GUIDES TO THE EVALUATION OF PERMANENT IMPAIRMENT

CHAPTER 12 – **THE VISUAL SYSTEM** – 5^{th} edition, 2001

This presentation is based on a draft for Chapter 12 in the official AMA *Guides*
For official use of the *Guides*, for a discussion of its principles (Ch. 1, 2) and for impairments of other organ systems, please see the official publication.

Introduction

This chapter provides criteria for evaluating permanent impairment of the visual system as it affects an individual's ability to perform activities of daily living. The visual system consists of the eyes and supporting structures, the neural pathways, and the visual cortex of the brain. The visual system is unique in that it combines the input from two separate eyes into a single visual perception.

This chapter focuses on functional impairment of the visual system as a whole. The impairment ratings in this chapter estimate the severity of the effects of certain types of vision loss on the ability to perform activities of daily living (ADL). Changes due to abnormalities in the optic nerve or visual cortex are also discussed in the chapter on the nervous system, Chapter 13.

This chapter has been significantly revised from the 4th edition of the *Guides*. The revision was based on a consensus within the international community of experts in low vision. Individuals interested in further discussion, including an emphasis on ability, can refer to the *Guide for the Evaluation of Visual Impairment*, published for the International Society for Low Vision Research and Rehabilitation.[12]

A summary of revisions follows.

1. The Visual Efficiency Scale that was used up to the 4th edition of the *Guides to the Evaluation of Permanent Impairment*[22, 23] was developed by Snell in 1925.[19, 20, 21] This scale was replaced with the Functional Vision Score (FVS).[17] The FVS provides an estimate of the effect of certain types of vision loss on the ability to perform activities of daily living. On this scale 20/200 is rated as a 50% impairment .

2. The Functional Vision Score is based on an assessment of visual acuity and visual field. The FVS allows for individual adjustments for other functional deficits, such as contrast and glare sensitivity, color vision, binocularity, stereopsis, suppression, and diplopia, if these deficits cause a significant ability loss that is not reflected in a visual acuity or visual field loss.

3. The extra scale and losses for diplopia and aphakia have been removed. Recommendations to make adjustments on an individual basis, if needed, have been added.

4. Near vision measurements are optional; the last section of this chapter contains a discussion on how to make the assessment of reading acuity more accurate.

5. Visual field is recalculated using a new Visual Field Score (VFS). To better account for the functional significance of losses in the two lower quadrants, the lower visual field carries 50% more weight than the upper field. Hemianopia is also scored more appropriately.

6. Visual impairment ratings are calculated using the formula (3 x OU + OD + OS)/5 instead of the prior formula (3 x better eye + 1 x lesser eye)/4. The new formula better accounts for situations where the binocular function is not identical to the function of the better eye. This can be particularly important for dissimilar field losses.

7. This edition also calculates a binocular impairment value for visual acuity and for field loss before combining these into an estimate of total visual loss and functional vision.

8. The impairment rating for the visual system = 100- the FVS.

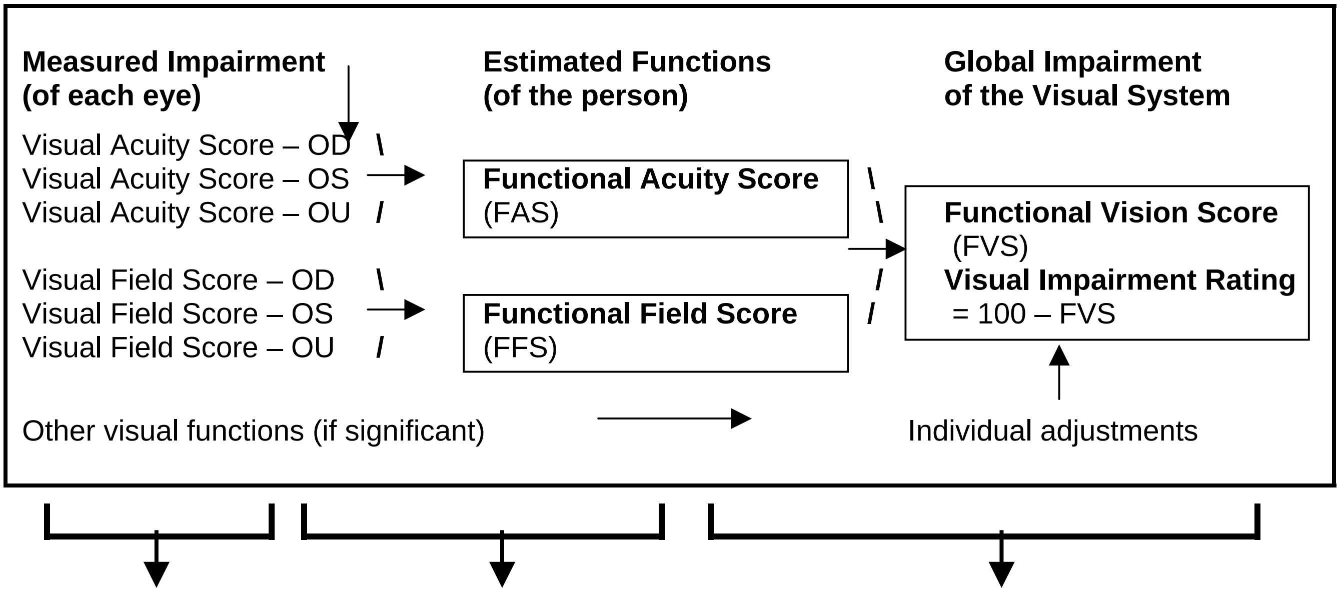
12.1 – Principles of Assessment

Before using the information in this chapter, the *Guides* user should become familiar with Chapters 1 and 2 and the Glossary. Chapters 1 and 2 discuss the *Guides'* purpose, applications, and methods for performing and reporting impairment evaluations. The Glossary provides definitions of common terms used by many specialties in impairment evaluation.

A permanent visual impairment is defined as a permanent loss of vision that remains after maximal medical improvement of the underlying medical condition has been reached. Ophthalmology has the capability to measure organ functions such as visual acuity and visual field rather precisely. Accordingly, this chapter uses a numerical assessment of visual functions to derive an estimate of their effect on functional vision (ie, on the ability to perform generic activities of daily living). The process is summarized in Table 12-1 *and in the following diagram that does not appear in the official Guides.*

See:	**Measured Visual Functions** *(how the eyes function)*	**Estimated Visual Abilities** *(how the person functions)*	*See:*
Tbl 12-1	**V**isual **A**cuity **S**core (VAS) = count of letters recognized	**F**unctional **A**cuity **S**core (FAS) combines: 60% OU + 20% OD + 20% OS	*Tbl 12-2*
Tbl 12-5	**V**isual **F**ield **S**core (VFS) = count of points detected	**F**unctional **F**ield **S**core (FFS) combines: 60% OU + 20% OD + 20% OS	*Tbl 12-6*
Txt 12-4b	Optional adjustment for other vision problems		
		Functional **V**ision **S**core (FVS) estimates general visual ability as: FAS x FFS / 100, (other losses)	*TXt 12-4*
		Visual System Impairment (VSI) estimates visual ability loss as: VSI (AMA) = 100 – FVS	*Txt 12-4c* *Tbl 12-10*
		Whole Person Impairment (WPI)	
Chapter 1-2	Using the WPI calculation and other factors to determine monetary compensation is a separate, administrative decision, beyond the scope of the AMA Guides.		

Table12-1 – Calculation of the Impairment Rating for the Visual System



1. Use Table 12-2 to convert each of the measured acuity values to a *Visual Acuity Score.*

2. Use Table 12-3 to combine the acuity scores from each eye to determine a single *Functional Acuity Score* .

5. Use the rules in Section 12.4 to combine the Functional Acuity Score and the Functional Field Score to determine the *Functional Vision Score* .

3. Use Table 12-5 or the rules in Section 12.3c to convert each of the measured field values to determine a *Visual Field Score*.

4. Use Table 12-6 to combine the field scores from each eye to determine a single *Functional Field Score.*.

6. Make adjustments for other visual function deficits, if significant.

Note that the prefix *visual* is used when the score refers to each eye. The prefix *functional* refers to the estimated performance of the individual. The term *vision score* combines visual acuity and visual field estimates (and individual adjustments, if significant).

12.1a – Steps to Calculate the Visual Impairment Rating

1. Measure visual acuity. Use Table 12-2 to convert each of the measured acuity values to a Visual Acuity Score (VAS).

2. Use Table 12-3 to combine the acuity scores from each eye to determine a single Functional Acuity Score (FAS).
Note: If the visual fields are normal and no individual corrections are made, the impairment rating for the visual system is equal to the acuity-related impairment rating (100 - FAS).

3. Measure the visual fields. Use Table 12-5 or the detailed instructions in Section 12.3c to convert each of the measured field values to a Visual Field Score (VFS).

4. Use Table 12-6 to combine the field scores from each eye to determine a single Functional Field Score (FFS).

5. Use the rules in Section 12.4 to combine the Functional Acuity Score and the Functional Field Score to determine a Functional Vision Score (FVS).

6. Subtract the Functional Vision Score from 100 to obtain the impairment rating for the visual system.

7. If additional visual impairments are not reflected in the reduction of visual acuity or visual field, the examiner may make an adjustment as explained in Section 12.4. The need for such adjustment must be well documented.

The procedure as outlined in Table 12-1 reduces a complex reality to a single number. This number ignores individual differences in adjustment to vision loss. This approach can be helpful for administrative and legal purposes because it does not penalize the individual who has made a good adjustment with a reduction of the impairment rating. By the same token, this approach cannot be used for individualized rehabilitation plans. Such plans must be based on an ability profile detailing each of the various skills and abilities of the specific individual. As the rehabilitation proceeds, successful adaptations will reduce further rehabilitation needs. Thus, the ability profile may change while the generic impairment rating will remain the same.

12.1b – Interpretation of Symptoms

Subjective symptoms of vision loss usually are the result of objective changes in visual acuity and/or visual field.

Visual acuity describes the ability of the eye to perceive details. Visual acuity loss will manifest itself in an inability to perform detail-oriented tasks, such as reading and face recognition. A lay term for visual acuity loss is *blurred vision.* Visual acuity loss affects many activities of daily living. Although visual acuity is governed by only a small area of the retina (the fovea, the central-most area), it occupies a major part of the visual cortex.

Visual field refers to the ability to detect objects in the periphery of the visual environment. A lay term for peripheral field loss is *tunnel vision*. Visual field loss will manifest itself in an inability to detect peripheral objects and, often, in a reduced ability to avoid obstacles. The peripheral visual field occupies the largest part of the retina, but it occupies a smaller part of the visual cortex.

Good visual acuity and good visual field are both needed for the performance of daily living skills. A person with tunnel vision may not notice when someone enters the room. A person with visual acuity loss, on the other hand, may notice the newcomer but may have difficulty recognizing the person’s face. Once an object has been detected in peripheral vision, central vision will be used to recognize it. A person with a visual field defect (ie, tunnel vision) may not notice a sign on the road or on a wall, but could read the sign once found, assuming the individual had good visual acuity. A person with normal visual field ability but a visual acuity loss will detect the sign, but will not be able to read it.

Another important function is contrast sensitivity. Whereas visual acuity is generally measured with small objects of high contrast, contrast sensitivity refers to the ability to detect larger objects of poor contrast. This ability is often needed for daily living skills. Facial characteristics are an example of typical low contrast objects. Contrast sensitivity loss often accompanies visual acuity loss, but it can occur separately. Because measurement methods for contrast sensitivity are not standardized, this function is not included in the impairment ratings. Where indicated, contrast sensitivity loss that exceeds the effects of the visual acuity loss may be handled as an individual adjustment.

