satisfied with the state of the works. It is usual to make the contractors of these works an allowance, when they have a large quantity of materials on the ground, as part payment; for instance, when two million or more bricks are on the spot, fifty per cent. on their value is usually advanced ; and, ge­nerally speaking, if it is seen that the contractor is proceed­ing with his work in a spirited manner, he should be en­couraged by every reasonable assistance in the power of the parties by whom he is employed.

The schedule of prices for extra and additional works should include every thing which is at all likely to be re­quired ; such as fencing, excavations, brickwork, concrete, stonework, specifying the nature and quality of the stone, and the description of the work ; such as string courses, coping, ashlar work, imposts, cornices, caps to pilasters, quoins, &c. ; the price of wrought and cast-iron work, of culverts, drains, and ditching, specifying the size in each case ; of timber, stating the size and description ; pruning and levelling at the ends of the viaduct ; piling for founda­tions ; the formation of roads ; laying railways, distinguish­ing the price with blocks from those with sleepers ; and all other things which it may be necessary to order in the course of the work.

It is usual to take security from the contractors for these works. Many an excellent contractor may not be able to find substantial sureties. In this case, his character from his last work will form the best criterion. It is always ad­vantageous to get a zealous, active, and substantial con­tractor, even at a higher price, for all large works.

The specification should state in a clear manner the site of the viaduct. Its intended use, and what work is to be in­cluded in the contract, with, any other information, so as to enable the contractor clearly to see his way. The level should be stated, the span, height, and form of the arches, whether any are askew, and if so, the angle of their incli­nation ; the radius of the curve, if there is any ; the nature and quality of the principal material ; and if this should be brick, then whether there are to be stone arch quoins, springing courses, string course, plinth, or coping ; also, what pilasters, &c. are intended ; what is to be the form of the piers, whether they project from the face line of the arch ; what description of wing walls, and whether they are to be built plumb, or battened, or curved, and what arched openings they may have, and if so, whether there are to be inverts to them, and also any other internal openings which may be intended; for instance, in railway viaducts, walls will be required in the abutments for the support of each line of rails ; but these may be built considerably cheaper, by lightening them with arched openings, having inverts un­derneath. In this case, the wing walls might be built plumb, and extended just far enough for the required slope of the embankment at each end. The space between the walls, for supporting the four lines of rails, should be arched over with nine-inch brickwork for supporting the earth and ballasting of the railway. The spandril walls should be perpendicular, and a wall should be run, if the height re­quires it, under each rail, extending over the arches, piers, and abutments ; the spaces between these walls being arch­ed over in a similar manner to those described above.

The form and dimensions of every part of the viaduct should be shown in the drawing, which should contain an elevation, plan of foundations, plan of the roadways or wa­terways, if any ; sections through the square and askew arches and piers, the abutments and parapet walls, showing the form of the string course, plinth, and coping ; and last­ly, a longitudinal section throughout the whole length of the viaduct. The nature of the ground should be carefully studied, before the footings of the piers and abutments are decided on ; and if at all doubtful, concrete should be used ; but in all cases, the footings should be stipped outwards, and carried so low as to rest on an entirely good and solid

foundation. Should there be any waterways under any of the arches, the outer course of materials of the piers on each side the water, should be laid in Roman cement, high enough to ensure their safety in this respect. The piers of askew arches may generally be lightened in the interior, and the mode of doing this should be shown in the drawing.

The spring course should if possible be of stone, not less than twenty inches thick on the face, say for an arch of fifty feet span, and rising behind, so as to form the proper skewback of the arch. These should be laid over the tops of the piers and abutments, each stone not being less than three feet six inches in the bed, each course consisting of not less than eight stones in the width of a viaduct of about twenty-eight feet broad ; and no stone should be less than three feet six inches in length, dowelled and leaded to the adjoining one. If the viaduct is brick, the upper surface of the stones, at the springing of any askew arches, should be made in steps or notches, for receiving the brick-work of the arch, each step taking five courses of bricks, and be­ing cut at right angles to the brickwork, rising behind at the proper summering for forming the skewback of the arch. The five courses of bricks agreeing with each arch stone, should all fit into a corresponding step in the springing course.

The form of arches is so much a matter of taste, that no general rules can be given without assuming some particu­lar one. We shall therefore take a segment of a circle, a very substantial viaduct in that form having been built by Robert Stephenson, Esq. They were fifty feet span, thirty feet eight inches in length, and three feet thick. The thickness of each arch quoin was equal to five courses of bricks ; and they were alternately three feet three inches, and two feet six inches in length on the soffit from the face of the arch, and rising in steps to reccive the horizontal courses of the spandril walls.

Great care should be taken in giving all the arch quoins a true and perfect bed throughout each stone ; and no pin­ning should be used in any part. The joints of the arch stones should be neatly chamfered rustic, and the faces of them fair tooled, and projecting about an inch from the brick work. The proper summering should be given to the bricks in the arch ; and any irregularity of form, arising from imperfection in the laggings, workmanship, centering, or any other cause, should be removed, and immediately- corrected by the contractor. The centres should in no case be struck without one week’s notice to the engineer. After they are removed, the whole of the brickwork in the soffit of the arches should be carefully and neatly pointed. With respect to keeping the arches dry—a point which it has been found extremely difficult to effect, and without which the brick work soon becomes damaged—we believe that puddling, if carefully and properly done, will always succeed. Drainage by pipes through the piers has been tried, and failed. A mixture of coal tar and lime has been found to succeed, and so has coal tar alone, boiled ten or twelve hours, so as to evaporate the water and ammoniacal liquor. As, in cooling. It sets moderately hard. It must not be laid on in wet weather, and the surface of the brickwork should be clean swept previous to applying it. Leading the arches with about five pound lead is a sure preventive ; but the process is expensive. The asphaltic cement is also a certain cure, but is dear compared with coal tar.

The backing should be built up to the required height, with good brickwork, well grouted. The wing walls of a railway viaduct should consist of six walls, built plumb up to the level of the crown of the arches, and extending in the direction of the railway towards the embankment at each end. They should be well bouded into the abut­ments, and lightened by arched openings. The top of the exterior walls should be brought to a proper level with the upper side of the arches, for receiving the string course