Driving with Bioptics in California from a Professional and Personal Perspective

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CALIFORNIA LICENSED DRIVERS

- 2022 population in California was 39 million of which 27 million are licensed drivers (69% of the total population)
- 88% of Californians of Driving age are licensed to drive
- CA DMV does not divulge the number of persons using a bioptic to driver because drivers' vision records are protected by confidential Federal HIPPA regulations.

PART 1

OBTAINING A LICENSE IN CALIFORNIA USING A BIOPTIC TELESCOPE

CA Bioptic Timeline

- **Bioptic Developed in 1950's by Dr. William Feinbloom where first license using bioptics was issued in NY**
- **In 1970 Dr. Donald Korb published the first report using bioptics in MA for low vision drivers to obtain a license**
- **In March 1971, Dr. Dennis Kelleher became the first licensed Bioptic Driver issued in CA and became the third state to approve bioptics for driving**
- **Bioptic Guidelines for CA DMV were developed in 1976**
- **Bioptic Training film for CA DMV staff was produced 1982**
- **Bioptic Safety report published in 1983 by Janke concluded that Bioptic drivers had a worse safety record than the general population. This was not accurate due to a misinterpretation of data. The correction was published in 1996 showing that no significant difference existed between the safety records of the general population and those using bioptics to drive.**

California Driver License Application Process

The applicant must:

1. **Complete a DL 44 application form**
2. **Pass a written test on the rules of the road**
3. **Pass a Vision screening Test at DMV**
4. **Pass a behind the wheel road test**
5. **Pay a $98 fee for original license or $58 fee for renewal license. License term is up to 5 years**

Applicants who are age 70 or above must renew in person at DMV and take both a written and eye test. They may also be required under certain circumstances to take a road test.

If the applicant is unable to pass the DMV Vision screening test, they will be given a Form DL 62, "Report of Vision Examination" that must be completed by an Optometrist or Ophthalmologist.

What is a Bioptic Telescope

- Miniature aperture telescope
- Standard field (Galilean)
- Expanded field (Keplerian)
- Magnification Ranges 1.7X to 6X
- 2.2X, 3X & 4X most commonly used for driving

When is a Bioptic Telescope Considered for Driving?

- If Visual Acuity less than 20/70
- Must Have Visual Acuity of greater than 20/200 through the carrier lens
- Stable eye pathology
- Peripheral Visual Fields about 150 degrees
- Reasonable Eye Motility

Vehicle Code 12805 (a)(2)

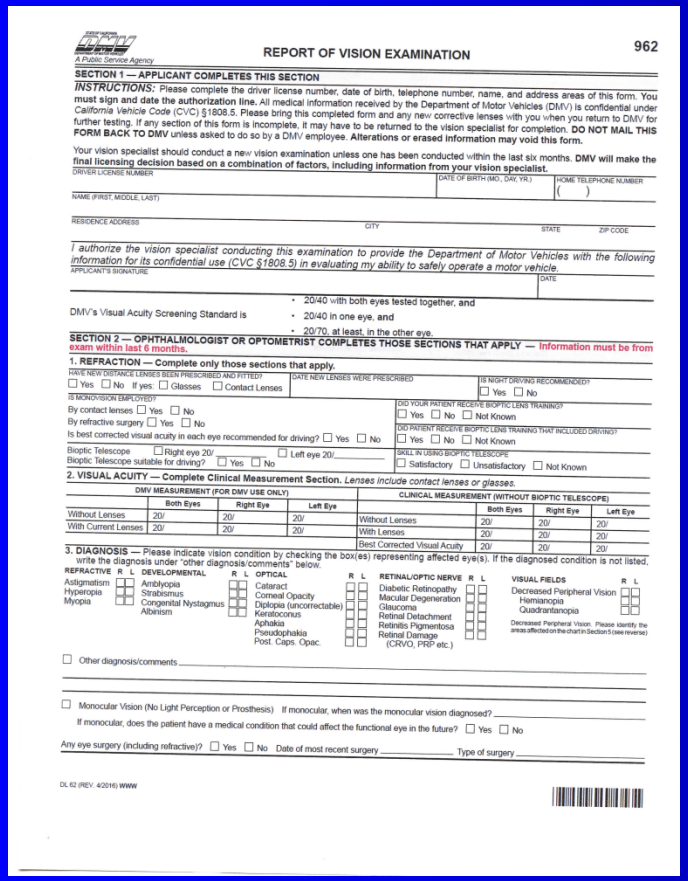
The Department shall not issue a driver's license to, or renew a driver's license of, any person:

(2) Whose best corrected visual acuity is 20/200 or worse in that person's better eye, as verified by an optometrist or ophthalmologist. No person may use a bioptic telescope or similar lens to meet the 20/200 visual acuity standards.

California Vision Required Standards & Guidelines

- **MUST Have Greater than 20/200 VA through carrier lens without the use of the bioptic**
- **20/40 Visual Acuity Screening Standard with Bioptic**
- **150 Degree Visual Field**
- **Stable Eye Condition**
- **Ability to Differentiate Color**
- **Ability to Track Objects**
- **Peripheral Vision in Both Eyes**

CA DMV FORM DL-62



DEPARTMENT OF MOTOR VEHICLES
A Public Service Agency

REPORT OF VISION EXAMINATION 962

SECTION 1 — APPLICANT COMPLETES THIS SECTION

INSTRUCTIONS: Please complete the driver license number, date of birth, telephone number, name, and address areas of this form. **You must sign and date the authorization line.** All medical information received by the Department of Motor Vehicles (DMV) is confidential under *California Vehicle Code* (CVC) §1808.5. Please bring this completed form and any new corrective lenses with you when you return to DMV for further testing. If any section of this form is incomplete, it may have to be returned to the vision specialist for completion. **DO NOT MAIL THIS FORM BACK TO DMV** unless asked to do so by a DMV employee. **Alterations or erased information may void this form.**

Your vision specialist should conduct a new vision examination unless one has been conducted within the last six months. **DMV will make the final licensing decision based on a combination of factors, including information from your vision specialist.**

DRIVER LICENSE NUMBER | DATE OF BIRTH (MO., DAY, YR.) | HOME TELEPHONE NUMBER ( )

NAME (FIRST, MIDDLE, LAST)

RESIDENCE ADDRESS | CITY | STATE | ZIP CODE

I authorize the vision specialist conducting this examination to provide the Department of Motor Vehicles with the following information for its confidential use (CVC §1808.5) in evaluating my ability to safely operate a motor vehicle.