Other symptoms may result from deficits in glare sensitivity, color vision, night vision, binocularity, stereopsis, suppression, and diplopia. If these deficits cause a significant ability loss that is not reflected in a visual acuity or a visual field loss, they may also be handled as adjustments to the impairment rating.

12.1c – Description of Clinical Studies

To obtain the required information, the physician needs to perform a detailed visual assessment, including the cause, severity, and prognosis of the underlying disorder and the expected or documented effects of the vision loss on the ability to perform activities of daily living. Such a visual assessment includes the following.

- Medical history with particular emphasis on pre-existing conditions and treatments and on the major cause of the current vision loss.
- Current condition of the eyes and visual system, with documentation of relevant anatomical findings.
- Visual acuity measurement, with best correction, binocularly and for each eye separately. Accurate measurement of distance visual acuity (letter chart acuity) is mandatory; measurement of near acuity (reading acuity) is optional.
- Visual field measurement for each eye.
- Other visual functions, such as contrast sensitivity or color vision, if considered relevant.
- Calculation of an initial impairment rating (visual ability estimate), as detailed in this chapter.
- Other factors that may affect the individual's ability to perform activities of daily living.
- Discussion (with documentation) of factors that might justify an adjustment of the initial ability estimate and discussion of apportionment considerations, if relevant.

In addition to the equipment needed for a standard ophthalmological evaluation, the following tools are required for the functional evaluation.

- Standardized letter chart. A lighted chart in a lighted room is preferred because it is more representative of normal viewing conditions than is a projector chart in a semidark room. Charts with 5 letters per line, proportional spacing, and a geometric progression of letter sizes are preferred.[5-10] For vision in the normal and near-normal ranges, testing at 20 ft is recommended. For testing in the low vision range, testing at 1 m is recommended (see Table 12-2). Test charts for this distance are commercially available.[24]
- Standardized reading tests. Such tests are optional. If performed, they should use standardized tests with continuous text segments as specified in the last section of this chapter. A geometric progression of letter sizes is preferred. Letter size designations should be in M-units[24] because the implementation of point size and Jaeger numbers has been shown to be inconsistent from chart to chart.
- Visual field equipment. If a restriction of the visual field is claimed or suspected, formal visual field testing on standardized equipment is required. If no visual field restriction is claimed, a confrontation visual field is acceptable to confirm the absence of field restrictions.
- Other functional tests, such as a contrast sensitivity test or glare test, if problems in these areas are reported.
- Samples of actual job-related tasks, if these tasks are different from average reading tasks.

12.2 – Impairment of Visual Acuity

12.2a – Visual Acuity Notations

Visual acuity is usually recorded as a fraction comparing the subject's performance to a performance standard. If the subject needs letters that are twice as large or twice as close as those needed by a standard eye (ie, 2x angular magnification), the visual acuity is 1/2. If letters are needed that are 5 times larger or 5 times closer than those needed by a standard eye, the visual acuity is 1/5, etc. In the US, it is customary to standardize the numerator at 20. Thus, a visual acuity of 1/2 is recorded as 20/40 and 1/5 is recorded as 20/100.

12.2b – Test Procedures

Visual acuity is usually measured with symbols (letters, numbers, pictures, or other symbols) presented in a letter chart format. Because visual acuity values can vary widely, the optimum testing distance is not the same for all groups.

12.2b.1 – Testing in the Normal Range

Individuals in the normal and near-normal range of vision (20/60 or better, *ICD-9-CM*[2], Table 12-2) represent the majority of all patients. The traditional letter charts and projector charts were designed for this group. The most common testing distance is 20 ft (6 m) because at this distance the optical difference with infinity may be ignored. When a printed chart is used, the indicated visual acuity values are valid only if the subject is located at the distance for which the chart was designed. If a projector chart is used, the subject must be located at the distance for which the projector was adjusted. Charts with a geometric progression of letter sizes, 5 letters on each row, and letter spacing that is equal to the letter size (often referred to as *ETDRS-type charts*) are the preferred standard.[9, 10]

The individual is placed at the distance for which the chart was designed and encouraged to read as far down as possible. The line is considered read when more than half of the characters (eg, 3 of 5) are read correctly. Most charts will indicate the visual acuity level that corresponds to the ability to read each line. When visual acuity is measured in this way, the result should be recorded using the standard US notation (ie, 20/…). The subject should be tested with the best available refractive correction.

When testing for visual acuities around the 20/200 level ("legal blindness"), the choice of letter chart is particularly important because it affects the assignment of benefits. On traditional charts that have no lines between 20/100 and 20/200, the descriptor "20/200 or less" becomes, effectively, "less than 20/100", so patients with 20/125 would be recorded as 20/200. On newer charts, "20/200 or less" is more appropriately interpreted as "less than 20/160". If only an older printed chart is available, the patient can be brought to 10 ft so that "less than 20/160" can be interpreted as "less than 10/80". The patient with 20/125 (10/63) is then reported appropriately as better than 20/200. Note that the term *"legal blindness"* is a misnomer because 90% of the individuals who have 20/200 or less visual acuity are not blind. The term *severe vision loss* as used in *ICD-9-CM* should replace the term *legal blindness*.

12.2b.2 – Testing in the Low Vision Range

Use of the *Guides* will often involve individuals whose visual acuity has dropped to less than 20/60 (ie, to the low vision range in *ICD-9-CM* [2], Table 12-2). Individuals in the low vision range form a minority of the general population, but may represent the majority of those for whom visual impairment evaluations are requested.

Traditional letter charts often have only a few letters for visual acuities worse than 20/100. Such charts are inadequate for the low vision range and have promoted the use of vague statements such as “count fingers” and “hand motions.” More accurate results can be obtained by bringing the chart closer. Testing at 1 m is recommended because it can cover the entire low vision range, down to 1/50 (20/1000).

When visual acuity is measured at 1 m, it should be recorded as a metric Snellen fraction in which the numerator records the test distance in meters (in this case 1 m, thus 1/…) and the denominator indicates the smallest letter size read in “M-units” (1 M = 1.45 mm = about 1/16 in). The standard US notation may be added in parentheses. Thus, the ability to read 8 M characters at 1 m should be recorded as 1/8 (20/160). Charts with a cord attached and labeled for 1-m testing are available commercially.[24]

12.2b.3 – Correction for Refractive Error

The visual acuity without correction may be reported as part of the general eye examination. The impairment ratings should be based on the *best-corrected* visual acuity. It is important, therefore, to ensure that the refractive correction is appropriate for the testing distance. This is especially true for the short viewing distances used for low vision subjects. If uncorrected and best-corrected visual acuity are the same, this should be stated explicitly.

12.2b.4 – Monocular vs Binocular Acuity

Because binocular viewing represents the most common viewing condition in daily life, the impairment rating should consider the best-corrected binocular visual acuity as well as the best-corrected acuity for each eye separately.

Under most circumstances, best-corrected visual acuity measured binocularly will be determined by the acuity of the better eye. There are exceptions, however. Patients with latent nystagmus may have better eye stability, and hence better acuity, when viewing binocularly than when one eye is occluded. Some patients with diplopia or with distortions in one eye may see better when the poorer eye is occluded.

12.2b.5 – Incomplete Data

Whenever possible, determination of an impairment rating should be based on direct examination of the patient. Occasionally, it may be necessary to determine a tentative impairment rating based on chart review, where complete data may not be available. If no better information is obtainable, use the following.

Interpret CF	… ft	as	…/200.
Interpret CF	… m	as	…/60.
Interpret HM	… ft	as	…/1000.
Interpret HM	… m	as	…/300.

Therefore, CF 3ft is interpreted as 3/200, HM 5ft is interpreted as 5/1000.

12.2b.6 – Use of Realistic Conditions

The evaluation of visual functions should be based on performance under optimal conditions. An exception can be made, however, when the best possible conditions are not feasible in daily life. Examples include a patient who would see better with contact lenses, but who cannot tolerate them; a patient with a large inter-ocular difference in refractive error who cannot tolerate full correction of both eyes; and a patient who can achieve better acuity with an extremely high or extremely low illumination level that cannot be achieved under daily living conditions or in the workplace.

Under these and similar conditions, the evaluation should be based on measurements obtained under realistic daily living conditions. Document why testing under suboptimal conditions is most appropriate. When testing multihandicapped individuals, a distinction must be made between failure to see and failure to respond.

12.2c – Steps for Assigning a Visual Acuity-based Impairment Rating

1. Assign a Visual Acuity Score for each eye.

Measure visual acuity as outlined above. Use Table 12-2 to replace the visual acuity value with a score value.

The left part of Table 12-2 lists the visual acuity ranges used in *ICD-9-CM*.[2] At the top of the scale are those with normal vision (20/20 or better) and at the bottom are those who are blind (no light perception). In between are those who have lost part of their vision. This group is said to have low vision (the word *vision* indicates that they are not blind, the word *low* indicates that they have less than normal vision). The visual acuity values follow a geometric progression—each line differs from the adjacent lines by a fixed ratio (25%, 10 steps = 10x).

The central part of Table 12-2 lists impairment ratings. This conversion is based on Weber-Fechner's law, which states that a proportional increase in the stimulus corresponds to a linear increase in sensation. The Visual Acuity Score (VAS) has fixed increments (5 points) based on counting 1 point for each letter read on a standard acuity chart with 5 letters per line. The VAS is an *ability* scale on which higher values indicate better function. The impairment rating, which is a scale of *ability loss*, is obtained by subtracting the VAS from 100. Note that the VAS extends beyond 100 (as does normal visual acuity), but that ability loss is counted only when visual acuity is less than 20/20.

The right part of Table 12-2 lists the estimated impact of visual acuity loss on reading ability. These ranges are based on a general ability scale with the following gradations.[17]

100 +/- 10	Range of normal	Normal function, with reserve capacity
80 +/- 10	Mild loss (near-normal)	Normal function, but loss of reserve capacity
60 +/- 10	Moderate loss	Normal function, but need for some aids
40 +/- 10	Severe loss	Restricted function, slower than normal, even with aids
20 +/- 10	Profound loss	Restricted function, marginal performance, even with aids
0 +/- 10	(Near-)total loss	Cannot perform, needs substitution skills

The three parts of Table 12-2 fit well with each other. This confirms that the Visual Acuity Score is a reasonable estimate of acuity-related visual abilities and that the impairment rating is a reasonable estimate of acuity-related performance loss. If no visual acuity data were obtainable, the right side of Table 12-2 might be used to obtain a very rough impairment estimate.

2. Combine the acuity values.

After the best corrected visual acuity values for binocular vision (OU), for the right eye (OD), and for the left eye (OS) have been obtained and converted to Visual Acuity Scores (VAS), these values need to be combined to a single Functional Acuity Score (FAS). The FAS provides an estimate of the ability of the person to perform acuity-dependent daily living tasks. This is done using Table 12-3.

Note that VAS and FAS may differ. For example, a subject with one blind eye will have a 0 VAS for that eye. However, if the other eye is normal, the FAS will be near-normal, indicating normal performance but loss of reserves (see Examples 12-2 and 12-14).

The acuity-related impairment rating (IR) is calculated by subtracting the Functional Acuity Score from 100. Note that the FAS can be larger than 100, but that the impairment rating is truncated at 0.

3. Consider reading acuity. (optional)

Determination of reading acuity (near vision) is optional. It is explained in more detail in the last section of this chapter. Reading acuity is typically determined binocularly, but may be determined monocularly if this gives better results.

