which are R1, R2, R3 and R4. The parameter Q_o determines the lightness of pavement color (degree of whiteness or blackness).

Table 1 contains a summary of information from the Canadian measurements.

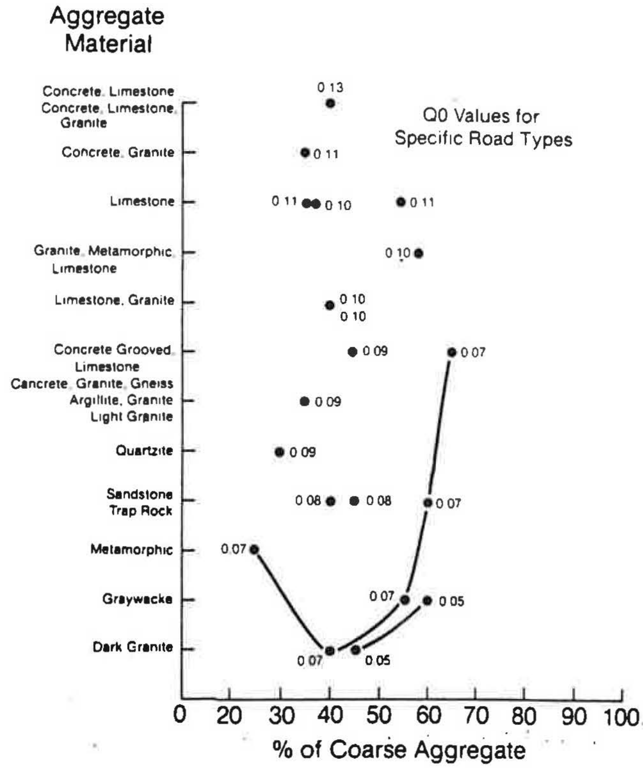
Table 1 - Recommended Design Values for Canadian Pavements

COMPOSITION	CIE CLASS	AVG.LUMINANCE COEFF. QO
limestone dense friction course	R2 R3	0.104
limestone, granite open grade	R2	0.068
limestone, granite dense friction course	R1	0.095
sandstone* open grade	R1	0.070
sandstone dense friction course	R2	0.080
quartzite dense friction course	R2	0.090
graywacke* open grade	R1	0.052
graywacke dense friction course	R2	0.070
dark granite open grade	R3	0.047
dark granite dense friction course	R3	0.069
light granite dense friction course	R2	0.087
granite,metamorphic,lime-stone open grade	R2	0.095
argillite, granite dense friction course	R3	0.085
traprock dense friction course	R4	0.077
metamorphic dense friction course	R2	0.068
concrete, limestone plain	R2	0.129
concrete, limestone lateral grooves	R3	0.094
concrete,limestone,granite plain	R2	0.129
concrete, granite plain	R2	0.110
concrete,granite,gneiss lateral grooves	R1	0.091

Open grade: 5-8% voids; dense friction course: <5% voids (9).
*Classed as open grade as a result of the seal coat.

It should be noted that aggregates have a tendency to get polished under traffic, depending on their wear resistance, which is low for limestone and higher for traprock, for instance. Correspondingly the specularity class may shift with age, for instance from R2 to R3 or from R3 to R4. On the other hand, changes in Q_o may occur due to contamination or bleaching. Thus concrete darkens with time and asphalt brightens. Laterally grooved concrete appears darker (shadow effect) than the same concrete nongrooved. Figure 1 shows some details of Q_o relationships to aggregate composition.

Figure 1 - Aggregate material vs. % coarse aggregate



USE OF COMPUTER GRAPHICS TO AID IN DESIGN OF PUBLIC LIGHTING SYSTEMS

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The present work at TRRL arose from a combination of two existing projects, VIGIL and STAN.

VIGIL was a computer graphics system used to produce color-shaded perspective views of road scenes. This was a two-stage process, the first being the writing of a FORTRAN program defining the assembly of "primitives", such as spheres and cones, into an approximation of the real world. Subroutines were also written for the definition of common objects, such as lighting columns, signs and trees, enabling their generation by a simple subroutine call. The output of this stage was a computer file representing a mathematical description of the complete model.

The second stage used this output, together with viewing and lighting commands, to draw a color-shaded perspective display on a TV screen. This stage was interactive, in that viewing positions could be re-defined and a new perspective produced in less than a minute.

The limitations of this system were that the colors of materials were set subjectively, and severely limited in number. The total size of the model was also limited, as the hidden surface removal algorithm needed the whole model definition available at once. The advantages were that the picture output was geometrically correct and the viewpoint unlimited.

STAN is the CIE computer program for the calculation of road luminance patterns. This uses