APPLICANT'S SIGNATURE | DATE

DMV's Visual Acuity Screening Standard is
- 20/40 with both eyes tested together, and
- 20/40 in one eye, and
- 20/70, at least, in the other eye.

SECTION 2 — OPHTHALMOLOGIST OR OPTOMETRIST COMPLETES THOSE SECTIONS THAT APPLY — Information must be from exam within last 6 months.

1. REFRACTION — Complete only those sections that apply.

HAVE NEW DISTANCE LENSES BEEN PRESCRIBED AND FITTED? ☐ Yes ☐ No If yes: ☐ Glasses ☐ Contact Lenses | DATE NEW LENSES WERE PRESCRIBED | IS NIGHT DRIVING RECOMMENDED? ☐ Yes ☐ No

IS MONOVISION EMPLOYED? By contact lenses ☐ Yes ☐ No; By refractive surgery ☐ Yes ☐ No

Is best corrected visual acuity in each eye recommended for driving? ☐ Yes ☐ No

Bioptic Telescope ☐ Right eye 20/ ☐ Left eye 20/
Bioptic Telescope suitable for driving? ☐ Yes ☐ No

DID YOUR PATIENT RECEIVE BIOPTIC LENS TRAINING? ☐ Yes ☐ No ☐ Not Known

DID PATIENT RECEIVE BIOPTIC LENS TRAINING THAT INCLUDED DRIVING? ☐ Yes ☐ No ☐ Not Known

SKILL IN USING BIOPTIC TELESCOPE ☐ Satisfactory ☐ Unsatisfactory ☐ Not Known

2. VISUAL ACUITY — Complete Clinical Measurement Section. *Lenses include contact lenses or glasses.*

DMV MEASUREMENT (FOR DMV USE ONLY)	Both Eyes	Right Eye	Left Eye
Without Lenses	20/	20/	20/
With Current Lenses	20/	20/	20/

CLINICAL MEASUREMENT (WITHOUT BIOPTIC TELESCOPE)	Both Eyes	Right Eye	Left Eye
Without Lenses	20/	20/	20/
With Lenses	20/	20/	20/
Best Corrected Visual Acuity	20/	20/	20/

3. DIAGNOSIS — Please indicate vision condition by checking the box(es) representing affected eye(s). If the diagnosed condition is not listed, write the diagnosis under "other diagnosis/comments" below.

REFRACTIVE	R	L
Astigmatism	☐	☐
Hyperopia	☐	☐
Myopia	☐	☐

DEVELOPMENTAL	R	L
Amblyopia	☐	☐
Strabismus	☐	☐
Congenital Nystagmus	☐	☐
Albinism	☐	☐

OPTICAL	R	L
Cataract	☐	☐
Corneal Opacity	☐	☐
Diplopia (uncorrectable)	☐	☐
Keratoconus	☐	☐
Aphakia	☐	☐
Pseudophakia	☐	☐
Post. Caps. Opac.	☐	☐

RETINAL/OPTIC NERVE	R	L
Diabetic Retinopathy	☐	☐
Macular Degeneration	☐	☐
Glaucoma	☐	☐
Retinal Detachment	☐	☐
Retinitis Pigmentosa	☐	☐
Retinal Damage (CRVO, PRP etc.)	☐	☐

VISUAL FIELDS	R	L
Decreased Peripheral Vision	☐	☐
Hemianopia	☐	☐
Quadrantanopia	☐	☐

Decreased Peripheral Vision. Please identify the areas affected on the chart in Section 5 (see reverse)

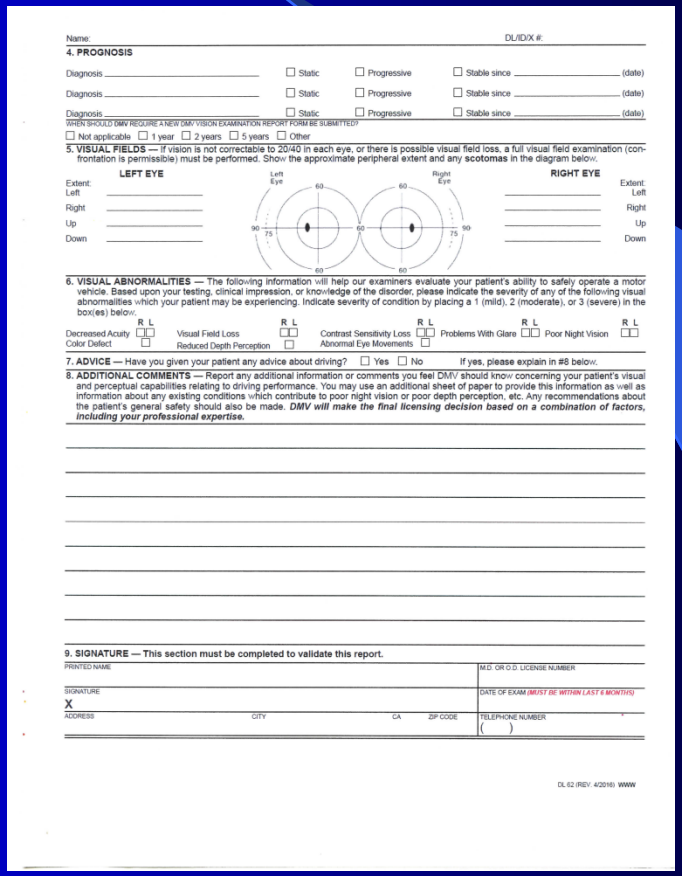
☐ Other diagnosis/comments

☐ Monocular Vision (No Light Perception or Prosthesis) If monocular, when was the monocular vision diagnosed?

