

## Model Approach – Low Vision Driver's Training and Assessment

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**(Abstract)** – The following article is intended to provide readers with an overview of the multidisciplinary approach undertaken and progress made by staff at the West Virginia Rehabilitation Center, from September 23, 1985 to September 30, 1987 relative to Low Vision Driving Research. Core project staff consist of representation of the Vocational Training, Client Services and Medical Services sections of this public, residentially-based rehabilitation facility. The latter is operated by the State of West Virginia's Division of Rehabilitation Services.

### Introduction

Many low vision individuals are capable of detecting visual clues with their field(s) of vision but because of their reduced central acuity, are unable to always define or interpret these clues.<sup>1</sup>

The driving task requires drivers to detect visual clues of "critical objects" within their field(s) of vision and sight with their central acuity to enable the brain to make an accurate assessment of the correct action required.<sup>1</sup>

Driver education professionals define "critical objects" as any object or condition which can be predicted to cause drivers to modify their vehicles' speed, lane position, or planned path of travel.<sup>2</sup>

Such experts stress that all drivers learn how to group these objects or conditions into three general categories: other road users, traffic

control devices and roadway characteristics. Grouping facilitates object recognition and decision making, affording drivers an increased margin of safety to decrease hazard or decrease the likelihood of collision in their dynamic driving environment.<sup>2</sup>

Since 90-97% of all driving clues are detected by one's field(s) of vision, it is believed that certain "low vision" drivers with full field(s) of vision and reduced visual acuity could learn to benefit from the same increased margin of safety as their normally sighted counterparts via appropriate low vision aids and training.<sup>1</sup>

### Problem With Status Quo

Up to now neither formalized nor standardized assessment and training criteria has been established to identify and train those individuals with full field of vision and low visual acuity wishing to be licensed in the State of West Virginia. Many tests, training strategies, and assessment techniques available for the normally sighted desiring to drive may or may not be applicable to the low vision individual.<sup>1</sup>

### **Project's Primary Goal**

By our comprehensive three-year research study, we intend to address and identify those test/screening procedures, training strategies and assessment techniques which are applicable in determining the driving potential for low vision individuals.<sup>1</sup>

### Vision Requirements for Candidates Selected for Inclusion in Study

Low vision individuals accepted for participation in our project's efforts must meet and maintain the following visual protocol:

1. Distance visual acuities between 20/50 and 20/200 inclusive, with best standard spectacle or contact lens correction in the better eye;
2. Visual field of 120° horizontally and 80° vertically or greater in the same eye as used for the visual acuity determination;
3. 20/40 or better distance visual acuity using distance optical low vision aids prescribed by either a licensed optometrist or ophthalmologist;
4. No ocular diagnosis or prognosis which is likely to result in significant deterioration of vision below the protocol levels of visual acuity and visual field.

It continues to be the responsibility of our Center's consulting optometrist to periodically evaluate the ocular condition and function of all students enrolled in this research project.<sup>1</sup>



## Candidate Screening Procedures

### Method #1 (Preliminary low vision exam)

The first method utilized by Center and field optometric/ophthalmological staff to screen and identify "potential" project candidates is a *preliminary low vision examination*. This clinical assessment advises the individual up front whether or not they qualify visually. The latter mandatory requirement for initial consideration saves staff, client, and Agency considerable time and money in avoiding unnecessary secondary testing for those who do not qualify.

Though results of gross confrontation type of visual field testing are acceptable for preliminary low vision screening purposes, only those candidates who illustrate full fields of view after undertaking a Full-field 120 point 3 Zone Screening Test on our agency's Humphrey's Field Analyzer with memory module (during Method 1 or Method 2 testing) will continue as potential candidates.

This state of the art automated perimetry testing apparatus enables staff to screen/test a student's central, as well as peripheral, field of view within minutes. Likewise, its built-in computer capabilities allows staff to store, print out, retrieve, monitor, and compare student's field testing results from one date to another.

