

## **2.0 THE ROLE OF VISION IN DRIVING**

Good visual function is essential for safe driving. Any significant loss of visual function, such as visual acuity or visual field, will diminish a person's ability to operate a motor vehicle safely on today's congested, high-speed roadways. A driver with a marked visual defect may fail to perceive a potentially dangerous situation altogether or may see it too late to react appropriately.

When a patient is visually impaired, the Canadian Ophthalmological Society (COS) recommends that the physician inform him or her of the nature and extent of the visual defect and report the problem to the appropriate authorities if required. Reporting by ophthalmologists, other physicians and optometrists is one of the most effective ways to screen for visual defects that may be incompatible with safe driving.

This report presents information about recommendations for mandatory standards, other important visual functions that should be taken into consideration in determining fitness to drive, and recommendations for exceptional cases that require individual assessment. It also provides further details on recommended testing procedures (Appendix 1), and a list of medical conditions with increased risk for vision problems and a statement on the use of vision aids in driving (Appendix 2).

## **Recommended vision standards for driving**

### **2.1 VISUAL ACUITY**

The corrected visual acuity standards are shown in Table 1. A driver's visual acuity must at least be such that s/he has time to detect and to react to obstacles, pedestrians, other vehicles and signs while moving at the maximum posted speed in daylight and in darkness. Greater levels of visual acuity are required for some licence classes to ensure public safety. Road signage should be designed to be easily legible at a safe distance for all drivers who meet the minimum visual acuity standard.

**Table 1–Corrected visual acuity\* standards for the various classes of driving licences**

<b>Class of licence</b>	<b>Recommended standard</b>
5,6,7,8 (Personal Use)	Not less than 20/50 (6/15) with both eyes open and examined together
1, 2, 3,4	Not less than 20/30 (6/9) with both eyes open and examined together. Worse eye not less than 20/100 (6/30).
*The recommended testing procedure is outlined in Appendix 1.	

## 2.2 VISUAL FIELD

The visual field standards are shown in Table 2. An adequate continuous field of vision is important to safe driving. Any significant scotoma or restriction in the binocular visual field can make driving dangerous. Conditions often associated with visual field loss are listed in Appendix 2. If a visual field defect is suspected (based on a medical condition, subjective report or confrontation field assessment), the patient should be referred to an ophthalmologist or optometrist for further testing.

**Table 2–Visual field\* standards**

<b>Class of licence</b>	<b>Recommended standard</b>
5,6,7,8 (Personal Use)	120 continuous degrees along the horizontal meridian and 15 continuous degrees above and below fixation with both eyes open and examined together
1, 2, 3,4	150 continuous degrees along the horizontal meridian and 20 continuous degrees above and below fixation with both eyes open and examined together

\*The recommended testing procedure is outlined in Appendix 1.

## 2.3 DIPLOPIA

Diplopia (double vision) within the central 40° (i.e., 20° to the left, right, above and below fixation) of primary gaze is incompatible with safe driving for all classes of licence. Patients with uncorrected diplopia within the central 40° of primary gaze should be referred to an ophthalmologist or optometrist for further assessment. If the diplopia can be corrected completely with a patch or prisms to meet the appropriate standards for visual acuity and visual field, the patient may be eligible to drive. Before s/he resumes driving, there should be an adjustment period of 3 months or sufficient to satisfy the treating ophthalmologist or optometrist that adequate adjustment has occurred.

## **2.4 COLOUR VISION**

Colour is one of the information sources used in the recognition of traffic signs and signals, and various vehicle lamps and signals. All drivers must be able to recognize and respond to these stimuli in the driving environment. However, color vision in itself is not a requirement for safe driving and testing for color vision is not required. A driver may use such cues as the location, size, shape or brightness to recognize a sign or signal. A deficit in insight or cognition that may affect the driver's ability to make use of these compensatory strategies should be reported to the licensing authority.

## **2.5 CONTRAST SENSITIVITY**

People with reduced contrast sensitivity may experience difficulty with driving, in spite of having adequate visual acuity to drive. However, it is unclear at this time what level of reduction in contrast sensitivity represents an unacceptable risk for driving. Loss of contrast sensitivity can be associated with increased age, cataract and refractive surgery as well as other ocular disorders. Patients should be made aware of any significant reduction in contrast sensitivity.

## **2.6 DEPTH PERCEPTION**

Automobile accidents sometimes occur because of the driver's inability to judge distances accurately. However, judging distance is a skill that can be learned, even by people with monocular vision. Judgments of depth can be made based on monocular clues, such as the relative size or interposition of objects, and clearness of details. A more refined form of distance judgment, called stereopsis, is based on information coming from both eyes. A driver who has recently lost the sight of an eye or stereopsis may require a few months to recover the ability to judge distance accurately.

## **2.7 DARK ADAPTATION AND GLARE RECOVERY**

The ability to adapt to decreased illumination and to recover rapidly from exposure to glaring headlights is of great importance for night driving. The partial loss of these functions in older drivers, particularly those with cataracts or macular disease, may at times justify limiting their driving to daylight hours.