If monocular, does the patient have a medical condition that could affect the functional eye in the future? ☐ Yes ☐ No

Any eye surgery (including refractive)? ☐ Yes ☐ No Date of most recent surgery Type of surgery

DL 62 (REV. 4/2016) WWW



Name: DL/ID/X #:

4. PROGNOSIS

Diagnosis ☐ Static ☐ Progressive ☐ Stable since (date)
Diagnosis ☐ Static ☐ Progressive ☐ Stable since (date)
Diagnosis ☐ Static ☐ Progressive ☐ Stable since (date)

WHEN SHOULD DMV REQUIRE A NEW DMV VISION EXAMINATION REPORT FORM BE SUBMITTED?
☐ Not applicable ☐ 1 year ☐ 2 years ☐ 5 years ☐ Other

5. VISUAL FIELDS — If vision is not correctable to 20/40 in each eye, or there is possible visual field loss, a full visual field examination (confrontation is permissible) must be performed. Show the approximate peripheral extent and any **scotomas** in the diagram below.

LEFT EYE
Extent: Left
Right
Up
Down

RIGHT EYE
Extent: Left
Right
Up
Down

6. VISUAL ABNORMALITIES — The following information will help our examiners evaluate your patient's ability to safely operate a motor vehicle. Based upon your testing, clinical impression, or knowledge of the disorder, please indicate the severity of any of the following visual abnormalities which your patient may be experiencing. Indicate severity of condition by placing a 1 (mild), 2 (moderate), or 3 (severe) in the box(es) below.

	R	L		R	L		R	L		R	L
Decreased Acuity	☐	☐	Visual Field Loss	☐	☐	Contrast Sensitivity Loss	☐	☐	Problems With Glare	☐	☐
Color Defect	☐		Reduced Depth Perception	☐		Abnormal Eye Movements	☐		Poor Night Vision	☐	

7. ADVICE — Have you given your patient any advice about driving? ☐ Yes ☐ No If yes, please explain in #8 below.

8. ADDITIONAL COMMENTS — Report any additional information or comments you feel DMV should know concerning your patient's visual and perceptual capabilities relating to driving performance. You may use an additional sheet of paper to provide this information as well as information about any existing conditions which contribute to poor night vision or poor depth perception, etc. Any recommendations about the patient's general safety should also be made. ***DMV will make the final licensing decision based on a combination of factors, including your professional expertise.***

9. SIGNATURE — This section must be completed to validate this report.

PRINTED NAME | M.D. OR O.D. LICENSE NUMBER
SIGNATURE X | DATE OF EXAM *(MUST BE WITHIN LAST 6 MONTHS)*
ADDRESS | CITY | CA | ZIP CODE | TELEPHONE NUMBER ( )

DL 62 (REV. 4/2016) WWW

Contents of Form DL 62

- VA in both eyes without lenses
- VA in both eyes with standard lenses
- VA through Bioptic in better eye
- Date and type of most recent prescription
- Visual field degrees in both eyes
- Etiology and Diagnosis (cause of low vision)
- Prognosis (stability)
- Advice on Driving, when should DMV require new vision report be submitted. Doctor shall report any addition information relating to driving performance. DMV will make the final licensing decision based on a combination of factors including doctor's professional expertise.

Bioptic License Requirements in CA

- **Must complete a Form DL44 Application for Driver License**
- **Must provide a recently completed DL-62 Report form of Vision Examination within 6 mo.**
- **Must pass a written test**
- **Must pass a road Test including freeway driving or accept restriction of no freeway driving**
- **Initially may be restricted to daylight driving only but then may pass a night drive test to remove this restriction.**
- **May not renew by mail**

Bioptic Training Sequence

- Locate Stationary Objects while Still
- Locate Moving Objects while Still
- Locate Moving Objects while Moving
- Accurate Rapid Decision Making
- Spatial Awareness & Memory
- Adjustments to Various Lighting Conditions
- Visual Perception and Interpretation

Behaviors Associated with Effective Bioptic Use in Driving

- **Spotting Device**
- **Vary Amount of Bioptic Use**
- **Maximizing Eye Movement**
- **Constant Scanning of the Driving Environment**

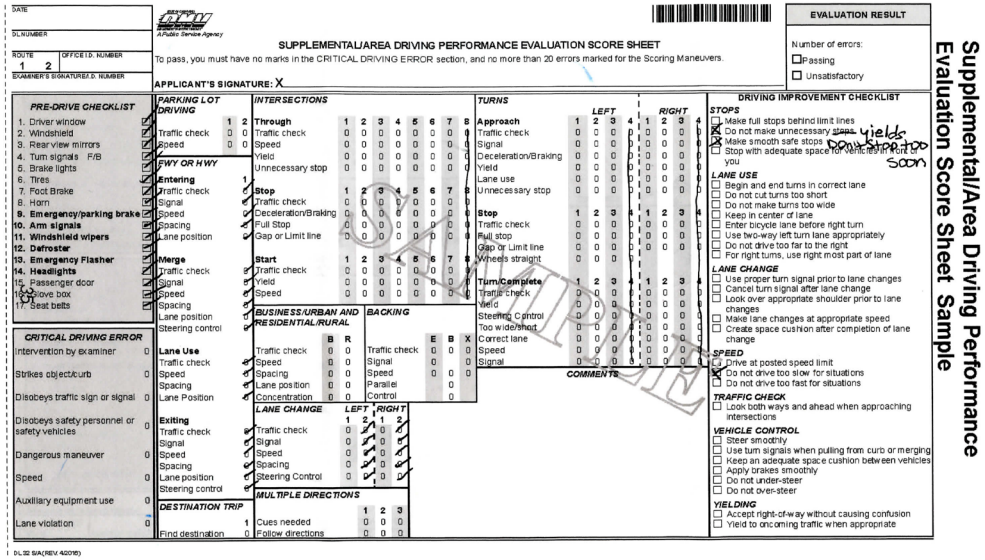
Indicators of Effective Bioptic Use

- Recognize traffic lights, stop signs, pedestrians in crosswalks first through the bioptic, then the carrier lens
- Spotting & reading freeway signs within seconds
- Varies bioptic use between freeways, residential & business areas
- Determining distance from passible hazards

Driving Performance Evaluation (drive test)

- Steering, Shifting & Turning
- Speed Control & Braking
- Backing Up and Parking
- Entering & Exiting Freeways
- Use of Mirrors
- Use Courtesy at Intersections
- Never Insist on Right of Way
- Can’t make video or audio recording of test
- Can’t use certain ADAS technology features

DMV Driver Performance Evaluation Score Sheet



SUPPLEMENTAL/AREA DRIVING PERFORMANCE EVALUATION SCORE SHEET

To pass, you must have no marks in the CRITICAL DRIVING ERROR section, and no more than 20 errors marked for the Scoring Maneuvers.

