

# Four-wheel Drive Vehicles and Equipment Course

## LOS ANGELES COUNTY SHERIFF'S DEPARTMENT

### SPECIAL OPERATIONS OF FOUR-WHEEL DRIVE VEHICLES AND EQUIPMENT COURSE

#### EXPANDED COURSE OUTLINE

#### DAY ONE

#### I . INTRODUCTION AND ORIENTATION 1/2 HOUR

##### A. Orientation

##### 1. Administrative process

##### B. Overview of Course

1. This sixteen-hour course consists of six hours of lectures and ten hours of practical application on an off-road driving course. The lectures include off-road driving techniques, four-wheel drive systems, dynamics of winching, off-road tires and accessories, and vehicle dynamics. The practical application includes winching, performance driving, driving through streams, in sand, hill climbing, and over rough terrain. Each agency is required to furnish one four-wheel drive vehicle for each two officers that attend.

C. Course Objective

1. The objective of this course is to provide specialized four-wheel drive vehicle and equipment training and to improve the skills of those officers who drive off-road during rescue operations and enforcement activities. The students will learn the performance capabilities and limitations of themselves, their vehicles, and off-road equipment. The course is designed to minimize personal injuries and vehicle damages that occur during off-road rescue operations or during routine off-road patrol.

2. The course instructors are the leading experts in their fields. The sixteen-hour course consists of six hours of lectures and ten hours of practical application on and off-road driving area. The practical application included winching, performance driving, driving through streams, in sand, over rough terrain, and hill climbing.

**11. OFF-ROAD DRIVING  
TECHNIQUES**  
**1 HOUR**

A. Rocks and Hills

1. Vehicle speeds
2. Gear selection
3. Use of clutch
4. Use of starter motor
5. Momentum
6. Vehicle compression
7. Brakes
8. Large rocks and ruts
9. Downhill sliding
10. Looking over hood

11. Tire air pressure

B. Mud, Snow, and Sand

1. Vehicle speeds
2. Use of clutch
3. Steering techniques
4. Momentum
5. Gear selection
6. Tire air pressure
7. Hidden obstacles

C. Water Crossings

1. Width
2. Depth
3. Rate and direction of flow
4. River banks
5. Walking vs. Driving
6. Disconnection of fan belt
7. Air intake mounts
8. Vehicle speeds
9. Direction of travel
10. Alternate routes

D. Safety

1. Vehicle's and Driver's limitations
2. Seat belt and shoulder harness
3. Vehicle inspection
  
4. Safety equipment
5. Vehicle speeds
6. Roll-overs
  
7. Steering wheels
  8. Fatigue
  9. T.V. Commercials vs. Reality
  10. Driving at night

**III. FOUR-WHEEL DRIVE SYSTEMS**

**½ Hour**

- A. Different types of systems
  1. Standard four-wheel drive
  2. Full-time four-wheel drive
  
- B. Advantages of each four-wheel drive
  1. Standard four-wheel drive
  2. Full-time four-wheel drive
  
- C. Advantages of four-wheel drive
  1. Acceleration and traction

2. Braking and steering response

D. When to use four-wheel drive

1. Pavement
2. Off-road driving

E. Engaging different types of systems

1. Hubs
2. On the fly

**IV.**  
**DYNAMICS**  
**½ Hour**

**VEHICLE**

A. Vehicle Maneuvers

1. Efficiency of four-wheel drive vehicles
2. Driver capabilities
3. Vehicle capabilities
4. Four-wheel drive vs. Two-wheel drive
5. Oversteer vs. Neutral steering
6. Understeer vs. neutral steering
7. Two-wheel vs. Four-wheel deceleration
8. Cornering advantages in adverse conditions

**V . READING OFF-ROAD**

**TERRAIN**  
**½ Hour**

A. Location of hills/ mountains relative to traveled surface

1. Ahead of vehicle
2. Behind vehicle
3. Left or Right of vehicle

B. Location of bodies of water relative to traveled surface

1. Lakes
2. Springs
3. Streams
4. Terrain rise relative to water

C. General Geological Formation

1. Rock Out-cropping
2. Bedrock
3. Sand
4. Changeable surfaces

D. Terrain color change

1. Flora and Fauna
2. Rock and / or surface color

**V I . DYNAMICS OF**  
**WINCHING**  
**1 Hour**

A. History of the Winch

1. Definition of a winch
2. Manual
3. Crank Shaft
4. Power take-off
5. Electric Direct Current
  - a. Commercial / Industrial winches
  - b. Electric front mount self recovery winches
6. The principle of leverage in reverse
7. Maximizing line pull on upper layers