This device also excludes evaluator subjectivity in the administration or outcome of the testing and requires only minimal training.

Note, these preliminary optometric or ophthalmological evaluation results are not the sole determinant of a client's candidacy for our low vision driver education training program. Rather, it is a consensus of agreement reached by professionals of various disciplines at a client's evaluation staffing. The latter is undertaken upon completion of the second method used to further evaluate an individual's potential candidacy (as indicated below).

### Method #2 (Comprehensive multidisciplinary assessment)

Clientele who previously met the visual protocol set by our study group are then referred back to WVRC to participate in more extensive and varied evaluation procedures. These include:

1. Psychological examination (2-3 hours)
  - a. Intellectual assessment
    1. Wechlers Adult Intelligence Scale (WAIS)
    2. The WAIS Revised
  - b. Personality assessment
    1. Rorschach's Test of Personality Diagnosis

2. Bender's Motor Gestalt Test
3. Buch's House-Tree-Person Test
4. Minnesota Multiphasic Personality Inventory (MMPI)
2. Clinical low vision examination (2-3 hours)
  - a. History
  - b. Uncorrected and corrected visual acuities
  - c. Refraction
  - d. Slit lamp examination
  - e. Tonometry
  - f. Dilated fundus examination
  - g. Full field visual field examination
3. Audiological testing (1-2 hours)
  - a. Puretone audiometry
  - b. Speech audiometry
  - c. Impedence audiometry
  - d. Brain stem (if needed)
4. Perceptual assessment (2-3 hours)
  - a. Client interview
  - b. Visual observations during activity
  - c. In department nonstandardized subtest
  - d. Marianne Frostig development test of visual perception
  - e. Southern California figure ground vision perception test
  - f. Motor free visual perception test with adult standards
5. Physical therapy assessment (1 hour, if needed)
  - a. Associated injuries
  - b. Range of motion
  - c. Motor return or weakness
  - d. Sensory evaluation
  - e. Level of function
  - f. Other - equipment, skin, circulation
6. Driver education assessment (8-10 hours)
  - a. Complex reaction time testing
    1. steering response time
    2. braking response time
  - b. In car assessment
    1. level of driving skills
    2. level of detecting driving clues - using updated standard correction lenses only (bioptic usage not evaluated)
7. Low vision mobility assessment (8-10 hours)
  - a. Low vision mobility history
  - b. Indoor low vision mobility assessment



- c. Outdoor low vision mobility assessment
  - 1. walking
  - 2. passenger in vehicle
- 8. Routine medical examination (2 hours)
  - a. Physician/nurse
  - b. X-ray (chest)
  - c. Serology
  - d. Dental (if needed)

After completion of such procedures the student then returns home. Those who satisfactorily complete these procedures will have their name placed on a waiting list to participate eventually in the next phase of our project, namely, low vision driver education training. The latter takes place once their respective field counselor has an opportunity to review all evaluation results, approve of the intended recommended program of low vision driver education training, and order and receive the recommended distance aid which will be used while driving. This waiting period of at least 4-6 weeks also allows client and counselor to formulate and forward the required individualized written rehabilitation program (IWRP) and other admission materials necessary for acceptance before training is undertaken.

Note, students are advised that their participation and completion of the various phases of this research endeavor does not necessarily mean they will become licensed drivers. The latter rests on the outcome of the student's vision, written, and road tests administered by the State of West Virginia's Department of Motor Vehicles.

### **Training Strategies**

Unlike the previous one day outpatient and one week in-length evaluation procedures (the latter of which requires most candidates to stay at the Center), the student's third trip to the Center usually entails staying a period of 6-8 weeks for actual driver education training.

Note, presently only 1-2 students are accepted for evaluation and/or training purposes at any one time due to limited instructor(s) and consultant(s) availability.

Concurrent course work provided on a one-on-one daily basis consists of *Vision Utilization Training* (instructor-Huss) and actual *Driver Education Training* (instructor-Ramsey).