If reading acuity is significantly worse than letter acuity, the functional acuity score may be adjusted to the average of the letter chart (or distance) acuity score and the reading (or near) acuity score. The probable reason for the discrepancy should be explored and explained.

Table 12-2 – Impairment of Visual Acuity*

See next page

Table 12-3 – Calculation of the Acuity-related Impairment Rating *

Measured Snellen Values		Calculated Visual Acuity Scores	
OU: letter chart acuity: 20/___	→	VAS_{OU}: ___	x 3 = ___
OD: letter chart acuity: 20/___	→	VAS_{OD}: ___	x 1 = ___
OS: letter chart acuity: 20/___	→	VAS_{OS}: ___	x 1 = ___
Add and divide by 5 to calculate the weighted average			______+, /5
Functional Acuity Score (FAS)			= ___
Acuity-related Impairment Rating = 100 – FAS =			___

Optionally, calculate a Visual Acuity Score for reading (near) acuity. If the outcome is significantly different from the letter chart acuity score, document the differences and calculate the average:

$$FAS_{global} = (FAS_{letter\ chart} + FAS_{reading})/2.$$

*If visual fields are normal and no individual adjustments are made, the acuity-related impairment rating equals the visual system impairment rating .

Table 12-2 – Impairment of Visual Acuity*

Impairment Classes (Based on *ICD-9-CM*)		**Visual Acuity** US notation	**Visual Acuity** 1 m notation	**Visual Acuity Score** (ability)	**Impairment Rating** (ability loss)	**Estimated Reading Ability**
(Near-) Normal Vision	Range of Normal Vision	20/12.5 20/16 20/20 20/25	1/0.63 1/0.8 1/1 1/1.25	110 105 100 95	… … 0 5	Normal reading speed Normal reading distance Reserve capacity for small print
	Near-Normal Vision	20/32 20/40 20/50 20/63	1/1.6 1/2 1/2.5 1/3.2	90 85 80 75	10 15 20 25	Normal reading speed Reduced reading distance No reserve for small print
Low Vision	Moderate Low Vision	20/80 20/100 20/125 20/160	1/4 1/5 1/6.3 1/8	70 65 60 55	30 35 40 45	Near-normal with reading aids Uses low power magnifier or large print books
	Severe Low Vision	20/200 20/250 20/320 20/400	1/10 1/12.5 1/16 1/20	50 45 40 35	50 55 60 65	Slower than normal with reading aids Uses high-power magnifiers
	Profound Low Vision	20/500 20/630 20/800 20/1000	1/25 1/32 1/40 1/50	30 25 20 15	70 75 80 85	Marginal with reading aids Uses magnifiers for spot reading, but may prefer talking books
(Near-) Blindness	Near-Blindness	20/1250 20/1600 20/2000 less	1/63 1/80 1/100 less	10 5 0 negative	90 95 100 …	No visual reading Must rely on talking books, Braille, or other nonvisual sources
	Total Blindness	No light perception				

*Use this Table to determine a Visual Acuity Score for each eye. Proceed to Table 12-3 to combine the scores from each eye to a single Functional Acuity Score.

NOTE: The visual acuity values used in this table follow a strict geometric progression. For clinical use values such as 20/32 and 20/63 may be rounded to 20/30 and 20/60.

Table 12-4 – Classification of Visual Acuity-based Vision Loss*

Class 1 0%-9% Impairment of Visual Acuity	**Class 2 10%-29% Impairment of Visual Acuity**	**Class 3 30%-49% Impairment of Visual Acuity**	**Class 4 50%-69% Impairment of Visual Acuity**	**Class 5 70%-89% Impairment of Visual Acuity**	**Class 6 90%-100% Impairment of Visual Acuity**
FAS: $\geq$ 91	FAS: 90-71	FAS: 70-51	FAS: 50-31	FAS: 30–11	FAS: $\leq$ 10
Range of normal vision	Near-normal vision (mild vision loss)	Moderate vision loss	Severe vision loss	Profound vision loss	(Near-) Total vision loss
Both eyes have visual acuity of 20/25 or better	Both eyes have visual acuity of 20/60 or better	Both eyes have visual acuity of 20/160 or better	Both eyes have visual acuity of 20/400 or better	Both eyes have visual acuity of 20/1000 or better	Both eyes have visual acuity worse than 20/1000
	One eye has 20/200 or less, the other eye is normal	One eye has 20/200 or less, the other eye has 20/80	One eye has 20/200 or less, the other eye has 20/200		

*This Table assumes that the visual fields are normal and provides general impairment ranges for the listed conditions. Use Tables 12-2 and 12-3 to calculate a more exact impairment rating and to handle cases of visual acuity loss that are not listed. Proceed to Tables 12-5 and 12-6 if visual field loss is present.

12.2d – Calculation Examples for Visual Acuity Loss

Note: In the following examples it is assumed that the visual acuity loss is the only deficit. Visual fields and other visual functions are presumed to be normal.

Example 12-1 **15% Impairment Due to Visual Acuity Loss**

Subject: 17-year-old student.
History: Driving instructor questions the student's visual acuity.
Always liked to sit in front of the class to see the blackboard.
Current Symptoms: Has difficulty with distant road signs.
Physical Exam: No ocular abnormalities.
Diagnosis: Unexplained amblyopia, possibly congenital**.**
Clinical Studies: Best-corrected acuities are: VOU: 20/40, VOD: 20/40, VOS: 20/40.
Visual fields are normal in both eyes,
there are no other deficits in visual functions.
Functional Acuity Score: *Use Table 12-2 to determine the Visual Acuity Score for each eye. and Table 12-3 to combine the values to a Functional Acuity Score.*

VOU	20/40	85 x 3 =	255
VOD	20/40	85 x 1 =	85
VOS	20/40	85 x 1 =	85
Functional Acuity Score			425/5 = 85

Impairment Rating: 100 – 85 = 15% visual acuity impairment

Comment: This rating places the person in the range of near-normal vision or mild vision loss. Persons in this range can generally function normally, but they need to bring reading material close.

Example 12-2 **<u>16% Impairment Due to Visual Acuity Loss</u>**

Subject: 45-year-old office woman.
History: Office worker; left eye was enucleated in childhood.
Current Symptoms: Can perform all office functions.
Physical Exam: Left eye replaced by good fitting prosthesis.
Diagnosis: History of retinoblastoma.
Clinical Studies: Best-corrected acuities are:VOU: 20/15, VOD: 20/15, VOS: NLP.
Functional Acuity Score: *Use Tables 12-2 and 12-3, as above.*

VOU	20/15	105 x 3 =	315
VOD	20/15	105 x 1 =	105
VOS	NLP	0 x 1 =	0
Functional Acuity Score: =			420/5 = 84

Impairment rating: 100 – 84 = 16% visual acuity impairment.

Comment: Based on visual acuity, this person's condition is in the near-normal range. The visual field in the left eye is also lost (see Section 12.3). However, because this loss is not independent of the visual acuity loss (see the previous section) and does not exceed the visual acuity-based loss, the Functional Vision Score will still be equal to the Functional Acuity Score (see Example 12-14).

Example 12-3 **<u>21% Impairment Due to Visual Acuity Loss</u>**

Subject: 35-year-old man.
History: Farm worker; scratched the left eye on a branch several years ago.
Current Symptoms: Farm work is OK, no interest in reading or fine crafts.
Physical Exam: Dense corneal scar in OS.
Diagnosis: Vision loss due to corneal opacity.
Clinical Studies: Best-corrected acuities are: VOU: 20/40, VOD: 20/40, VOS: 20/400.
Functional Acuity Score: *Use Tables 12-2 and 12-3, as above.*

VOU	20/40	85 x 3 =	255
VOD	20/40	85 x 1 =	85
VOS	20/400	35 x 1 =	35
Functional Acuity Score =			395/5 = 79

Impairment Rating: 100 – 79 = 21% visual acuity impairment.

Comment: Even though the left eye has much poorer vision than in Example 12-1, this person is still in the range of near-normal vision or mild vision loss. Note that the impairment rating is influenced much more by binocular function than by the function of the lesser eye.

Example 12-4 **36% Impairment Due to Visual Acuity Loss**

Subject: 70-year-old woman.
History: Homemaker; noticed gradual vision loss over several years. Afraid of surgery.
Current Symptoms: Increasing difficulties with reading.
Physical Exam: Early lens opacity OD, dense cataract OS.
Diagnosis: Vision loss due to cataract.
Clinical Studies: Best-corrected acuities are: VOU: 20/60, VOD: 20/60, VOS: 20/800.
Functional Acuity Score: *Use Tables 12-2 and 12-3, as above.*

VOU	20/60	75 x 3 =	225
VOD	20/60	75 x 1 =	75
VOS	20/800	20 x 1 =	20
Functional Acuity Score =			320/5 = 64

Impairment Rating: 100 – 64 = 36% visual acuity impairment.

Comment: Although 20/60 is still in the near-normal range, the very poor condition of the other eye drops the person to the range of moderate vision loss. Persons in this range can perform activities of daily living but may require some aids, such as a hand-held magnifier, to perform detail-oriented tasks, such as reading. If VOU were not available, assume that VOU = VOD and proceed as above.

Example 12-5 **52% Impairment Due to Visual Acuity Loss**

Subject: 25-year-old woman.
History: College student; vision loss since teens.
Current Symptoms: Relies on talking books and videomagnifier for her studies.
Physical Exam: Irregular foveal reflex OU.
Diagnosis: Stargardt juvenile maculopathy.
Clinical Studies: Best-corrected acuities are: VOU: 20/200, VOD: 20/300, VOS: 20/200.
Functional Acuity Score: *Use Tables 12-2 and 12-3, as above.*

VOU	20/200	50 x 3 =	150
VOD	20/300	40 x 1 =	40
VOS	20/200	50 x 1 =	50
Functional Acuity Score =			240/5 = 48

Impairment Rating: 100 – 48 = 52% visual acuity impairment.

Comment: This person is in the range of severe vision loss (sometimes called legal blindness in the US) and will have limitations in the ability to perform activities of daily living even with aids. Persons in this range will need to rely more heavily on assistive devices.

12.3 – Impairment of the Visual Field

12.3a – Test Procedures

If no visual field impairment is claimed or suspected (impairment rating = 0), a confrontation visual field may be used to confirm a normal field. In all other circumstances (impairment rating > 0), formal visual field tests should be performed by qualified personnel according to the instructions provided with the equipment.

12.3a.1 – Confrontation Visual Field

This method uses only the examiner's hands. Seated in front of the subject, the examiner moves his or her hands from the periphery inward, to test for the peripheral field limits. This method is an acceptable way to confirm a normal visual field in subjects in whom no field loss is claimed, but it is too gross for detailed evaluation if a field loss is claimed or suspected.

12.3a.2 – Tangent Screen Testing

This method uses a black screen on which variously sized objects may be moved. This method is difficult to standardize and loses accuracy beyond 45°. It is not acceptable for the accurate assessment of permanent impairment.

12.3a.3 – Goldmann-type Testing

The Goldmann visual field equipment provided the first standardized measurement technique. Testing is done in a bowl so that all testing distances are equal while the background and stimulus luminances can be controlled tightly. The usual mode of testing is known as *kinetic perimetry* because a test stimulus of constant size and intensity is moved by an operator.

The test results are plotted as *isopters*, contour lines that outline the areas where stimuli of various intensity can be perceived. The functional implications of certain isopter patterns are relatively easy to interpret. Agencies, such as the Social Security Administration, often require testing of the Goldmann III4e isopter for eligibility determinations.