APPLICANT'S SIGNATURE: X

EVALUATION RESULT

Number of errors:
☐ Passing
☐ Unsatisfactory

Supplemental/Area Driving Performance Evaluation Score Sheet Sample

PRE-DRIVE CHECKLIST
1. Driver window
2. Windshield
3. Rear view mirrors
4. Turn signals F/B
5. Brake lights
6. Tires
7. Foot Brake
8. Horn
9. **Emergency/parking brake**
10. **Arm signals**
11. **Windshield wipers**
12. **Defroster**
13. **Emergency Flasher**
14. **Headlights**
15. Passenger door
16. Glove box
17. Seat belts

CRITICAL DRIVING ERROR
Intervention by examiner
Strikes object/curb
Disobeys traffic sign or signal
Disobeys safety personnel or safety vehicles
Dangerous maneuver
Speed
Auxiliary equipment use
Lane violation

PARKING LOT DRIVING
Traffic check
Speed

FWY OR HWY
Entering
Traffic check
Signal
Speed
Spacing
Lane position
Merge
Traffic check
Signal
Speed
Spacing
Lane position
Steering control
Lane Use
Traffic check
Speed
Spacing
Lane Position
Exiting
Traffic check
Signal
Speed
Spacing
Lane position
Steering control

DESTINATION TRIP
Cues needed
Follow directions
Find destination

INTERSECTIONS
Through
Traffic check
Speed
Yield
Unnecessary stop
Stop
Traffic check
Deceleration/Braking
Full Stop
Gap or Limit line
Start
Traffic check
Yield
Speed

BUSINESS/URBAN AND RESIDENTIAL/RURAL
Traffic check
Speed
Spacing
Lane position
Concentration

LANE CHANGE
Traffic check
Signal
Speed
Spacing
Steering Control

BACKING
Traffic check
Signal
Speed
Parallel
Control

MULTIPLE DIRECTIONS

TURNS
Approach
Traffic check
Signal
Deceleration/Braking
Yield
Lane use
Unnecessary stop
Stop
Traffic check
Full stop
Gap or Limit line
Wheels straight
Turn/Complete
Traffic check
Yield
Steering Control
Too wide/short
Correct lane
Speed
Signal

COMMENTS

DRIVING IMPROVEMENT CHECKLIST

STOPS
- ☐ Make full stops behind limit lines
- ☒ Do not make unnecessary ~~stops~~ yields
- ☒ Make smooth safe stops Don't stop too soon
- ☐ Stop with adequate space for vehicle in front of you

LANE USE
- ☐ Begin and end turns in correct lane
- ☐ Do not cut turns too short
- ☐ Do not make turns too wide
- ☐ Keep in center of lane
- ☐ Enter bicycle lane before right turn
- ☐ Use two-way left turn lane appropriately
- ☐ Do not drive too far to the right
- ☐ For right turns, use right most part of lane

LANE CHANGE
- ☐ Use proper turn signal prior to lane changes
- ☐ Cancel turn signal after lane change
- ☐ Look over appropriate shoulder prior to lane changes
- ☐ Make lane changes at appropriate speed
- ☐ Create space cushion after completion of lane change

SPEED
- ☐ Drive at posted speed limit
- ☒ Do not drive too slow for situations
- ☐ Do not drive too fast for situations

TRAFFIC CHECK
- ☐ Look both ways and ahead when approaching intersections

VEHICLE CONTROL
- ☐ Steer smoothly
- ☐ Use turn signals when pulling from curb or merging
- ☐ Keep an adequate space cushion between vehicles
- ☐ Apply brakes smoothly
- ☐ Do not under-steer
- ☐ Do not over-steer

YIELDING
- ☐ Accept right-of-way without causing confusion
- ☐ Yield to oncoming traffic when appropriate

DL 32 SA (REV. 4/2016)

Critical Driving Errors You FAIL if…..

Intervention by Examiner
Strike Object or Curb
Disobeys traffic sign/signal
Exceeds speed limit
Dangerous maneuver
Auxiliary equipment use
Lane Violation

DRIVER PERFORMANCE EVALUATION SCORE SHEET

DATE

DL NUMBER

ROUTE 1 2 Alt. | OFFICE I.D. NUMBER

EXAMINER'S SIGNATURE/I.D. NUMBER X

A Public Service Agency

DRIVING PERFORMANCE EVALUATION SCORE SHEET

To pass, you must have no more than 3 errors marked for Items 9-14 under PRE-DRIVE CHECKLIST, no marks in the CRITICAL DRIVING ERROR section, and no more than 15 errors marked for the Scoring Maneuvers.

APPLICANT'S SIGNATURE: X _____

EVALUATION RESULT

Number of errors:

☐ Passing

☐ Unsatisfactory

PRE-DRIVE CHECKLIST

1. Driver window ☐
2. Windshield ☐
3. Rear view mirrors ☐
4. Turn signals F/B ☐
5. Brake lights ☐
6. Tires ☐
7. Foot Brake ☐
8. Horn ☐
9. **Emergency/parking brake** ☐
10. **Arm signals** ☐
11. **Windshield wipers** ☐
12. **Defroster** ☐
13. **Emergency Flasher** ☐
14. **Headlights** ☐
15. Passenger door ☐
16. Glove box ☐
17. Seat belts ☐

CRITICAL DRIVING ERROR

Intervention by examiner	0
Strikes object/curb	0
Disobeys traffic sign or signal	0
Disobeys safety personnel or safety vehicles	0
Dangerous maneuver	0
Speed	0
Auxiliary equipment use	0
Lane violation	0