*Vision Utilization Training*, averaging 70.0 hours combined classroom and hands-on learning and experience, consists of:

- 1. Classroom instruction

- a. basic ocular anatomy, physiology and pathology
  - b. visual acuity and field
  - c. familiarization and limitations of distance optical low vision aids
  - d. eccentric viewing training (as needed)
  - e. car mirror usage
2. Distance low vision aid training exercises (indoor and outdoor)
  3. Doron Corp. I.P.D.E. (viewing 15 driver education simulation films using a large 16mm graflex instaload model 1120 film projector with wide angle anamorphic lens in conjunction with a 6x30 ft. projector screen located within a 40x45 ft. classroom setting)
    - a. I.P.D.E. process (Identify, Predict, Decide and Execute)
    - b. Hazard perception
    - c. 5 Keys to Space Cushion Driving
  4. Outdoor distance low vision aid and mirror reinforcement (student positioned as passenger in vehicle, covering the same 20+ routes as undertaken separately behind the wheel with their driver education instructor)
  5. Observing student's visual performance with their prescription bioptic lens in place while driving (driver education instructor positioned in the right front seat and the vision utilization instructor positioned in the left rear seat)

*Driver Education Training*, averaging 55.0 hours of classroom instruction and 50.0 hours (1100 miles) behind the wheel, entails:

1. Behind the wheel training (including exposure to rural, residential, urban, inner city and interstate types of driving; under a variety of traffic, lighting and roadway conditions)
2. Classroom instruction
  - a. Smith System for Space Cushion Driving
  - b. West Virginia Road Laws
  - c. Doron Corp. I.P.D.E. (20 filmstrip/cassettes covering a complete spectrum of driver decision making and hazard perception)
  - d. National Safety Council's Defensive Driving Course
  - e. Doron Corp. Alcohol and Drug Education Program
  - f. Driving efficiency (The Featherfoot program)
  - g. Changing a tire
  - b. Automobile insurance
  - i. Accident reporting

#### Low Vision versus Standard Driver's Education Training

Comparatively speaking, our low vision students receive ap-



proximately twice the number of classroom hours and nine times the number of behind the wheel hours of instruction as their normally sighted counterparts would receive in a standard driver education program. The latter includes what many states recognize as a required minimum of six hours behind the wheel and 30 hours of classroom instruction.

Note, assuredly, our low vision students who illustrate the need for more classroom instruction than that provided by project staff or who could benefit from remedial instruction in certain areas are requested to attend and participate in ongoing standard driver education classroom instruction. This evening course work entails approximately 2.0 hours of class instruction per night, 4 nights/week for 8 weeks at the West Virginia Rehabilitation Center.

The type of student whom we might recommend for such instruction would be a young, inexperienced beginner type of driver who over the years may have been advised by his/her parents and society that he/she would never be able to drive because of their respective visual condition; and thus never observed closely what is required to accomplish the driving task.

### **Study Group Identified<sup>3</sup>**

Background information on the 50 individuals identified to date as meeting our study's visual protocol is as follows:

**Sex:** 35 males  
15 females

**Marital Status:** 36 single  
10 married  
3 divorced  
1 widowed

<b>Visual Diagnostics:</b>	<b>No. Of Cases Identified</b>
1) Central Macular Degeneration, disease and hypoplasia (including Albinism)	22
2) General loss of sensitivity (congenital cataracts, optic atrophy)	15
3) Retinal disease or degeneration (including myopia)	13

Distance Acuity Ranges:	No. Of Clients
1) 20/50 - 20/70	17
2) 20/80 - 20/120	11
3) 20/100 - 20/200	22

Chronological Age (years):	No. Of Individuals Identified
1) 16-19	13
2) 20-29	22
3) 30-39	7
4) 40-49	6
5) 50-59	0
6) 60-over	2

(Note, approximately 80% of these individuals fall below the age of 40).

Geographically, this group is representative of 23 of West Virginia's 55 counties. These 23 counties are located amidst the 7 established Division of Rehabilitation Services' districts across the state.