12.3a.4 – Automated Perimetry

In recent decades, there has been a move from manual to automated perimetry. (Commonly used equipment includes Humphrey, Octopus, Dicon, and other brands.) This has been accompanied by a move to static perimetry. In static perimetry, the presentations are limited to various fixed locations where stimulus size and intensity are varied.

Automated perimetry results are commonly plotted as a gray scale. Such reports are better suited for automated statistical analysis. They are less intuitive for human interpretation with regard to functional vision. Most clinical tests are limited to the central 30° because this is the most important area for medical diagnostic purposes. For the functional assessment of visual field loss, however, testing to 60° or beyond is mandatory.

12.3a.5 – Binocular Fields

Considering both monocular and binocular function is even more important for a functional assessment of the field of vision than it is for visual acuity because intact field areas in one eye may compensate for field loss in the other eye. In cases of asymmetric field loss, the binocular field of view may be substantially better than the field of view of either eye alone.

Direct testing of the binocular visual field presents problems, however, because the amount of convergence in a bowl perimeter cannot be monitored and fixation monitoring devices will not work when the head, rather than the eye, is centered. Therefore, the fields of each eye should be measured separately and a binocular field plot should be derived from the superimposition of the two monocular field plots.

12.3a.6 – Tests Used

When Goldmann equipment is used, the III4e isopter should be plotted. If only a larger isopter is available, this isopter may be used (this may result in an underestimation of the field loss). If only smaller isopters are available, the test cannot be used for impairment evaluation.

If automated equipment is used, a pseudoisopter equivalent to the Goldmann III4e isopter should be constructed (see Example 12-9). On the Humphrey equipment, this would be the isopter for a 10 dB stimulus. Plots of the central 30° may only be used when the remaining field is smaller than 20° and confrontation testing indicates no further peripheral vision.

12.3b – The Visual Field Score (VFS)

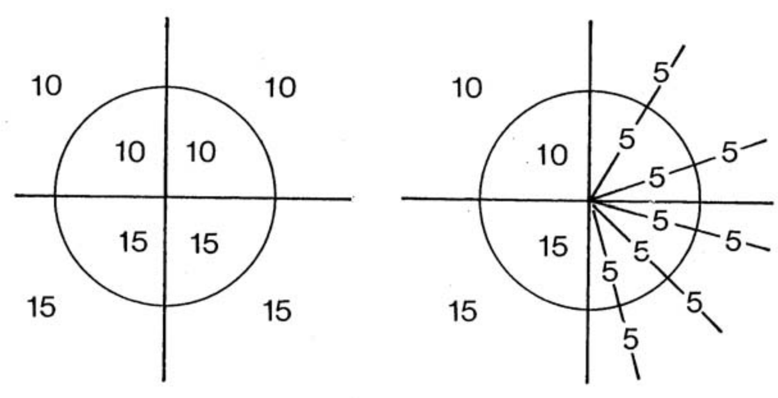
The Visual Field Score (VFS), which is the basis for the calculation of visual field-based impairment ratings, parallels the Visual Acuity Score (VAS). The Visual Acuity Score can be determined by counting the letters read correctly on a standardized visual acuity chart. Similarly, the Visual Field Score can be determined by counting the points seen on a standardized visual field grid. The combination rules are also similar.

12.3b.1 – Testing Grid

The testing grid is constructed by drawing 10 meridians: 2 in each of the upper quadrants and 3 in each of the lower quadrants. The optimal positions for the 10 meridians are: 25°, 65° (upper right), 115°, 155° (upper left), 195°, 225°, 255° (lower left), 285°, 315°, and 345° (lower right). Along these meridians 5 points (spaced 2° apart) are assigned to the central 10° and 5 points (spaced 10° apart) are assigned to the periphery beyond 10°. Thus, a 60° radius will represent 10 points. The nasal and superior meridians may not reach 60°, but the lateral field will extend further. Thus, the average normal field will score about 100 points.

Figure 1 summarizes the point assignments. The circle represents a 10° radius.

Figure 12-1 – Visual Field Testing Grid



This arrangement has the following effects.

- The visual field score for the central 10° is 50 points. This reflects that the central 10° of the visual field correspond to 50% of the primary visual cortex. This also maintains the traditional assumption that a visual field loss to a 10° radius is equally disabling as a visual acuity loss to 20/200.
- Choosing the measured meridians within the quadrants rather than along the horizontal and vertical meridians avoids the need for special rules for hemianopias.
- A complete homonymous hemianopia receives a 50-point score. This implies that it is considered equally disabling as a field restriction to a 10° radius or as a visual acuity loss to 20/200.
- Choosing 3 meridians in the lower quadrants and 2 in the upper ones acknowledges the functional importance of the lower field by giving it 50% extra weight.
- *ICD-9-CM* defines severe, profound, and near-total visual field loss as concentric restriction to a 10°, 5°, and 2.5° field radius.[2] These categories fit the VFS scale.

The Visual Field Score is summarized in Table 12-5, which is similar to Table 12-2 in organization.

Table 12-5 Impairment of the Visual Field*

See next page

Table 12-6 –Calculation of the Field-related Impairment Rating

Measured Field Plots		**Calculated Visual Field Scores**		
Binocular field plot (OU)	→	VFS_{OU}: ___	x 3 =	___
Field plot right eye (OD)	→	VFS_{OD}: ___	x 1 =	___
Field plot left eye (OS)	→	VFS_{OS}: ___	x 1 =	___
Add and divide by 5 to calculate the weighted average			________	+5, /5
Functional Field Score (FFS)			=	___
Field-related Impairment Rating = 100 – FFS =				___

Table 12-5 Impairment of the Visual Field*

Impairment Classes (Based on *ICD-9-CM*)		**Special Conditions**	**Avg. Radius** if loss is concentric	**Visual Field Score** (ability)	**Impairment Rating** (% ability loss)	**Estimated Ability for Visual Orientation and Mobility** (O + M Tasks)
(Near-) Normal Vision	Range of Normal Vision		60°	110 105 100 95	… … 0 5	Normal visual orientation Normal mobility skills
	Near-Normal Vision	Loss of one eye	50° 40°	90 85 80 75	10 15 20 25	Normal O + M performance Needs more scanning Occasionally surprised by events on the side
Low Vision	Moderate Low Vision	Lost upper field	30° 20°	70 65 60 55	30 35 40 45	Near-normal performance Requires scanning for obstacles
	Severe Low Vision	Hemianopia Lost lower field	10° 8°	50 45 40 35	50 55 60 65	Visual mobility is slower than normal. Requires continuous scanning. May use cane as adjunct
	Profound Low Vision		6 4°	30 25 20 15	70 75 80 85	Must use long cane for detection of obstacles May use vision as adjunct for identification
(Near-) Blindness	Near-Blindness		2° 0°	10 5 0	90 95 100	Visual orientation unreliable Must rely on long cane, sound, guide dog, and other blind mobility skills
	Total Blindness	No visual field				

*This Table follows the clinical usage of describing field losses on the basis of the remaining radius. In the rehabilitation and disability literature, field losses are often described on the basis of the remaining diameter (eg, a concentric field loss to a *radius* of 10° leaves a field with a *diameter* of 20°).

Use Table 12-5 or the detailed rules in Section 12.3c to determine a Visual Field Score for each eye. Proceed to Table 12-6 to combine the scores from each eye to determine a single Functional Field Score.

Table 12-7 – Classification of Visual Field-based Vision Loss*

Class 1 0%-9% Impairment of the Visual Field	**Class 2 10%-29% Impairment of the Visual Field**	**Class 3 30%-49% Impairment of the Visual Field**	**Class 4 50%-69% Impairment of the Visual Field**	**Class 5 70%-89% Impairment of the Visual Field**	**Class 6 90%-100% Impairment of the Visual Field**
FFS: ≥ 91	FFS: 90-71	FFS: 70-51	FFS: 50-31	FFS: 30-11	FFS: ≤ 10
Range of normal vision	Near-normal vision (mild vision loss)	Moderate vision loss	Severe vision loss	Profound vision loss	(Near-) Total vision loss
Both eyes have visual fields > 50°	Both eyes have visual fields ≤ 50° and > 30°	Both eyes have visual fields ≤ 30° and > 10°	Both eyes have visual fields ≤ 10° and 6°	Both eyes have visual fields ≤ 6° and >2°	Both eyes have visual fields of 2° radius or less
	One eye is lost (other eye normal)	Both eyes have lost the upper half-field	Both eyes have lost the lower half-field		
			Homonymous hemianopia		

*This Table assumes that the visual acuity is still normal. It can be used to determine the general impairment range for the listed conditions. Use Tables 12-5 and 12-6 or the detailed rules in Section 12-3c to calculate a more exact figure and to handle other visual field loss. Use Tables 12-2 and 12-3 if visual acuity loss is present.

12.3c – Assigning a Field-based Impairment Rating

Calculation of a visual field-based impairment rating requires the following steps.

1. Determine the extent of the visual field for each eye.

If Goldmann visual field plots are available, determine the III4e isopter for each eye.

If only automated visual field plots are available, determine a pseudoisopter by drawing a line surrounding all points with a sensitivity of 10 dB or better, excluding points with < 10 dB sensitivity.

If automated field plots are used, these should be full-field plots (Humphrey 60-2 or the equivalent). The 30° plot may be used only if confrontation testing has determined that there are no peripheral islands of vision and if a 30° central field plot (Humphrey 30-2 or the equivalent) shows that there is no vision beyond 20°.

2. Determine the Visual Field Score for each eye.

Use the pattern explained in Figure 1. This pattern can be implemented in several ways.

2a. Paper and pencil

- Starting with a visual field plot of the III4e isopter (or the equivalent), draw 10 meridians: 2 in each upper quadrant and 3 in each lower quadrant. To space the meridians evenly, use the following approximate positions: 25°, 65° (upper right), 115°, 155° (upper left), 195°, 225°, 255° (lower left), 285°, 315°, and 345° (lower right).
- Determine the extent of each meridian. Within 10° from fixation, round to the nearest 2° value; outside 10° round to the nearest 10° value. Convert the rounded extent to a subscore using Table 12-8.

Table 12-8 Conversion of Field radius to Field Score

Rounded Peripheral Field limits:

Extent:	0°	2°	4°	6°	8°	10°	20°	30°	40°	50°	60°	70° or more
Score:	0	1	2	3	4	5	6	7	8	9	10	11

Subtract for scotomata within 10°:

Radial Extent:	1°	2°	3°	4°	5°	6°	7°	8°	9°
Subtract:	0	1	1	2	2	3	3	4	4

Subtract for scotomata outside 10°:

Radial Extent:	1-4°	5-14°	15-24°	25-34°	35-44°	45-54°
Subtract:	0	1	2	3	4	5

- If a scotoma interrupts the meridian, round the extent of the scotoma to the nearest 2° or 10° value and subtract the corresponding point value. In the presence of scotomata, use of the overlay grid is the preferred method.
- Add the 10 subscores to obtain the Visual Field Score (VFS) for that eye. The average normal field will score about 100 points.

2b. Overlay grid

- Create an overlay grid with 10 meridians (see Step 2a) and grid points on each meridian at: 1°, 3°, 5°, 7°, 9°, 15°, 25°, 35°, 45°, 55° and 65°.
- Place the overlay grid over the field plot. Count the grid points enclosed by the III4e isopter (or the equivalent). Grid points within scotomata should not be counted. The total number of points seen is the Visual Field Score (VFS).