PARKING LOT DRIVING

	1	2
Traffic check	0	0
Speed	0	0

FWY OR HWY

Entering	1
Traffic check	0
Signal	0
Speed	0
Spacing	0
Lane position	0
Merge	
Traffic check	0
Signal	0
Speed	0
Spacing	0
Lane position	0
Steering control	0
Lane Use	
Traffic check	0
Speed	0
Spacing	0
Lane Position	0
Exiting	
Traffic check	0
Signal	0
Speed	0
Spacing	0
Lane position	0
Steering control	0

INTERSECTIONS

Through	1	2	3	4	5	6	7	8
Traffic check	0	0	0	0	0	0	0	0
Speed	0	0	0	0	0	0	0	0
Yield	0	0	0	0	0	0	0	0
Unnecessary stop	0	0	0	0	0	0	0	0

Stop	1	2	3	4	5	6	7	8
Traffic check	0	0	0	0	0	0	0	0
Deceleration/Braking	0	0	0	0	0	0	0	0
Full Stop	0	0	0	0	0	0	0	0
Gap or Limit line	0	0	0	0	0	0	0	0

Start	1	2	3	4	5	6	7	8
Traffic check	0	0	0	0	0	0	0	0
Yield	0	0	0	0	0	0	0	0
Speed	0	0	0	0	0	0	0	0

BUSINESS/URBAN AND RESIDENTIAL/RURAL

	B	R
Traffic check	0	0
Speed	0	0
Spacing	0	0
Lane position	0	0

BACKING

	E	B	X
Traffic check	0	0	0
Signal	0		0
Speed	0	0	0
Parallel		0	
Control		0	

LANE CHANGE

	L	R
Traffic check	0	0
Signal	0	0
Speed	0	0
Spacing	0	0
Steering Control	0	0

TURNS

	LEFT				RIGHT			
Approach	1	2	3	4	1	2	3	4
Traffic check	0	0	0	0	0	0	0	0
Signal	0	0	0	0	0	0	0	0
Deceleration/Braking	0	0	0	0	0	0	0	0
Yield	0	0	0	0	0	0	0	0
Lane use	0	0	0	0	0	0	0	0
Unnecessary stop	0	0	0	0	0	0	0	0
Stop	1	2	3	4	1	2	3	4
Traffic check	0	0	0	0	0	0	0	0
Full stop	0	0	0	0	0	0	0	0
Gap or Limit line	0	0	0	0	0	0	0	0
Wheels straight	0	0	0	0				
Turn/Complete	1	2	3	4	1	2	3	4
Traffic check	0	0	0	0	0	0	0	0
Yield	0	0	0	0	0	0	0	0
Steering Control	0	0	0	0	0	0	0	0
Too wide/short	0	0	0	0	0	0	0	0
Correct lane	0	0	0	0	0	0	0	0
Speed	0	0	0	0	0	0	0	0
Signal	0	0	0	0	0	0	0	0

COMMENTS

DRIVING IMPROVEMENT CHECKLIST

STOPS
- ☐ Make full stops behind limit lines
- ☐ Do not make unnecessary stops
- ☐ Make smooth safe stops
- ☐ Stop with adequate space for vehicles in front of you

LANE USE
- ☐ Begin and end turns in correct lane
- ☐ Do not cut turns too short
- ☐ Do not make turns too wide
- ☐ Keep in center of lane
- ☐ Enter bicycle lane before right turn
- ☐ Use two-way left turn lane appropriately
- ☐ Do not drive too far to the right
- ☐ For right turns, use right most part of lane

LANE CHANGE
- ☐ Use proper turn signal prior to lane changes
- ☐ Cancel turn signal after lane change
- ☐ Look over appropriate shoulder prior to lane changes
- ☐ Make lane changes at appropriate speed
- ☐ Create space cushion after completion of lane change

SPEED
- ☐ Drive at posted speed limit
- ☐ Do not drive too slow for situations
- ☐ Do not drive too fast for situations

TRAFFIC CHECK
- ☐ Look both ways and ahead when approaching intersections

VEHICLE CONTROL
- ☐ Steer smoothly
- ☐ Use turn signals when pulling from curb or merging
- ☐ Keep an adequate space cushion between vehicles
- ☐ Apply brakes smoothly
- ☐ Do not under-steer
- ☐ Do not over-steer

YIELDING
- ☐ Accept right-of-way without causing confusion
- ☐ Yield to oncoming traffic when appropriate

Driving Performance Evaluation Score Sheet Sample

DL 32 (REV. 5/2016)

Driver Test Scoring

Pre-Drive Test Checklist

1. Driver Window must roll down
2. Windshield cracks
3. 2 Rear View Mirrors
4. Turn Signals work
5. Brake Lights work
6. Tire tread at least 1/16”
7. Parking brake
8. Horn works
9. Parking Brake demo
10. Arm Signals demo
11. Windshield Wipers demo
12. Defroster demo
13. Emergency Flasher demo
14. Headlights demo
15. Passenger Door opens
16. Glove Box demo
17. Fasten Seat belt

To Pass must have no more than three errors in Pre check

Highway Driving

- Entering
- Traffic Check Look
- Mirror & shoulder check
- Signal
- Speed
- Spacing
- Lane Position Steering
- Exiting

Intersections

- Through
- Stop
- Yield
- Braking
- Unnecessary Stop
- Start
- Traffic Circles
- Turns
- Signaling
- Right of Way

Turns, Backing, Parking

- Signal
- Speed
- Approach
- Lane Use
- Spacing
- Look over shoulder
- Parallel park

To Pass must have no more than 15 errors in Scoring Maneuvers

10 MOST COMMON ERRORS ON A DRIVE TEST

1. Shoulder checking
2. 4 Way vs 2 Way Stops
3. Stopping position
4. Two Shoulder Checks
5. Failing to Signal
6. Following too Close
7. Incorrect Lane Positioning
8. Incorrect positioning for turning
9. Driving too slow
10. Failing to Look through the back Window

During the Drive Test Use Defensive Driving Skills

- Keep Your Eyes Moving
- See the Entire Picture
- Be Sure You are Seen
- Follow at a Safe Distance (4 seconds)
- Anticipate Other Driver(s) Actions
- Leave Yourself an Escape

