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For The Canadian Engineer.

RAILWAY ENGINEERING.*

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Chap. III.—(*Continued.*)

Article 10.- Easement on Transition Curves.

In article 6, under "Curve Resistances," is given formula (8), which indicates the amount that the outer rail on a curve should be elevated above the inner one, but, as the two rails on the adjoining tangents are of the same height at any given point, the question arises as to the best manner of effecting this change of conditions so as to lessen any shock to passengers or rolling stock, or indeed to entirely abolish it. Practice has determined that, where there is distance enough to permit, the curve super-elevation ought not to be lowered more than ½ inch per rail length (30 feet), or (*e.g.*) on a 10° curve of ½ inch super-elevation per degree, this would require a distance of 300 feet. The most common practice in America has been to bring the full elevation to the ends of the curve, and then lower it on the tangents. This, evidently, will act so that as a train approaches a curve the play of the wheels (½ inch to 1 inch) will all be at the outside, *i.e.*, the wheels will press against the inner rail, and then, at the instant the curve is reached, there will be a l rch to the outside in assuming the natural position, in passing round a curve, of the front wheel of each truck against the outer rail.

Some have tried to remedy this by lowering the elevation partially on the curve, and partially on the tangents, which merely divides one shock into two smaller ones. The true remedy lies in not making an abrupt change in horizontal alignment from a curve to a tangent or *vice versa*; but in so arranging the track at each end of a curve, that commencing with a curve of infinite radius, this radius is gradually decreased, *i.e.*, the curve is sharpened, and at the same time, the elevation of the outer rail is increased, keeping this elevation at each point just sufficient for the curvature until a junction is made with the main circular curve, with a curvature equal to it, and with a full elevation, and having kept an equipoise between curve and elevation at each instant, all lurches and shocks will be avoided. That this is the only true and rational solution, is proven by the fact that practical trackmen, unguided and even hindered, often, by engineers' rigid centre stakes, but recognizing the evil and its remedy, have introduced crude easement curves wherever they could do so, and improved the situation as much as possible; but as the tangent and main circular curve were both fixed in position by construction, all that could be done was to flatten the ends of the curve at the expense of the adjoining portions, which were thus made sharper than the main curve itself, and formed more or less of elbows in the track, often 2° or 3° sharper than the main curve.

Now this can be avoided by moving the curve inward bodily, or by changing the position or direction of the tangents, or by sharpening the whole curve slightly, any of which will permit of the introduction of proper easement curves at the two ends of the circular curve. Many methods have been advocated for putting in these easements, the endeavor being to simplify the process, in point of time and mental effort, and still preserve the essentials. Some of these are: (*a*) A succession of short pieces of curves of decreasing radii. (*b*) A modification of (*a*) in the form of a spiral. (*c*) A modified quadratic parabola (Holbrook spiral). (*d*) A modified cubic parabola. As any one of these can, when once understood, be easily laid out in the field, it is only necessary to decide on the most adaptable and suitable one for all cases to be met with, and study its theory and actually use it, after which its seeming difficult nature and laborious methods of application, so long dreaded by many railway engineers, will be found quite simple, and capable of rapid manipulation.

Almost all engineers are agreed that transitions are intrinsically necessary, and on European and the best American tracks their use has become established; the chief objections to their general adoption here have been the deeply rooted ideas that they were difficult to apply and too refined for ordinary use, but as speeds are being increased and competition is keener, they are beginning to be used by all roads of any importance because the consequent easier riding caters to the travelling public and also because the wear and tear on the rolling stock, and the difficulty of keeping the ends of curves in proper line, are thereby much decreased.

(*a*) This first class of transitions does not require any

*This series of papers will be issued in book form as soon as they have appeared in The Canadian Engineer.