2c. Automated calculation

- A pilot study in 1992 conducted with a Humphrey Field Analyzer and controlled by an IBM-PC, has shown the feasibility of a fully automated test sequence using the points of the overlay grid as stimulus positions.[16] Such a program is presently not yet available commercially.

3. Determine the Functional Field Score (FFS).

Determine the binocular field by superimposing the monocular fields. For the binocular field, points are counted as seen if seen by both eyes or by one of the eyes. This determines the binocular VFS.

Combine the Visual Field Scores for OU, OD, and OS (see Table 12-6): FFS = (3 x VFS_{OU} + VFS_{OD} + VFS_{OS})/5.

4. The visual field-based impairment rating is 100 – FFS.

12.3d – Calculation Examples for Visual Field Loss

The following examples calculate the Visual Field Score for a single eye. This needs to be followed by the same calculation for the other eye and for the binocular field (see Examples12-12 and 12-13). Finally, use Table 12-6 to combine these values to determine a Functional Field Score .

Example 12-6 **0% Impairment Due to Visual Field Loss**

Request: Determine the Visual Field Score for an eye with the Goldmann III4e isopter as shown in Figures 12-2 and 12-3.

Method 1: *Draw 10 meridians (see instructions on page XXX).*
Measure the extent in degrees of each meridian.
Use Table 12-8 to convert the extents to subscores.
Add the subscores: (10 + 9) + (9 + 11) + (11 + 11 + 11) + (10 + 9 + 9) = 100.

Method 2: *Create an overlay grid (see instructions in Section 12-3c). Count the points within the III4e isopter. The diagram has 100 solid dots within the 60⁰ circle and 8 open dots outside. The score is easily counted as: 100 – solid dots missed (symbol x) + open dots seen (symbol heavy **o**).*
For this field plot: FFS = 100 – 4 + 4 = 100.

Figure 12-2 – Normal field with Measured Meridians

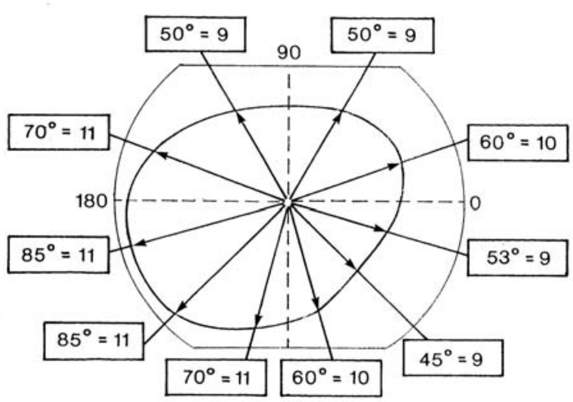
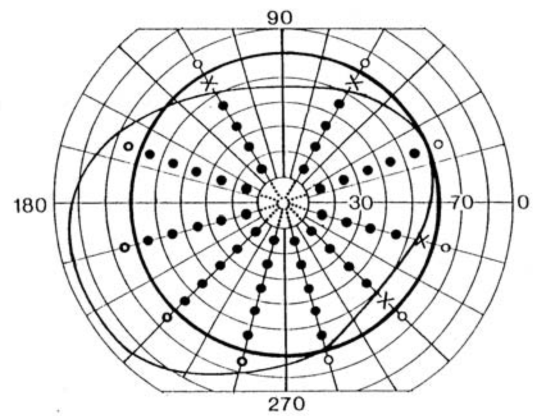


Figure 12-3 – Normal field with Overlay grid



Comment: The Visual Field Score is 100; therefore, the impairment rating is 0. Note that points seen laterally compensate for points missed nasally and superiorly.

Example 12-7 **<u>18% Impairment Due to Visual Field Loss</u>**

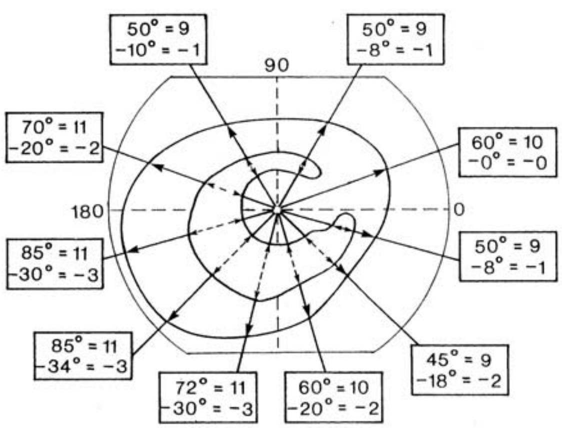
Request: Determine the Visual Field Score for a patient with a mid-peripheral ring scotoma due to early RP. The central field is not affected. The Goldmann II4e isopter is as indicated in Figures 12-4 and 12-5.

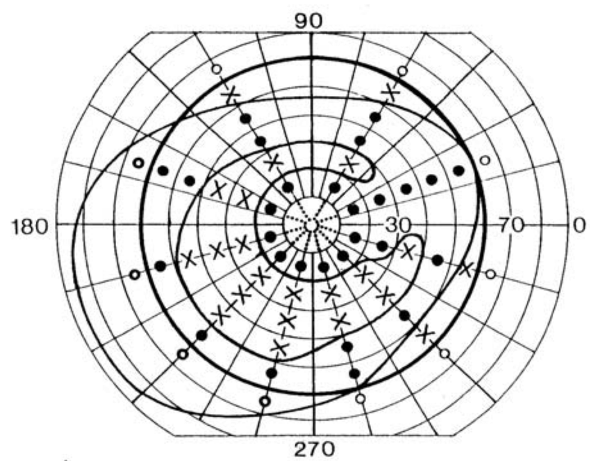
Method 1: *Determine the peripheral field limits and the peripheral subscore as in Example 12-8. (For simplicity, the peripheral score is kept the same.) Determine the extent of the scotoma in each of the sample meridians. Subtract the amounts indicated in Table 12-8.*
The Visual Field Score is 82. < *Note: "90" in the Guides is a typo* >

Method 2: *Using the overlay grid as in Example 12-8, do not count the 18 points within the scotoma.*

Figure 12-4 – Midperipheral scotoma with Measured Meridians

Figure 12-5 – Midperipheral scotoma with Overlay grid





Comment: The Visual Field Score is reduced by 18 points from 100 to 82 (18% impairment). This places the patient in the near-normal range. Because the scotoma is in the mid-periphery, central vision is not affected and far peripheral vision still warns of obstacles. Thus, the effect on daily living skills is relatively minor. The effect on the whole person depends on the exact condition of the other eye.

Example 12-8 **<u>20% Impairment Due to Visual Field Loss</u>**

This patient has a juxtafoveal scotoma due to early macular degeneration. Letter chart acuity is still unaffected.

Request: Determine the Visual Field Score.

Method 1: Subtract points from each meridian as indicated in the diagram.
100 – 20 = 80 (20% Impairment).

Method 2: Subtract the solid dots not seen. 100 – 20 = 80 (20% Impairment).

Comment: Although this scotoma is far smaller than the one in the previous example, it will significantly interfere with reading and similar ADL tasks. This justifies a significant decrease of the Functional Field Score and a corresponding increase in the impairment rating.
(See also Examples 12-13 and 12-14.)

Figure 12-6 – Juxtafoveal scotoma with Measured Meridians

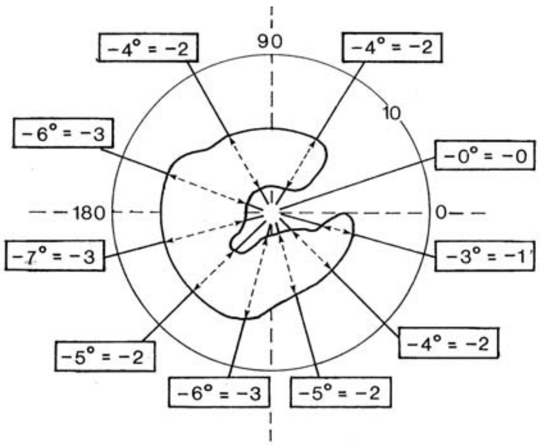
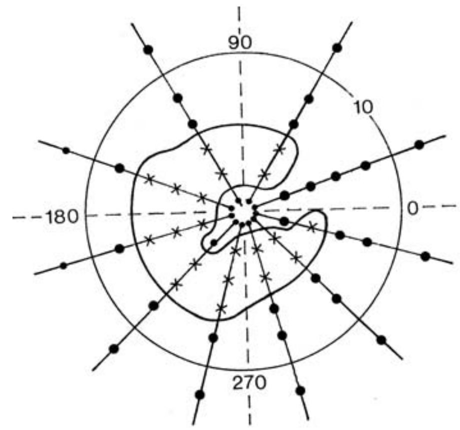


Figure 12-7 – Juxtafoveal scotoma with Overlay grid



Example 12-8 **<u>72% Impairment Due to Visual Field Loss</u>**

A Goldmann visual field test is not available for this patient. Automated static perimetry has been performed with the following result.

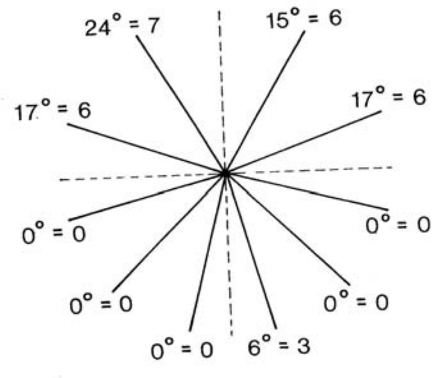
Figure 12-8 – Tunnel Vision: Automated Perimetry Plot

			4	0	0	0			
		0	16	18	0	5	0		
	0	6	14	22	18	18	16	11	
0	0	12	21	18	24	25	20	0	0
0	0	12	14	18	28	22	22	18	16
0	0	0	0	0	23	0	0	16	18
0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	
		0	0	0	0	0	0		
			0	0	0	0			

Follow these steps:

1. Construct a pseudoisopter around the points with better than 10 dB sensitivity.
2. Measure the extent in the 10 meridians. If this is a Humphrey 30-2 plot, the test points are 6° apart. The subscores are shown in Figure 12-9.

Figure 12-9 – Extent of the ten meridians for the Pseudoisopter in 12-8



The Visual Field Score is 28. The field-related impairment rating is 100 – 28 = 72.

Comment: This may be a case of advanced retinitis pigmentosa. The automated field test did not test points beyond 30° from fixation. The calculated Visual Field Score is acceptable only if there is additional evidence that there is no further peripheral vision. A full-field automated test is preferred. In the absence of such a test and in advanced cases like this one, evidence from a confrontation visual field may be acceptable.