Safety Margin Factors

Safety margin is anything that increases the chance of driver error

- **Emotional Status**
- **Reaction Time**
- **Mental Alertness & Driver Inattention**
- **Driver Inexperience & Over Experience**
- **Age and Other Impairments**
- **Legitimate Need to Drive**

Skills Useful for Low Vision Drivers to Help Compensate for their Disability

- Know Where You Are Going and Plan Your Route in Advance
- Drive During Less Demanding Conditions
- Impose Voluntary Self-Restrictions
- Be Attentive to the Driving Tasks at All Times
- Use Non-Visual Cues
- Use Low Vision Devices Appropriately
- Periodic Professional Training

Examples of License Restrictions that may be Placed on a license

(NOT AN EXHAUSTIVE LIST)

- No Freeway Driving
- No Nighttime Driving
- Geographic Area Restrictions (within 5 miles of home)
- Specific Hours (i.e. no driving during rush hour
- Specific Roads (fixed route)
- Special Vehicle & Equipment (i.e. extra mirrors)
- Driving to specific destinations (i.e.) doctor's office)
- Must always wear bioptic telescopic lenses while driving.

Doctors are required to report to the DMV Driver Safety Office any diagnosis that will impair driving such as lapse of consciousness, Alzheimers or other serious conditions. DMV will investigate and conduct a reexamination and take appropriate action when necessary. Drivers may request a hearing before action is taken on their license.

PART 2

THE FUTURE OF DRIVING and TRANSPORTATION

AUTONOMOUS (AV) VEHICLES

NCSL (National Conference of State Legislatures) have reported as of 2024

Twenty-nine states—Alabama, Arkansas, California, Colorado, Connecticut, Florida, Georgia, Illinois, Indiana, Kentucky, Louisiana, Maine, Michigan, Mississippi, Nebraska, New York, Nevada, North Carolina, North Dakota, Oregon, Pennsylvania, South Carolina, Tennessee, Texas, Utah, Virginia, Vermont, Washington and Wisconsin Washington D.C. have enacted legislation related to autonomous vehicles.

Governors in Arizona, Delaware, Hawaii, Idaho, Illinois, Maine, Massachusetts, Minnesota, Ohio, Washington and Wisconsin have issued executive orders related to autonomous vehicles.

Twelve states have not enacted legislation nor Governor executive orders related to autonomous vehicles—Alaska, Idaho, Iowa, Kansas, Maryland, Missouri, Montana, New Hampshire, New Jersey, New Mexico, Oklahoma and South Dakota.

The Testing of Autonomous Vehicles

Of those states with autonomous vehicle laws or Governor's executive orders and related rules on the books, there is a variety of stipulations on the level of autonomy of the vehicle (as defined by the Society of Automotive Engineers. (SAE) the type of vehicle allowed to be tested, the conditions to be tested and whether a licensed driver is required to be behind the wheel or not during the testing may vary.

IN CALIFORNIA WHAT IS AN (AV) AUTONOMOUS VEHICLE

Technology **The application of scientific knowledge for practical purposes in engineering and applied sciences including equipment and machinery**

California Code, Vehicle Code - VC § 38750

- **(1) "Autonomous technology" means technology that has the capability to drive a vehicle without the active physical control or monitoring by a human operator.**
- **(2)(A) "Autonomous vehicle" means any vehicle equipped with autonomous technology that has been integrated into that vehicle that meets the definition of Level 5 Automation of (Society of Automotive Engineers) SAE International's "Taxonomy and Definitions."**

6 LEVELS OF SAE AUTOMATION IN AUTONOMOUS VEHICLES

As the levels increase, the extent of the driverless car's independence increases.

At level 0, NO DRIVING AUTOMATION the car has no control over its operation and the human driver does all of the driving.

At level 1, DRIVER ASSISTANCE the vehicle's ADAS (advanced driver assistance system) has the ability to support the driver with either steering or accelerating and braking.

At level 2, PARTIAL DRIVER AUTOMATION the ADAS can oversee steering and accelerating and braking in some conditions, although the human driver is required to continue paying complete attention to the driving environment throughout the journey, while also performing the remainder of the necessary tasks.

At level 3, CONDITIONAL DRIVING AUTOMATION the ADAS (advanced driver assistance system) can perform all parts of a driving task in some conditions, but the human driver is required to be able to regain control when requested to do so by the ADAS. In those remaining conditions, the human driver executes the necessary tasks.

At level 4, HIGH DRIVING AUTOMATION the vehicle's ADAS is able to perform all driving tasks independently in certain conditions in which human attention is not required.

Level 5, FULL DRIVING AUTOMATION involves full automation whereby the vehicle's technology is able to perform all tasks in all conditions, and no driving assistance is required from the human driver. This full automation will be enabled by the application of 5G technology, which will allow vehicles to communicate not just with one another, but also with traffic lights, signage and even the roads themselves.

What are some advantages of Autonomous Vehicles

- **Reduction in traffic collisions and deaths because 94% of accidents are caused by human error due to lack of attention, fatigue, poor judgement or driving under the influence.**
- **Greater Accessibility, Freedom and Independence for persons who can't drive due to age or disability**
- **Lowered insurance costs due to fewer accidents and medical claims because of fewer injuries.**
- **Less congestion because of more efficiency in traffic flow, less commute time and more energy saved resulting in less CO_2 emissions in the atmosphere helping to reduce climate change**
- **Fewer vehicles and parking spaces will be needed since the AV lets the passenger off and independently goes away to pick up the next passenger to bring them to their destination.**

This list is by no means inclusive of all AV advantages

Are Autonomous Vehicles More Safe than Vehicles Controlled by Humans

BIG DATA is proving that in all testing phases thus far it is more safe with a total of over 25 Million Miles driven in California and 37 other states, AV's have been tested since 2009 under many driving conditions. with only one fatality.

NHTSA (National Highway Traffic Safety Administration) shows an average of 42,514 persons die in traffic accidents annually in the US. That means since 2009 more than 637,710 people lost their life in traffic relate accidents. Why? Because 94% of all accidents are due to human error When perfected, computers won't drive drunk or under the influence nor will they become fatigued, use poor judgement and suffer from driver inattention.