B. Characteristics

1. Exterior mounted winch
2. Hidden winch
3. Worm gear drives
4. Planetary gear
5. Spur gear
6. Intermittent duty
7. Owners manual
8. Size and types of cables

9. Breaking strength
10. High line winch

C. Operations of a winch

1. Winch mounting
2. Electrical connection
3. Battery
  - a. Alternator
  - b. Recharging batteries
4. Clutch operation
5. Remote control
6. Lubrication
7. Motor temperature
8. Cable installation
9. Damaged cable
  - a. Birdnest, etc.
  - b. When to replace cable
  - c. Loss of strength
10. Winch Guides

D. Techniques

1. Anchoring vehicle for self recovery
2. Stakes driven in solid earth
  - a. Chained together



3. Burying a log or spare tire
4. Two-parting
  - a. Multiple power
  - b. Winch kit
5. Wheel Power to assist winch
6. Righting a rolled vehicle
  - a. Wrapping cable
  - b. Multiplying power
  - c. Control
7. Angle of pull

#### E. Winch Safety

1. Covering cable
2. Opening hood
3. Gloves
4. Blocking vehicles on incline
5. Minimum wraps of cable to hold rating load
6. Accessory kits
7. Disengage clutch when not in use
8. Cable inspections
9. Spare cable clamps and hooks
10. Dangers of attaching hook to cable
11. Wet winch motor
12. Practicing with winch

**V I I . TIRE SELECTION**

**1 Hour**

**A. Radial vs. Bias-ply**

1. Radialization of tires
2. Design
3. Advantages of each
4. Concentric
5. Type of tread

**B. Computer designed tread**

1. Symmetrical
2. Asymmetrical
3. Harmonics
4. Concentric
5. Types of tread

**C. Types of tires available**

1. Specific needs
2. Highway tread
3. All-purpose tread
4. Off-road tread

D. Tire Characteristics and purposes

1. Wide tires
2. Narrow tires
3. Large tires
4. Flotation tires
5. Mud tires
6. Snow tires
7. Safety bead / angle of bead
8. Gear ratio for different tires
9. Tire ratings
  - a. M/S rating
  - b. C rating
  - c. Other ratings

E. Tire Pressure

1. Rocks vs. Sand
2. Rim cuts
3. When to “air down”
4. Manufacturer’s recommended tire pressure
5. Air leaks
6. Metal vs. rubber valve stems

F. Tire efficiency

1. Tire pressure

2. Cost per mile
3. Rotation
4. Use vs. abuse

**V I I I . PRACTICAL**  
**APPLICATION, OFF-ROAD**  
**DRIVING            3 Hours**

A. Winching

1. Winching Commands
2. Winching Safety (cable cover)
3. Demonstration

B. Hill Climbing

1. Spotting
2. Wheel placement
3. Forced crossed axle situation

C. Driving in soft sand

1. Airing down tires
2. Turning while in sand
  
3. Sand recovery

D. Stream crossings

1. Checking water depth
2. Scouting for underwater obstacles
3. Speed of crossing

E. Performance driving

1. Course description
2. Pre-drive with instructor
3. Timed student lap

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**EXPANDED COURSE OUTLINE**

**DAY TWO**

**IX. PRACTICAL**

**APPLICATION - ROUGH  
TERRAIN      7 Hours**

A. The class will caravan across rough terrain (Cattle Canyon, Angelus National Forest) for approximately 7 hours. The Driving area may include abandoned fire roads, wash areas, mountain / rock Climbing, snow covered hills (when available), and stream crossings.

1. Frequent stops to monitor driver experience
2. Monitor ground clearance on rocky areas
3. Discuss trail safety and Forest rules (signage, etc)

B. A driving area will also be chosen to include practical applications in Self recovery winching.

**X. COURSE  
EVALUATION  
1 Hour**

A. Instructor / Student critique

1. Debrief Practical application

B. POST course evaluation critiques

C. Vehicle Inspection

1. Out of Four wheel drive
  2. Brake check
  3. Underbody visual inspection
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