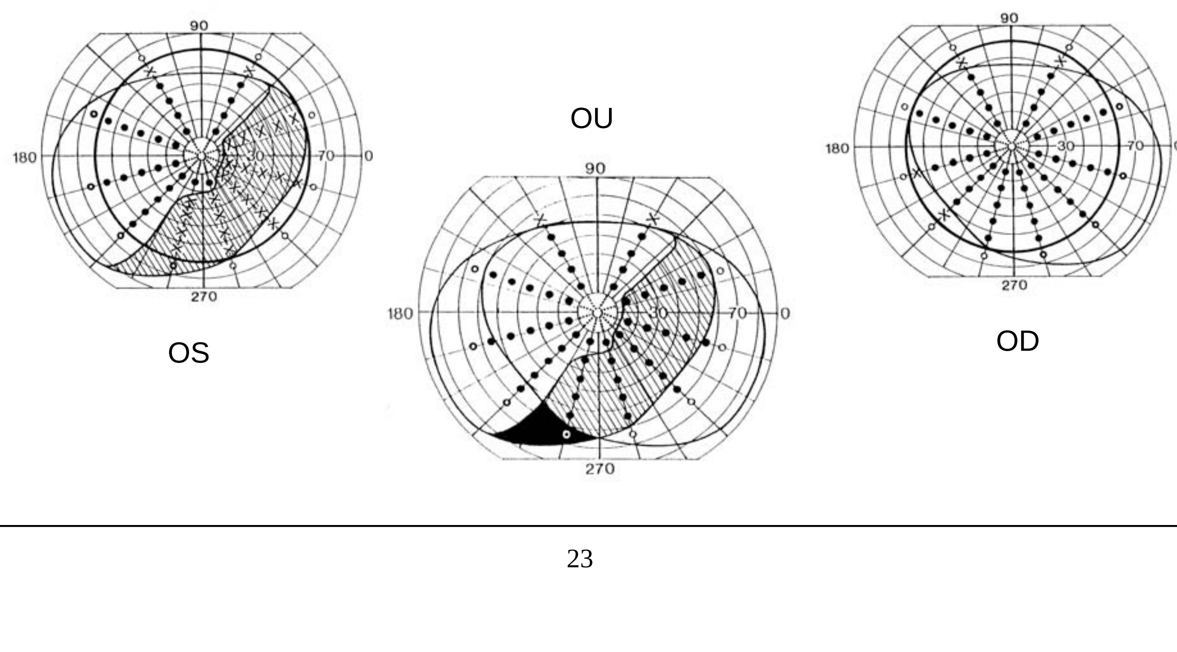
12.3e – Calculating the Binocular Field

Existing perimeters are not equipped to provide reliable measurements of the binocular visual field. Therefore, the binocular visual field is constructed by superimposing the two monocular plots. On the superimposed plot, areas seen by either eye are counted as seen; only areas not seen by either eye are counted as defects. The resulting binocular score can vary dramatically, depending on the location of the defects.

Example 12-10 1<u>% Impairment with consideration of Binocular Visual Field Loss</u>

An individual has a nasal defect in the left eye. The right eye is normal. See Figure 12-10.

Figure 12-10 – Effect of Nasal Field Loss on the Binocular Field



Visual Field Score – using the overlay grid (100 – solid dots missed (x) + open dots seen).

OS: 100 – 25 + 3 = 78
OU: 100 – 2 + 7 = 105 x 3 = 315
OD: <u>100</u>
493 / 5 = 98.6 (1% Impairment rating)

Comment: Because the defect in the left eye corresponds to a seeing area of the right eye, the scotoma is not counted in the binocular plot. Because the binocular field carries 60% of the weight of the Functional Field Score, the Functional Field Score is affected little.

Example 12-13 **<u>4% Impairment with consideration of Binocular Visual Field Loss</u>**

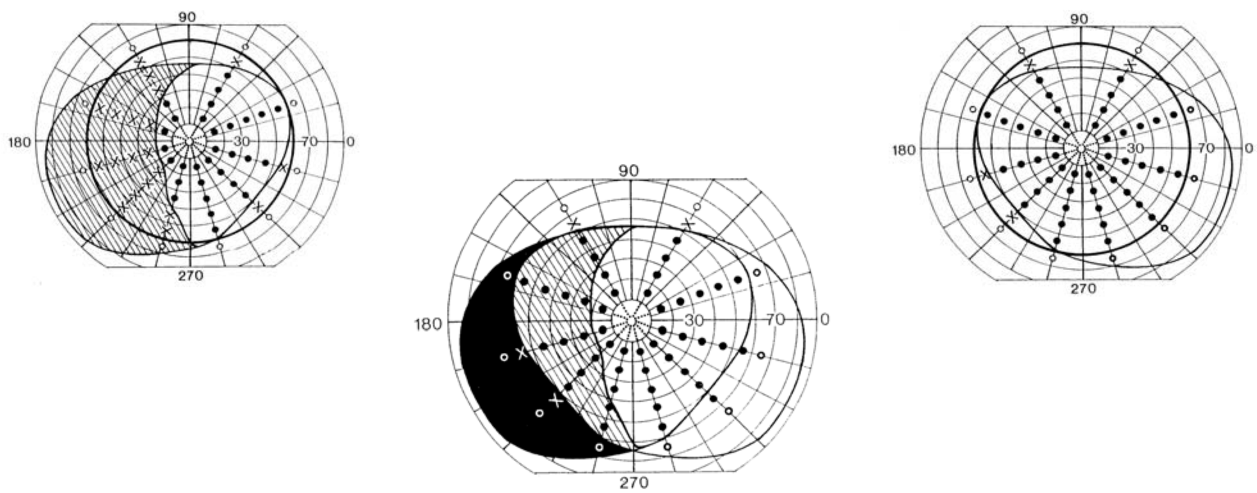
This individual has a temporal defect in the left eye. The right eye is normal. See Figure 12-11.

Visual Field Score – using the overlay grid (100 – solid dots missed (x) + open dots seen).

OS: 100 – 20 = 80
OU: 100 – 4 + 4 = 100 x 3 = 300
OD: <u>100</u>
380 / 5 = 96 (4% Impairment rating)

Comment: Because the temporal defect in the left eye extends beyond the area seen by the right eye, both the left eye score and the binocular score are affected. Thus, the Functional Field Score is affected more than in Example12-10.

Figure 12-11 – Effect of Temporal Field Loss on the Binocular Field



12.4 – Impairment of the Visual System

The preceding calculations have provided us with 2 separate impairment estimates. The Visual *Acuity* Score (VAS) provides an estimate for visual acuity-related abilities, such as reading, while the Visual *Field* Score (VFS) provides an estimate for visual field-related abilities, such as orientation and mobility. To obtain an overall estimate of visual impairment, the 2 impairment estimates must be combined to a single Functional *Vision* Score (FVS). Subtracting the FVS from 100 then provides the impairment rating for the visual system. See below (Section 12-4c, Table 12-10) for the whole person rating.

Because the calculations outlined so far consider only the visual acuity and visual field aspects of vision, there must be room for individual adjustments in cases where functional vision is limited by factors other than visual acuity and visual field. The procedure was summarized in Table 12-1.

12.4a – Calculating an Impairment Rating for the Visual System

The Visual Acuity Score and the Visual Field Score were calculated as weighted averages. This is appropriate because a good visual acuity or good visual field in one eye can compensate for loss of the same function in the other eye. Visual acuity-related functions and visual field-related functions, however, are largely independent. Good visual acuity cannot compensate for a loss of visual field and vice versa. Therefore, the visual acuity score and the visual field score are combined using a multiplication formula.

12.4a.1 – Basic Rule

To calculate the Functional Vision Score, the Functional Acuity Score and the Functional Field Score are multiplied as if they represented percentage scores:

Functional Vision Score (FVS) = (FAS x FFS)/100.

For example, if the FAS is 80 (a 20% impairment) and the FFS is 75 (a 25% impairment), the FVS is calculated as: 80% x 75% = 60% (a 40% impairment).

Note that this calculation can only be performed on the basis of the *residual ability* scores. Adding or multiplying the impairment ratings (which indicate *ability loss*) gives erroneous answers.

12.4a.2 – Additional Rules

Some additional rules are needed to avoid unrealistic calculations.

(1) For the purpose of this calculation, Functional Acuity and Functional Field Scores that are > 100 are treated as if they were 100.

Thus, losses are counted only if the performance drops below the performance standard. The average performance of healthy eyes often is better than the performance standard. This better performance is taken into account in calculating the Functional Scores (see Example12-2), but it is not counted as a reduction of the impairment rating.

(2) If visual field data are not available and if there is no clinical reason to suspect visual field loss, the Functional Field Score may be assumed to be 100.

In this case, the Functional Vision Score is the same as the Functional Acuity Score, and the impairment rating for the visual system is the same as the impairment rating for the visual acuity loss.

12.4a.3 – Rule for Central Scotomata (Field Loss and Acuity Loss are Not Independent)

The dense array of points in the central 10° area of the visual field grid means that paracentral scotomata (blind spots adjacent to the point of fixation) will be counted even if they do not affect the central acuity. This is appropriate because it has been shown that such scotomata can interfere significantly with reading ability and with other activities of daily living.

However, if the scotoma is central (ie, it covers the point of fixation), it affects both visual acuity and visual field and the two impairment ratings can no longer be treated as independent. Using the basic formula, central scotomata would be counted twice: once through their effect on visual acuity and once through their effect on the central field. Therefore, an additional rule is needed:

(3) If visual acuity is reduced, some central visual field losses will not be counted, as specified in Table 12-9.

Table 12-9 - Correction for Central Scotomata

If the Visual Acuity Score is	100-90	89-80	79-70	69-60	59-50	49 or less
(that is, if the VAS loss is	0-10	11-20	21-30	31-40	41-50	51 or more
and visual acuity is	≥ 2 0/30	≥ 20/50	≥ 20/80	≥ 20/125	≥ 20/200	< 20/200)
ignore central field loss up to	…	2°	4°	6°	8°	10°.

Thus, for every 10 points of VAS loss, field losses in one ring of 10 grid points are ignored. This means that these points are *counted as if they were seen*. This adjustment is made for each eye separately. The effect of this rule is that patients with a small island of good acuity within a pericentral scotoma will get credit for this scotoma, but that patients with a central scotoma that affects visual acuity will not get double benefits. The adjustment does not affect peripheral field losses. Thus, a patient with peripheral field loss due to glaucoma who also develops a central loss due to macular degeneration will get credit for the central loss as well as for the peripheral field loss. (See Examples 12-13, 12-14, and 12-15.)

12.4b – Individual Adjustments

Although visual acuity loss and visual field loss represent significant aspects of visual impairment, they are not the only factors that can lead to a loss of functional vision. This edition of the *Guides* does not provide detailed scales for other functions, such as:

- Contrast sensitivity. This is the ability to perceive larger objects of poor contrast. Loss of this ability can interfere significantly with many activities of daily living. It is often, but not always, associated with a loss of visual acuity.

- Glare sensitivity (veiling glare), delayed glare recovery, photophobia (light sensitivity), and reduced or delayed light and dark adaptation. These are other functions that may interfere with proper contrast perception.

- Color vision defects. These defects are not uncommon, but usually do not interfere significantly with generic activities of daily living. Severe color vision defects (achromatopsia) are usually accompanied by visual acuity loss. In some vocational settings the impact of minor color vision deficiencies can be significant. This could be a case where the generic impairment rating does not reflect the job-specific employability rating.

- Binocularity, stereopsis, suppression, and diplopia. These functions vary in their effect on activities of daily living. Their significance often depends on the environment and on vocational demands.

Standardized measurement techniques upon which standardized ability estimates can be based have not yet been developed for most of these functions. Furthermore, their effect may be partially accounted for by a loss of visual acuity and may vary significantly according to environmental demands.

If significant factors remain that affect functional vision and that are not accounted for through visual acuity or visual field loss, a further adjustment of the impairment rating of the visual system may be in order. The need for the adjustment, however, must be well documented. The adjustment should be limited to an increase in the impairment rating of the visual system (reduction of the Functional Vision Score) by at most 15 points.

The same rule should be observed as in the case of central scotomata: deficits should only be counted to the extent that their effect exceeds the effect of the related visual acuity or visual field deficit. Note the following examples.