This is why so many Auto Makers and Technology companies are spending millions of dollars competing to be the first to perfect driverless vehicles.

In a recent poll by the Institute of Mechanical Engineers, public perception show an increase in confidence toward AV's. 49% of the responders said they'd feel comfortable in the driving seat as long as the AV could also be driven as a conventional vehicle. 50% of the responders said they'd think fully autonomous vehicles should be available to people with disabilities who cannot drive. More younger people that older people are comfortable with sharing the road with AV's. As more automation is perfected and Artificial Intelligence is incorporated into autonomous vehicles their use will become a reality as public perception and trust increases.

What are some Challenges of Autonomous Vehicles

- **Technical software challenges involving large amounts of data in real time**
- **Job Loss in transportation and other areas**
- **Hacker Attacks and Data Protection issues**
- **Unknown Legal, Social and Economic challenges**

This list is by no means inclusive of all AV disadvantages

Although there are still many challenges to overcome, governments, many technology and automobile companies around the world are working to find solutions and establish autonomous vehicles on the roads as quickly as possible. Every new technology in the past faced challenges to overcome such as those changes caused by the Industrial Revolution, the use of telegraphs, electricity, automobiles, aircraft, computers and the Internet yet they solved the problems changed the public perception and improved the quality of life.

Common ADAS safety features included in many vehicles now using cameras and sensors

Blind-Spot Collision-Avoidance Warning
Rear Cross-Traffic Collision Warning
Lane Keeping Assist
Lane Following Assist
Forward Collision-Avoidance Assist
Highway Driving Assist (HDA)
Leading Vehicle Departure Alert
Smart Cruise Control (SCC) with Stop & Go
Navigation-based Smart Cruise Control
Driver Attention Warning
Rear Occupant Alert (ROA) with Door Monitoring
Automatic parallel parking and Reverse Parking Warning

AUTONOMOUS VEHICLE TESTING PERMIT HOLDERS WITH CALIFORNIA DMV

A manufacturer with a permit to test with a safety driver is authorized to test on any public road within the State of California. As of April 10, 2024, DMV has issued Autonomous Vehicle Testing Permits (with a driver) to the following entities:

AIMOTIVE INC
APEX.AI
APOLLO AUTONOMOUS DRIVING USA LLC
APPLE INC
AURORA OPERATIONS, INC
AUTOX TECHNOLOGIES INC
BEEP
BLACK SESAME TECHNOLOGIES INC
BLUESPACE.AI, INC
BOSCH
CRUISE LLC
GATIK AI INC
HELM.AI INC
IMAGRY INC
MAY MOBILITY
MERC BENZ
MOBILEYE
MOTIONAL
NIO USA INC.
NISSAN
NURO, INC
NVIDIA CORPORATION
PLUSAI, INC
PONY.AI
QUALCOMM TECHNOLOGIES, INC
RIDECELL INC
TELENAV, INC.
TESLA
VALEO NORTH AMERICA, INC.
VUERON TECHNOLOGY USA, INC
WAYMO LLC
WeRide Corp DBA WeRide AI
WOVEN PLANET NORTH AMERICA, INC
XMOTORS.AI, INC
ZOOX INC

DMV has authorized the following manufacturers to test autonomous vehicles without a safety driver – *Updated April 17, 2024*

Apollo Driving USA

Auto X Tech Inc.

Nuro Inc,

Waymo LLC

WeRide Corp AI

Zoox Inc

DMV authorized Deployment of AV's as of January 11, 2024

To the following entities

Mercedez Benz USA

Nuro Inc.

Waymo LLC

Autonomous Cars with the Highest Automation

Waymo is a subsidiary of Google's parent company, Alphabet. Google began testing autonomous driving vehicles in 2009 on test tracks. Presently, Waymo has over 20 million miles of autonomous driver experience in real world driving situations, far more than any other vehicle technology system. Their ADAS system is presently the closest one to being certified as an SAE Level 4. They operate a driverless Robo-taxi 24/7 across 63 square miles in Los Angeles for the public. There is a waitlist to use it.

Mercedes has been certified SAE Level 3 by the state of Nevada. Tesla, BMW, Ford and GM have systems that can satisfy some but not all requirements of SAE level 3.

Presently there are no driverless technology systems that have achieved SAE Level 5. The automotive industry experts expect that ADAS systems will achieve SAE Level 5 by 2035.

WAYMO AUTONOMOUS VEHICLE

Chrysler Pacifica hybrid with Advanced Autonomous Technology Software Installed by Waymo

Autonomous Driving Trucks

It is expected as early as 2030, completely driverless, autonomous trucks will be on the roads. Presently in California, Nevada, Arizona, Texas and Georgia partially automated trucks have a licensed driver in case of emergency.

TuSimple is a company that operates self driving trucks out of Tucson AZ and has over 200,000 autonomous miles of paid freight haulage. They require a driver supervisor Class A licensed driver while operating autonomously.

Waymo, Daimler, Tesla and Volvo also operate autonomous driving trucks delivering freight using interstate highways. Trucks are equipped with a laser based radar system and a human driver.

Why is the Topic of Autonomous Vehicles Included in a Presentation about Driving with Bioptics

Using Autonomous Vehicles will be a new alternative for people to use to move about especially for those who cannot drive due to age or disability that will give them new independence and freedom that did not exist previously and will change everyone's life in the decades ahead.

Most everyone agrees that the future in transportation is autonomous vehicles is inevitable because of greater safety, energy efficiency and convenience. The only debate now is exactly how soon that future will arrive.