On a larger scale, yet of insight to the low incident population group we are studying here, is the fact that West Virginia ranked a respectable 24th in the nation in 1985 with 749.4 motor vehicles registered per every 1,000 state residents. The latter sheds light on the spread out population and absence of public transportation in many parts of our state.<sup>4</sup>

#### Statistical Synopsis of Clients Who Have Been Identified, Participated and/or Completed Project Services:

- 50—number of clients identified by preliminary clinical low vision testing as meeting project's set visual protocol (7/1/82 - 9/10/87).
- 28—number of clients previously identified who subsequently have also participated and completed project's one week in-length series of multidisciplinary evaluation procedures (9/23/85 - 9/18/87).
- 25—number of clients who *satisfactorily* completed the aforementioned preliminary and one week in-length evaluation procedures and have been accepted to return for participation in low vision driver education training (9/23/85 - 9/30/87).
- 19—number of clients who have returned and initiated actual low vision driver education training (11/4/85 - 9/30/87).
- 14—number of clients who have satisfactorily completed training to date and are now legally licensed drivers in the State of West Virginia.



8—number of clients to date who have already been screened, identified, and completed evaluation procedures successfully, but who will tentatively pursue intended low vision driver training during year three of this research project (10/1/87 - 9/30/88).

#### **Assessment Techniques:**

##### **Driver Performance Measurement (DPM)**

The third major effort by project staff is to address and identify standardized type of assessment procedures which are applicable in determining the driving potential of low vision individuals.

In effort of doing so, project staff have initiated attempts at determining whether or not Michigan State University's research "Driver Performance Measurement" can provide a standardized method for establishing a baseline on, and assessment of, progress in driver performance of project candidates.

In the early 1970s extensive research by Michigan State University's Highway Traffic Safety Center and Psychology departments resulted in standardization and validation of this objective type of driver assessment process.<sup>5</sup>

To date, DPM research has received considerable recognition, success and acceptance in other driver education circles—including driver education research, driver licensing, school bus driver evaluation, Michigan State Police trooper evaluations, and auto carrier truck driver testing.<sup>5</sup>

##### **DPM Route**

For our project purposes, Michigan State University's Traffic Safety Specialist, Fred E. Vanosdall, M.S., and support staff as needed, were able to successfully develop and/or provide the following:

1. A 1-1/2 hour 40-mile in-length standardized DPM test route;
2. Performance standards including valid assessment criteria for use in evaluating driver performance;
3. Instructional materials for training project staff members as evaluators;
4. Training project staff how to use the above methods and/or procedures for future assessment purposes with low vision driver candidates.

The test route offers the student a wide range of driving experiences (some easy and of which most drivers are expected to negotiate

without difficulty, and others more difficult which even the best drivers may have problems negotiating) amidst a variety of driving environments.

This assessment course includes travel through typical rural, residential, business, and inner city types of driving environments under variable lighting and traffic conditions. Roadways traveled include narrow two-lane versus multilane one-way roads/streets, secondary highways, and interstate/expressways – typical of West Virginia driving.

DPM runs are undertaken at different times and on different days of the week with the student behind the wheel and at least two, if not all three, trained evaluators present (Ramsey, Huss and Boyce).

### DPM Rating Procedure

Each student's dynamic driving performance is assessed on 24 different location sites (called "test segments") on our DPM route. Each time evaluators rate a student's performance on such a section of a route, the evaluators must ask themselves: 1) Did the student driver increase hazard and likelihood of collision? (Pattern Score) 2) What did the student driver do regarding search, speed, and directional control? (Behavioral Element Score).

The Pattern Score (question #1 rating) is the most important for comparative analysis and is a more reliable measure of safe driving performance.