1. An individual with a congenital dark adaptation deficit with normal acuity and normal fields may be given a limited impairment rating based on this deficit. In a patient with rod dystrophy (RP) manifested by field loss as well as dark adaptation problems, the impairment rating will be determined by the field loss and no additional rating is given for the dark adaptation deficit.

2. Most patients with visual acuity loss due to macular degeneration also have a loss of contrast sensitivity. Because the impairment rating is dominated by the visual acuity loss, no additional rating is given for the contrast sensitivity loss. Occasionally, patients will have a bothersome contrast sensitivity loss while the visual acuity is still normal. In these cases, a limited impairment rating may be given based on the contrast sensitivity loss.

3. Minor color vision deficits exist in about 5% of males. These deficits do not interfere with generic activities of daily living and do not receive an impairment rating. A printer with such a deficit would have no problems with black-and-white printing, but may have difficulty judging the accuracy of color prints. This is a deficit that affects his employability in a specific job, but it does not enter into the generic impairment considerations in this chapter (See Chapters 1 and 2). Total color blindness (achromatopsia) is extremely rare. It is accompanied by visual acuity loss, in which case the visual acuity loss will determine the impairment rating.

12.4c – Impairment of the Whole Person

In classes 1, 2 and 3, individuals may benefit from vision enhancement techniques, such as large print, better illumination and better contrast. In classes 4, 5 and 6, a shift to vision substitution techniques occurs; this may include talking books, Braille, long cane etc. Because of these techniques a totally blind person is not totally incapacitated. In the previous section a downward adjustment of the Functional Vision Score of up to 15 points was allowed for additional impairments whose effect exceeds that of the visual acuity and/or visual field loss. A similar, but opposite adjustment may be made in classes 4, 5 and 6 to account for the effects of vision substitution skills that alleviate the effects of the permanent vision loss.

This adjustment affects the translation of of the impairment rating of the visual system (VSI) to an impairment rating of the whole person (WPI) as shown in Table 12-10. Since the effectriveness of vision substitution skills will vary from person to person and cannot be predicted from the visual acuity and visual field measurements, the adjustments in Table 12-10 are generalized estimates. The applicable formula is: if VSI $\leq$ 50, then WPI = VSI; if VSI > 50, then WPI = 50 + 0.7 x (VSI-50).

That the whole person impairment rating is not reduced further, even for blind persons who have made very effiective adjustments, reflects the fact that vision substitution skills alleviate the effects of vision loss but do not eliminate the vision loss itself.

Table 12-10 – Classification of Impairment of the Visual System* (expanded)

Class 1	**Class 2**	**Class 3**	**Class 4**	**Class 5**	**Class 6**
Range of normal vision	Near-normal vision / mild vision loss	Moderate vision loss	Severe vision loss	Profound vision loss	(Near-) Total vision loss
Estimated ability to perform activities of daily living					
Normal (or near-normal) performance			Restricted (or failing) performance		
Has reserve capacity	Lost reserve capacity	Need for vision enhancement aids	Slower than normal, even with aids	Marginal visual performance, even with aids	Cannot perform visually, needs substitution aids
Functional Vision Score (FVS) – estimate of visual abilities					
≥ 91 points	90 – 71 points	70 – 51 points	50 – 31 points	30 – 11 points	≤ 10 points
Visual System Impairment Rating (VSI) – estimate of visual ability loss					
0 % – 9 %	10 % – 29 %	30 % – 49 %	50 % – 69 %	70 % – 89 %	90 % – 100 %
Whole Person Impairment Rating (WPI) - estimate of overall ADL-ability loss					
0 % – 9 %	10 % – 29 %	30 % – 49 %	50 % - 63 %	64 % - 77%	78 % - 85 %

Examples:

Both eyes have *normal visual fields* and					
Visual acuity of ≥ 20/25	Visual acuity of ≥ 20/60	Visual acuity of ≥ 20/160	Visual acuity of ≥ 20/400	Visual acuity of > 20/1000	Visual acuity < 20/1000
	one eye ≤ 20/160, other eye normal	one eye ≤ 20/160, other eye 20/80	one eye ≤ 20/160, other eye 20/200		
Both eyes have *normal visual acuity* and					
Visual fields of > 50° (radius)	Visual fields of > 30° (radius)	Visual fields of > 10° (radius)	Visual fields of ≤ 10° (radius)	Visual fields of ≤ 6° (radius)	Visual fields of ≤ 2° (radius)
	Loss of 1 eye (other normal)	Both eyes lost upper half-field	Both eyes lost lower half-field		
			Homonymous hemianopia		

Whole Person (WPI) adjustment:

FVS:	100	90	80	70	60	50	40	30	20	10	0
VSI:	0	10	20	30	40	50	60	70	80	90	100
WPI:	0	10	20	30	40	50	57	64	71	78	85

*The examples in this Table refer to visual acuity loss alone or to visual field loss alone. Use Tables 12-2, 12-3, 12-5, and 12-6 and the rules in this section to calculate an impairment value when there is both visual acuity loss and visual field loss.

12.4d – Calculation Examples Combining Visual Acuity and Visual Field Loss

Example 12-12 **16% Impairment Due to VA Loss combined with Visual Field Loss**

As stated in Example12-2, the patient lost the left eye, the right eye is normal.

Subject: 45-year-old woman. (See also example 12-2)
History: As stated in example 12-2, the left eye was enucleated in childhood. The right eye is normal.
Current Symptoms: Can perform all office functions.
Physical Exam: Left eye replaced by good fitting prosthesis.
Clinical Studies: Best-corrected acuities are: VOU: 20/15, VOD: 20/15, VOS: NLP.
Functional Acuity Score: The Functional Acuity Score is 84 (as calculated in Example 12-2).

Functional Field Score:

Field OD	full field	100 x 1 =	100
Field OS	no field	0 x 1 =	0
Field OU	full field	100 x 3 =	300
Functional Field Score			400/5 = 80

Functional Vision Score: In this case, the visual acuity loss and the visual field loss are not independent. Multiplying the 2 ratings, FAS x FFS/100 → (84 x 80)/100 = 67, would count the same deficit twice. Because the field loss includes the point of fixation, the rule for central scotomata applies. Because the 100% field loss in the left eye does not exceed the 100% visual acuity loss in that eye, the field loss is ignored for the FVS calculation (counted as FFS = 100, ie, 0% impairment). The Functional *Vision* Score thus equals the Functional *Acuity* Score. The Functional Vision Score = (84 x 100)/100 = 84.

Diagnosis: History of retinoblastoma.
Impairment Rating: 100 – 84 = 16% impairment of the visual system, which is also the impairment of the whole person.

Comment: The loss of one eye reduces the Functional Vision Score to the near-normal range, indicating a significant loss of reserves but not a significant restriction of the ability to perform activities of daily living.

Note: To simplify the presentation of the following cases, the assumption is made that both eyes have identical conditions so that the Functional Acuity and Field Scores equal the Visual Acuity and Field Scores of the eye that is discussed. In real cases there usually will be differences in the scores.

Example 12-13 **16% Impairment Due to perifoveal Visual Field Loss**

Subject: 65-year-old man.
History: No prior history of eye disease.
Current Symptoms: Reading is no longer enjoyable.
Physical Exam: Atrophic macular degeneration (geographic atrophy).
Diagnosis: Age-related maculopathy.
Clinical Studies: Best-corrected acuities remain VOU: 20/20, VOD: 20/20, and VOS: 20/20. Visual field studies reveal a central island of good foveal vision surrounded by a scotoma; beyond this scotoma the peripheral field is normal.
Functional Acuity Score: Normal visual acuity means Functional Acuity Score = 100.
Functional Field Score: The grid points at 3° and 5° are missed in all 10 meridians

(20 points lost). The Visual Field Score is 100 – 10 x 2 = 80.
Functional Vision Score: Because the field loss does not include the center of fixation, the rule for central scotomata does not apply. The Functional Vision Score is FAS x FFS /100 → 100 x 80 /100 = 80.
Impairment Rating: 100 – 80 = 20% Impairment of the visual system, which also is the impairment of the whole person.

Comment: The impairment rating reflects the significant effect of a perifoveal scotoma on reading ability and other daily living skills. Without the perifoveal scotoma, the impairment would have been 0%.

Example 12-14 **<u>45% Impairment Due to VA Loss combined with Visual Field Loss</u>**

Subject: 68 year old man described in Example 12-13.
History: Prior history of macular degeneration.
Current Symptoms: Has lost the central island of his vision. Reading is possible only with a strong magnifier.
Physical Exam: Progressive macular degeneration, now including the macular area.
Diagnosis: Progressive macular degeneration.
Clinical Studies:
Functional Acuity Score: Visual acuity dropped to 20/160. The Visual Acuity Score, considered alone, is 20/160 = 55 (45% Impairment rating).
Functional Field Score: All grid points at 1°, 3°, and 5° are lost. The Visual Field Score, considered alone, is 100 – 10 x 3 = 70 (30% Impairment rating).
Functional Vision Score: Because the field loss now includes the center of fixation, the rule for central scotomata now applies. For the calculation of the Functional Vision Score, the central field loss of 30% is ignored because it does not exceed the 45% visual acuity loss. Therefore, the Functional Field Score is entered into the calculation as if it were 100.
The calculation is: FAS x FFS /100 → 55 x 100 /100 = 55.
Impairment Rating: 100 – 55 = 45% impairment of the Visual System, which also is the impairment of the whole person.

Comment: In Example 12-13, the impairment rating was determined by the visual field loss. In this case, the visual acuity loss dominates.

Example12-15 **59% Impairment Due to VA Loss combined with Visual Field Loss**

Subject: 75 year old man, described in exanples 12-13 and 12-14.
History: Prior history of macular degeneration. In recent years the individual has been followed for glaucoma.
Current Symptoms: Reading remains possible with a strong magnifier, but the individual complains of being startled by objects in his peripheral vision.
Physical Exam: The macular degeneration appears stationnary. The optic disc shows cupping.
Diagnosis: Age-related maculopathy. Chronic open-angle glaucoma.
Clinical Studies:
Functional Acuity Score: The Visual Acuity Score is still 55 (45% impairment rating).
Functional Field Score: In addition to the 30 central points, 25 peripheral points are now lost. The Visual Field Score, considered alone, is 100 – 30 – 25 = 45 (55% impairment rating).
Functional Vision Score: Although the visual field loss alone (55%) is worse than the visual acuity loss alone (45%), for the calculation of the Functional Vision Score the central field loss is ignored, since this part of the vision loss is already accounted for in the visual acuity impairment rating (see example 12-14 and Table 12-9). The peripheral field loss, which is independent of the visual acuity loss, is not ignored. Therefore, the Functional Field Score is now entered into the calculation as if it were: 100 – 25 = 75.
Therefore: FVS = FAS x FFS /100 → 55 x 75 = 41 (59% impairment).
Impairment Rating: 100 - 41 = 59% impairment of the visual system, which may be rated as 56% impairment of the whole person (see Table 12-10).

Comment: The impairment rating is now affected by the visual acuity loss as well as by the peripheral field loss.

12.5 – Visual Acuity Measurement at Near (Reading Acuity)

Consideration of reading acuity in the calculation of the Functional Acuity Score is optional. It is warranted only if the reading acuity is significantly different from the distance acuity. In that case, it is appropriate to use the average of the Functional Acuity Score for letter chart acuity and the Functional Acuity Score for reading as indicated in Table 12-11. This section contains instructions for accurate reading acuity measurement.

12.5a – Near Acuity vs Distance Acuity (Reading Acuity vs Letter Chart Acuity)

Near acuity may be measured with a reduced-size letter chart or with continuous text. When the objective is the assessment of functional vision — as is the purpose of the *Guides* — continuous textual reading material should be used.