PART 3

MEDICAL INTERVENTIONS THAT WILL IMPACT ALBINISM IN THE FUTURE

WHAT IS CRISPR

CRISPR stands for:

CLUSTERED REGULATORY INTERSPACED SHORT PALINDROMIC REPEATS

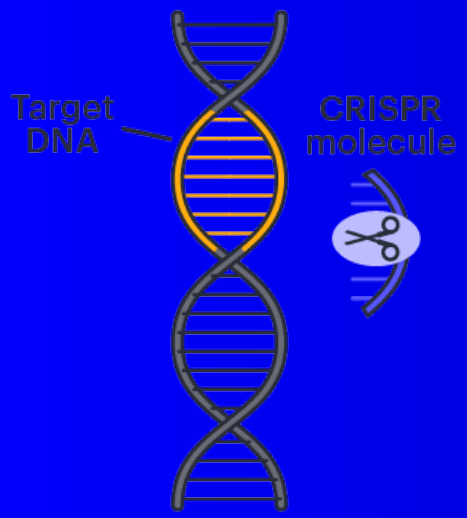
It is a new Gene Editing medical procedure developed in 2013 that has the potential to treat many genetic defects by repairing and replacing mutations in the genome, which is the complete set of DNA material in an organism. With these systems, researchers can permanently modify genes in living cells and organisms that can make it possible to correct mutations at precise locations in the humane genome in order to treat genetic causes of many disorders.

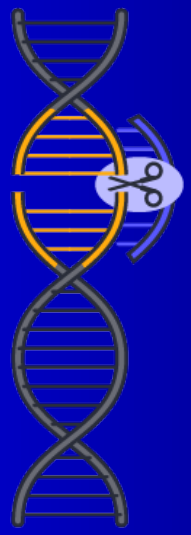
HOW DOES CRISPR WORK

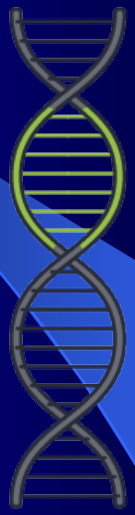
CRISPR "spacer" sequences are transcribed into short Ribonucleic acid (RNA) sequences capable of guiding the system to matching sequences of Deoxyribonucleic Acid (DNA)

When the target DNA is found, Cas9, one of the enzymes produced by the CRISPR system, binds to the DNA and cuts it, shutting the target gene off or it may cut and remove the defective sequence and replace it with a customized alternative sequence that can be inserted into the gene to repair the defect.

CRISPR GENE EDITING







1 **SEARCH**
A CRISPR molecule finds a precise location in the target DNA.

2 **CUT**
The CRISPR enzyme cuts the target DNA at the point found by the guide.

3 **EDIT**
A new custom sequence can be added when the DNA is repaired.

What are some conditions caused by genetic defects

A few are:

Albinism
Alzheimer's Disease
Cancer
Cystic Fibrosis
Diabetes Type 1
Heart Disease
Leukemia
Macular Degeneration
Muscular Dystrophy
Retinitis Pigmentosa
Sickle Cell Disorder

But there are thousands more

Can CRISPR Gene Editing correct genetic disorders like Albinism

It is probable, but it likely won't happen anytime soon for a variety of reasons:

1. There are risks with this procedure that may affect future offsprings of persons who are treated with CRISPR that may cause unintended consequences involved when editing genetic mutations.

2. We do not have sufficient experience and knowledge yet about long term impacts in using CRISPR to ameliorate genetic mutations

3. Some genetic disorders involve shortened life span, pain accompanied by very unpleasant side effects for those afflicted. No doubt, these conditions will get top priority to relieve human suffering by using available research funds

4. The cost to treat individual patients is extremely high presently. There are insufficient financial resources to treat all genetic anomalies know so priorities will go to genetic disorder groups that contain the largest numbers of people first such as cancer, Alzheimer's disease, specific heart diseases, and Diabetes type 1 to name just a few.

IT IS TRUE THAT CRISPR HAS SHOWN GREAT PROMISE THUS FAR

YES. In 2019 the first case of Cycle Cell Disease was successfully cured at a cost of 2-3 million dollars. BUT, we need to continue to learn more. There have also been successful interventions on very small groups of patients with HIV, Diabetes 1 and Cancer.

Be careful, however, not to fall victims to "a cruel hoax" perpetrated by unscrupulous media reports on the Internet that cures for all diseases caused by genetic mutations are imminent. That is not True!

Well informed, respected experts at UC Berkeley, Harvard and Johns Hopkins, to name a few, tell us that we are a long way away from curing everyone who has a genetic disorder. As we learn more and utilize Artificial Intelligence (AI) to assist us to resolve the challenges that we know exist, perhaps we will be able to cure some genetic defects and ameliorate the impact of others as early as 2050 or 2075.

The Take aways

TECHNOLOGY IS THE EQUALIZER FOR PERSONS WHO HAVE DISABILITIES

We can all do things with technology that we cannot do without it. Technology is changing at an exponential rate, a rate that is constantly increasing. Technology improves the quality of human life. Change is inevitable. Barack Obama had it right when he said, "CHANGE WE CAN BELIEVE IN" and "YES YOU CAN". I hope you have all gained valuable information about driving in California with bioptics and are excited and inspired about the positive future that lays ahead for all of us in transportation and medical science that will change our lives by providing opportunities we don't have now. Thank you all for attending and best wishes for a fantastic life in the future.

RESOURCE LINKS

CA Driver Handbook

https://www.dmv.ca.gov/portal/file/california-driver-handbook-pdf

Form DL-62 Report of Vision Examination

https://www.dmv.ca.gov/portal/file/report-of-vision-examination-dl-62-pdf

Driver Performance Evaluation Score Sheet
https://www.dmv.ca.gov/portal/uploads/2020/05/Driving-Performance-Evaluation-Score-Sheet-Sample-.pdf

DMV Videos
https://www.dmv.ca.gov/portal/driver-education-and-safety/educational-materials/videos-2/

TIPS TO PASS YOUR DRIVING TEST
https://www.youtube.com/watch?v=eQ8AGkmtS1Q

10 Most Common errors on a Drive Test
https://www.youtube.com/watch?v=ejSd6IW_P9M

CA DMV regulations regarding Autonomous Vehicles

https://www.dmv.ca.gov/portal/vehicle-industry-services/autonomous-vehicles/california-autonomous-vehicle-regulations/

Robo taxi Ride with us in Los Angeles

https://waymo.com/waymo-one-los-angeles/

Waymo FAQ's On Self Driving Cars

https://waymo.com/faq

CRISPR Gene Editing

Https://en.wikipedia.org/wiki/CRISPR_gene_editing

FOR QUESTIONS OR MORE INFORMATION

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