## **2.8 EXCEPTIONAL CASES**

The loss of certain visual functions, including total loss of vision in one eye, can often be compensated for adequately, particularly in the case of long-standing or congenital impairments. When a person becomes visually impaired, the capacity to drive safely varies with his or her compensatory abilities. As a result, there may be people with visual deficits who do not meet the vision standards for driving but who are able to drive safely. On the other hand, there may be people with milder deficits who do meet the vision standards but who cannot drive safely.

In these exceptional situations, it is recommended that the person undergo a special assessment for fitness to drive. The decision regarding fitness to drive can be made only by the appropriate licensing authorities. However, the COS recommends that the following information be taken into consideration: favourable reports from the ophthalmologist or optometrist; good driving record; stability of the condition; no other significant medical contraindications; other references (e.g., professional, employment); and assessment by a specialist at a recognized rehabilitation or occupational therapy centre for driver training.

In some cases it may be reasonable to grant a restricted or conditional licence to a driver to ensure safe driving. It may also be appropriate to make such permits exclusive to a single class of vehicles.

## **APPENDIX 1**

### **Recommended procedures for testing various visual functions**

#### **Visual Acuity**

The distance visual acuity of applicants should be tested using the refractive correction (spectacles or contact lenses) that they will use for driving. The examiner should assess visual acuity under binocular (both eyes open) or monocular conditions, if required by the standard. It is recommended that visual acuity be assessed using a Snellen chart or equivalent at the distance appropriate for the chart under bright photopic lighting conditions (i.e., greater than 80 cd/m<sup>2</sup>). Charts that are designed to be used at 3 m or greater are recommended.

#### **Visual field**

When a confrontation test is carried out to screen for visual field defects, the following procedure is recommended as a minimum.

The examiner stands or sits about 0.6 m in front of the examinee with eyes at about the same level. The examiner asks the examinee to fixate on the nose of the examiner with both eyes open.

The examiner extends his or her arms forward, positioning the hands halfway between the examinee and the examiner. With arms fully extended, the examiner asks the examinee to confirm when a moving finger is detected.

The examiner should confirm that the ability to detect the moving finger is continuously present throughout the area specified in the applicable visual field standard. Testing is recommended in an area of at least 180° horizontal and 40° vertical, centred around fixation.

If a defect is detected, the applicant should be referred to an ophthalmologist or optometrist for a full assessment.

When a full assessment is required, the following techniques are acceptable. **Please note that binocular testing is always preferred. If monocular field studies of the type noted below are available from the patient's file, they may suffice, but if the driver requires new field testing, please request binocular fields. Goldmann, Esterman and Humphrey 135 are the only tests that will test 150 degrees of horizontal vision as required for professional (Class 1-4) drivers.**

1. Goldmann III4e and V4e isopters.
2. Humphrey Esterman test.
3. Humphrey 81,120, 135, or 246 point screener. Set test strategy to single intensity or 3 zone and all other parameters to standard. Two zone Humphrey testing is inadequate.
4. Medmont 700 Driving Field.
5. Other visual field techniques will be accepted if appropriate.

Some automated testing devices used in driver testing centres have a procedure for assessing the extent of the visual field. However, these tests are often insensitive to many types of visual field defect, and thus may not be adequate for screening purposes.

### **Diplopia**

Any patient reporting double vision should be referred to an ophthalmologist or optometrist for further assessment.

### **Contrast sensitivity**

Assessment of contrast sensitivity is recommended for applicants referred to an ophthalmologist or optometrist for vision problems related to driving. Contrast sensitivity may be a more valuable indicator of visual performance in driving than Snellen acuity. The COS therefore encourages increased use of this test as a supplement to visual acuity assessment.

Contrast sensitivity can be measured by means of several commercially available instruments: the Pelli-Robson letter-based contrast sensitivity chart, the 25% or the 11% Regan low-contrast acuity chart, the Bailey-Lovie low-contrast acuity chart or the VisTech contrast sensitivity test. The testing procedures and conditions recommended for the specific test used should be followed.

**Depth perception**

There are no clinical tests available for assessing depth perception other than those used for stereopsis. If stereopsis assessment is required, the Titmus test can be used.

**Dark adaptation and glare recovery**

Currently there are no standardized tests or procedures that can be recommended for assessing these functions.

## **APPENDIX 2**

### **Medical conditions with increased risk for vision problems, and vision aids for driving**

#### **Medical Conditions**

Some medical conditions have a greater risk of associated vision problems.

Examples include:

- Corneal scarring
- Refractive surgery
- Cataract
- Diabetic eye disease
- Retinal disease
- Glaucoma
- Eye movement disorders
- Strabismus
- Optic nerve disorders
- Stroke
- Brain tumour/surgery
- Head injury
- Neurological disorders
- Multiple sclerosis

There are many other conditions that can cause vision problems. If a vision problem is suspected as a result of a medical condition, it is recommended that the patient be referred to an ophthalmologist or optometrist for further assessment of visual function.

#### **Vision aids**

Although telescopic spectacles, hemianopsia aids and other low-vision aids may enhance visual function, there are significant problems associated with their use in driving a motor vehicle. These include loss of visual field, magnification causing apparent motion and the illusion of nearness. It is felt, therefore, that the use of such aids is incompatible with safe driving.