Under most circumstances, letter chart acuity and reading acuity – if measured appropriately and with the proper refractive correction – will be similar. If significant differences between reading acuity and letter chart acuity exist, measurement errors, inappropriate refractive correction, and/or other complicating factors should first be suspected. The nature of these factors needs to be explored, documented, and corrected where possible. Accurate calculation of the reading acuity requires accurate measurement of the letter size as well as the viewing distance. Many practitioners record only the letter size read and not the reading distance. Table 12-11 shows that this is inappropriate because small changes in the reading distance can result in significant changes in visual acuity, especially if the reading distance is short.

One cause for a true discrepancy between reading acuity and letter chart acuity might be that the subject uses a small central island within a ring scotoma for letter acuity while using a larger, more eccentric area for reading. Another cause might be that when measuring letter chart acuity, subjects are usually pushed for threshold or marginal performance, whereas reading tests more often aim at a level of comfortable performance. For this reason, the magnification requirement for reading acuity may be somewhat greater than that for letter acuity. The difference is known as the magnification reserve needed for reading fluency.

12.5b – Letter Size Notations

Another reason for discrepancies can be found in the use of inaccurate letter size notations. The commonly used Jaeger numbers refer to the labels on the boxes in the printing house in Vienna where Jaeger selected his print samples in 1856. They have no numerical value and their implementation on various reading cards is notoriously variable. The J-numbers listed in Table 12-11 present the range of J-designations found for each letter size when a number of reading cards was surveyed.

Some charts use a notation in Printer's points. Point sizes have a numerical value but may vary depending on the type style used. Many reading cards list distance equivalents. This notation is valid only if the card is used at the distance for which the card was designed. At any other distance, the use of distance equivalents is utterly confusing.

The only letter size unit that allows a comparison between letter chart acuity and reading acuity is the M-unit. M-units refer directly to the actual letter size (X-height for uppercase letters on a letter chart, x-height for lowercase letters in a reading segment). One M-unit subtends 5 minutes of arc at 1 m and equals 1.454 mm (10% less than 1/16").

12.5c – Measurement Guidelines for Reading Acuity (Near-vision Acuity)

Visual acuity measurement at near is more complex than visual acuity measurement at distance because both letter size and viewing distance can vary. When reading acuity is measured, follow these guidelines.

If binocular reading is possible, the binocular reading acuity should be recorded. If binocular reading is not possible or not preferred, the reading acuity of the eye that is preferred for actual reading should be used.

The measurement of reading acuity requires a reading card with calibrated reading segments. Cards with proportionally spaced segments of equal length are preferred. The preferred step size is the same as for letter charts. The viewing distance should be measured and recorded carefully. Measurement with a diopter ruler simplifies calculations (see 12.5d, below) and provides a direct comparison to the required accommodation or reading add. Letter size specification in M-units is mandatory if any calculations or comparisons are involved. One M-unit equals 1.454 mm, which is slightly smaller than 1/16 in. Measuring the letter size in units of 1/16 in overestimates the visual acuity by slightly less than half a standard step size.

To test reading acuity for the normal and near-normal range, many cards are available. Most will indicate distance equivalents. Note that these distance equivalents are valid only if the designated distance is used.

Many subjects undergoing impairment evaluation will fall in the low vision range. They may require shorter reading distances and/or larger print sizes. Table 12-11 shows the proper visual acuity values and impairment ratings for many combinations of letter size and viewing distance.

12.5d – Modified Snellen Formula

The visual acuity values found in Table 12-11 could be calculated using the standard Snellen fraction V = m/M, in which the viewing distance is specified in m (1 m = 100 cm = 40 in, 1 in = 2.5 cm) and the letter size is in M-units. Use of the standard Snellen fraction becomes awkward when the viewing distance (in m) is itself a fraction. In this case, it is more convenient to use the reciprocal of the viewing distance, which is known as the diopter (2 diopters = 1/2 m, 5 D = 1/5 m, etc). The use of reciprocal values turns the Snellen fraction into a multiplication, which is more easily calculated in one's head ~~by memory~~ because it uses whole numbers instead of fractions within fractions.

The traditional formula: $V = \frac{m}{M}$ thus becomes: $\mathbf{1/V} = \frac{M}{m} = M \times \frac{1}{m} = \mathbf{M \times D}$.

(M = letter size in M-units, m = viewing distance in meters, D = viewing distance in diopters.)

12.5e – Instructions

To find the optimal combination of reading distance and letter size, start at the reading distance that corresponds to the subject's current reading add and/or accommodative power. Increase the reading add (reduce the reading distance) to reach smaller print. Using Table 12-11, find the visual acuity at the intersection of the letter size row and the reading distance column. Alternatively, using the M x D formula and a diopter ruler, calculate the 1/V value.

For each combination of viewing distance and letter size read, compare the reading add to the viewing distance in diopters to verify the appropriate refractive correction. Also, compare the M x D value to verify that the visual acuity values are consistent.

12.5f – Correction of Refractive Error

To verify that the refractive correction is appropriate for the viewing distance, it is often useful to ask the subject to move the card back and forth to find the best possible focus. If the refractive correction (reading add) is not optimal, the measured acuity will not be the best-corrected visual acuity. Measuring the reading distance in diopters has the advantage of easy comparison to the reading addition.

Table 12-11 – Determination of Reading Acuity and Reading Impairment Rating Using Letter Size and Viewing Distance *

Letter Size		**Viewing Distance** (glasses to text, not valid for magnifiers)													*ICD-9-CM*
		5 cm *2"* 20 D	6.3 cm *2.5"* 16 D	8 cm *3.2"* 12.5 D	10 cm *4"* 10 D	12.5 cm *5"* 8 D	16 cm *6.3"* 6.3 D	20 cm *8"* 5 D	25 cm *10"* 4 D	32 cm *12.5"* 3.2 D	40 cm *16"* 2.5 D	50 cm *20"* 2 D		100 cm *40"* 1 D	
3.2 p J 1	**0.4 M**	45 *20/160*	40 *20/125*	35 *20/100*	30 *20/80*	25 *20/63*	20 *20/50*	15 *20/40*	10 *20/32*	5 *20/25*	0 *20/20*	*20/16*		*20/8*	Above
4 p J 1	**0.5 M**	50 *20/200*	45 *20/160*	40 *20/125*	35 *20/100*	30 *20/80*	25 *20/63*	20 *20/50*	15 *20/40*	10 *20/32*	5 *20/25*	0 *20/20*		*20/10*	
5 p J 1,2	**0.63M**	55 *20/250*	50 *20/200*	45 *20/160*	40 *20/125*	35 *20/100*	30 *20/80*	25 *20/63*	20 *20/50*	15 *20/40*	10 *20/32*	5 *20/25*		*20/12*	Normal range
6.3 p J 2-5	**0.8 M**	60 *20/320*	55 *20/250*	50 *20/200*	45 *20/160*	40 *20/125*	35 *20/100*	30 *20/80*	25 *20/63*	20 *20/50*	15 *20/40*	10 *20/32*		*20/16*	
8 p J 3-6	**1 M**	65 *20/400*	60 *20/320*	55 *20/250*	50 *20/200*	45 *20/160*	40 *20/125*	35 *20/100*	30 *20/80*	25 *20/63*	20 *20/50*	15 *20/40*		0 *20/20*	
10 p J 4-7	**1.25M**	70 *20/500*	65 *20/400*	60 *20/320*	55 *20/250*	50 *20/200*	45 *20/160*	40 *20/125*	35 *20/100*	30 *20/80*	25 *20/63*	20 *20/50*		5 *20/25*	
12 p J 7,10	**1.6 M**	75 *20/630*	70 *20/500*	65 *20/400*	60 *20/320*	55 *20/250*	50 *20/200*	45 *20/160*	40 *20/125*	35 *20/100*	30 *20/80*	25 *20/63*		10 *20/32*	Near-normal
16 p J 7,10	**2 M**	80 *20/800*	75 *20/630*	70 *20/500*	65 *20/400*	60 *20/320*	55 *20/250*	50 *20/200*	45 *20/160*	40 *20/125*	35 *20/100*	30 *20/80*		15 *20/40*	
20 p J 10,12	**2.5 M**	85 *20/1000*	80 *20/800*	75 *20/630*	70 *20/500*	65 *20/400*	60 *20/320*	55 *20/250*	50 *20/200*	45 *20/160*	40 *20/125*	35 *20/100*		20 *20/50*	
25 p J 14	**3.2 M**	90 *20/1250*	85 *20/1000*	80 *20/800*	75 *20/630*	70 *20/500*	65 *20/400*	60 *20/320*	55 *20/250*	50 *20/200*	45 *20/160*	40 *20/125*		25 *20/63*	
32 p J 16	**4 M**	95 *20/1600*	90 *20/1250*	85 *20/1000*	80 *20/800*	75 *20/630*	70 *20/500*	65 *20/400*	60 *20/320*	55 *20/250*	50 *20/200*	45 *20/160*		30 *20/80*	Moderate L. V.
40 p J-	**5 M**	100 *20/2000*	95 *20/1600*	90 *20/1250*	85 *20/1000*	80 *20/800*	75 *20/630*	70 *20/500*	65 *20/400*	60 *20/320*	55 *20/250*	50 *20/200*		35 *20/100*	
50 p J-	**6.3 M**	*20/2500*	100 *20/2000*	95 *20/1600*	90 *20/1250*	85 *20/1000*	80 *20/800*	75 *20/630*	70 *20/500*	65 *20/400*	60 *20/320*	55 *20/250*		40 *20/125*	
63 p J-	**8 M**	*20/3200*	*20/2500*	100 *20/2000*	95 *20/1600*	90 *20/1250*	85 *20/1000*	80 *20/800*	75 *20/630*	70 *20/500*	65 *20/400*	60 *20/320*		45 *20/160*	
80 p J-	**10 M**	*20/4000*	*20/3200*	*20/2500*	100 *20/2000*	95 *20/1600*	90 *20/1250*	85 *20/1000*	80 *20/800*	75 *20/630*	70 *20/500*	65 *20/400*		50 *20/200*	Low Vision
100 p J-	**12.5M**	*20/5000*	*20/4000*	*20/3200*	*20/2500*	100 *20/2000*	95 *20/1600*	90 *20/1250*	85 *20/1000*	80 *20/800*	75 *20/630*	70 *20/500*		55 *20/250*	
		Near-total Visual Acuity Loss							Profound Low Vision				Severe		

* Columns indicate reading distances. Rows indicate letter sizes. The resulting reading acuity ratings are found at the intersections. The large number in each box represents the reading impairment rating (100 – Visual Acuity Score, truncated at 0 and at 100). The small number represents the Snellen distance equivalent.
Note that the visual acuity values and reading impairment ratings are arranged in diagonal bands. The same visual acuity value can be represented by many different combinations of viewing distance and letter size. The outer edge of the Table indicates the ranges of vision loss for each diagonal band in *ICD-9-CM*.

References

Classifications

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Test Chart

24. *Low Vision Test Chart.* One side: letter chart from 50 M to 1 M (acuity: 1/50, 20/1000 to 1/1, 20/20), 1 m cord attached. Other side: reading segments from 10 M to 0.6 M, diopter ruler included, standardized segments for reading rate measurements. Available in English, Spanish, Portuguese, German, Dutch, Finnish, Swedish. Precision Vision, 944 First Street, LaSalle, IL 61301. Fax: 815-223-2224.