surface of the pavement. In addition to that, concrete paving stones are not resilient to straight blunt blows, which is why using heavy and sharp objects (axe, lever) is forbidden. Blows damage the surface of the stones and may cause crumbling within the layers of stone, resulting in making them receptive to cold damage. It´s recommended to use sand to aid with slipperiness and on areas with less traffic (sidewalks) also granite gravel can be used.

Salt or chemicals can be used only at your own risk, but it´s not recommended - salt may weaken the structure of concrete and slowly damage the surface of the pavement.

Grass is removed from the pavement mechanically by weeding or by using pesticides suited for use on stone pavements. Moss is removed mechanically while keeping from damaging stones with metal objects.

In case of “dirt” it needs to be determined whether it has accumulated over time and incrusted or just recently. The expected end result of cleaning needs to be determined before starting cleaning. The origin of the dirt has to be determined to use the right cleaning methods and achieve the best possible result. The main principle of cleaning is to avoid mechanically or chemically influencing the surface of the pavement. In order to avoid surprises or damaging the surface, it would be wise to test the chosen method of cleaning on a small area beforehand. The areas which were cleaned with strong cleaning substances will stand out as different spots. This spottiness can also happen when old pavement is mended using new, freshly produced paving stones. The differences in colour will even over time. The pavement is cleaned of trash by sweeping and washing it with water. Incrusted dirt can be removed with water and brush or washing it with a pressure washer on low pressure. Pressure washers with too much capacity may damage the surface of paving stones. It needs to be observed that the sand from joints is not washed away when using a pressure washer. In case of demanding objects, it pays to order the cleaning service from specialists who have solutions for challenging situations.

Oil or grease stains do not damage the surface of paving stones. The stain needs to be removed as soon as possible to avoid its absorption into the stones, if possible. Paper, sawdust or other absorbing materials are suitable for removing these stains. After that the stones are scrubbed with hot water or a pressure washer. Dish washing liquid may also be used, but any residue has to be washed off as it may cause the structure of concrete to weaken. Today there are also special chemicals available for removing oil and grease stains.

Mechanical weeding is used for removing grass. Another option is to burn the grass using a liquid gas burner. Burning may influence the surface of stones and shorten the lifespan of concrete paving stones. The most effective may for removing grass is using herbicides, which prevent grass growth. It needs to be made certain that the product is suitable for use on concrete paving stones before using the substance. The instructions provided by the manufacturer needs to be carefully followed when using herbicides. Moss is removed mechanically from the pavement.

“White frost” or efflorescence can be removed using special chemical substances. Dry or wet brushing may be tried first in milder cases. Washing with a vinegar solution (1 part vinegar, 5 parts water) may also help. The surface can also be washed with diluted hydrochloric acid. In case of coloured concrete, the maximum strength is 3% to prevent changes in colour and texture. The surface of the stone must be moistened with water before applying the acid to prevent the acid from absorbing too deep into the structures of concrete and later it must be washed thoroughly with pure water.

Turfstone installation manual

The purpose of turfstone is to create greenery on large areas, where it is crucial to maintain usability. Turfstone is well-suited for large parking lots, which require the softening influence of grass as well as the vehicular endurance offered by concrete.

Recommended order for the installation:

1. Reinforced sub-soil
2. Geotextile if necessary
3. Sub-base – chippings material
4. Sand bedding or compacted granular chippings
5. Turfstone
6. Soil into the voids of turfstone
7. Sowing grass seed

Taking into account the size and shape of turfstone, a carefully prepared strong and smooth sub-soil is very important in the case to avoid the stones breaking under pressure.

Filling the voids of turfstone with soil

After surfstone has been installed, its voids are filled with soil and suitable grass seed is sown. There are two ways of filling the voids:

1. In the beginning the voids of turfstone are filled to the brim and it is expected for the soil to sink naturally into the voids while continuously watering with spriklers. The surface of the soil in the void must be 1-2 cm lower than the top surface of the voids so that the stems of grass plants would remain at minimal height when stepped upon.
2. The voids are mechanically pushed 1-2 cm lower of the top surface, using a footing or another something else suitable for this purpose. The growth of plants in turfstone is ensured when the soil in the void must be 1-2 cm lower than the top surface of the voids, guaranteeing the plants minimal growth space and space for thickening. Thickening of grass begins after moving the grass and considering that the purpose of turfstone is to create greenery on areas with high usability, it is important for the grass in the voids to grow. There is no air or space for growth necessary for plant roots in a thickly stuffed surfstone void, causing the plants to die. This means that greenery will be substituted by soil. In addition to that, plants may die as a result of the weight and car maneuvers (turning the wheels of cars one the spot using power steering). However, when plants remain below the top surface, and when to care for the grass employing correct techniques, the result can be a very effective green area.

Maintenance instructions for turfstone

The grass plants growing inside the turfstone require watering, fertilising and lawn- moving. Since the amount of soil in each void is small, nutritional elements are used up quickly. The plants must be fertilised in every two weeks during the vegetation period in order to achieve an ideal result, starting from the time when the day-and-night temperature is at least +8 degrees

Celsius. The plants in turfstone must also be watered using sprinkles, during drought at least once a day – the soil in the turfstone dries fast because the amount of soil is little and turfstone accumulates heat, therefore contributing to the drying process.

Instructions for mowing the grass

The grass must be mowed according to conditions and needs – the grass needs moving for the first time usually 4-6 weeks after sowing when the plants are already in the budding phase. The first mowing is usually performed at 1/3 of the plants' height, and the next ones at half of the plants' height, but at no less than 5- 6 cm. At first, the mowed grass may be left withering on the ground for protection from the hot sun. Thick mowed tuffets of grass may contribute to the spread of fungal diseases in the grass, especially in humid conditions. The time of the last mowing in the fall is also very important. There grass mustn't remain too high for winter as it may seriously damage the plants. The last mowing should be done when the day-and-night temperature is +10 degrees Celsius. The recommended overwinter height for the grass is 4-6 cm.