The Behavioral Element Score of search, speed, and directional control (question #2 rating) only show behavioral consistency in relationship to each test segment and across test segments.<sup>6</sup>

### DPE Feedback

Feedback sessions which follow completion of each run (and which are conducted out of the car):

1. Allow evaluators an opportunity to compare and determine whether or not uniformity in rating student's driving behaviors has been achieved and, if not, why not;
2. Apprise the student of their level of developing driving skills; and
3. Advise the student what instructional areas need to be emphasized, deleted or modified during their remaining weeks of training to correct or improve respective driving skills prior to consideration for application for driver licensing.



### Use of Independent Driver Education Evaluator

An added dimension to our DPM assessment sequence is having a concurrent driver evaluation conducted on each student during their final DPM by an "independent driver education evaluator."

These individuals are contracted by our agency on an hourly basis and:

1. Evaluate our student's overall driving performance continually over the entire 40-mile test route;
2. Sit in and compare their assessment with ours during subsequent DPM feedback sessions; and
3. Forward a separate written report to us comparing our student(s) performances to other fully sighted high school students or adults with whom they work.

To date, the principal outside evaluator with which we have contracted professional services is Ms. Kathy Regan, Driver Educator (2076 Tamerick Drive, Lexington KY 40504).

### Preliminary DPM Results<sup>7</sup>

Overall, preliminary results of DPM procedures conducted on these first 14 students who have completed their respective programs of low vision driver education at WVRC indicate that:

1. An average of 4 DPM assessments were conducted with each student.
2. Such procedures with novice low vision drivers can be introduced successfully midway through their respective training programs (approximately Week #5) and, thereafter, undertaken once every remaining week. The latter allows time for learning and skill development to take place before the next graded assessment.
3. The majority of students demonstrated improvement up to an average passing DPM score.
4. Students who complete WVRC's Low Vision Driver Education and Assessment program perform at a level comparable to that of their normal sighted counterparts in terms of basic visual skills and demonstrated above average skills in vehicle handling and ability to react to traffic hazards.
5. Specialized driver education programs, are needed for the low vision population.
6. There is a need to generate an information set for use by motor vehicle personnel including medical advisory boards to determine qualifications for licensing for low vision individuals.

7. A need exists to examine and assess the appropriateness of typical road tests administered by the Motor Vehicle Department for vehicle licensing.

### Follow-Up Data

#### Licenses Granted

All 14 individuals who initiated and completed their respective low vision driver education programs during the first two years of project implementation at WVRC applied for and received a State of West Virginia's drivers license.

#### License Restrictions

The only restriction placed on these student's licenses to date by our State's Department of Motor Vehicles is that they have in place and use their prescription lens system while driving, as intended.

However, self-imposed restrictions suggested or recommended by project staff on an individual basis and not applicable to all include:

1. Type of roadway(s)
2. Time of day
3. Direction of travel (angle of sunlight)
4. Use of sunwear
5. Area of restrictions
6. Night travel
7. Weather
8. Accompaniment of others
9. Riding as a passenger for the first or second time through or in an unfamiliar area

These restrictions are similar to self-imposed restrictions placed on many new drivers or older drivers where differing eye conditions limit their driving.

Though discussed throughout their respective training programs, students are advised specifically as to what restrictions to self-enforce at their final progress staffing.

#### Educational and Vocational Impact

While too premature to assume for all, feedback received by us from more than half of our graduates to date indicates that acquisition of a valid driver's license has improved their chances or opportunities to obtain jobs or educational advancement as personally desired.



If, at a later date, we are able to confirm the above we will have accomplished the mission set by the West Virginia Division of Rehabilitation Services which is: to improve the quality of life of all West Virginians by maximizing or eliminating in a cost effective manner, the adverse effects of physical and mental disabilities, thereby enabling handicapped individuals like those which we have served to achieve their maximum potential for participation in the mainstream of society.<sup>8</sup>

More specific data and facts will be forthcoming in subsequent articles and newsletter releases concerning our graduates: DPM findings, educational and/or vocational placement and driving diaries (including miles driven, self-imposed driving restrictions, driving experiences and accident/violation/conviction records).

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