SWANA®
SOLID WASTE ASSOCIATION
of North America

ROAD-E-O MANUAL

SWANA ROAD-E-O MISSION

To provide operators of solid waste collection and landfill equipment an opportunity to showcase their skills.

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INTRODUCTION

Background & Rationale

Beginning in 1992, SWANA's International Road-E-O has been held independently from the Association's Annual Exposition (WASTECON®). The last International Road-E-O that was held in conjunction with WASTECON® took place in Vancouver, British Columbia in August of 1990.

In addition, there is a policy of SWANA (MA-2) that precludes the host of the International Road-E-O from holding the event 10 calendar days before the start of WASTECON® or 10 calendar days after the start of WASTECON®. When a chapter submits a request to hold the International Road-E-O to SWANA they must submit the date of the event to show compliance with this policy requirement. The exception to the timing of the International Road-E-O with WASTECON® is if the host chapter of WASTECON® would like to hold the International Road-E-O in conjunction with WASTECON®.

There are a number of reasons for the establishment of an International Road-E-O. Among these are:

1. To **promote** professionalism on the part of drivers and mechanics in the field of solid waste management.
2. To **create** a spirit of competition and goodwill throughout the participating organizations (chapters and the Association).
3. To **provide** additional services by the Association to a segment of the solid waste management field heretofore not served extensively by the Association.
4. To **bind** the chapters together as a functioning and participating unit.

With the addition of an awards dinner in 1992, further opportunities were provided for recognition of those excelling in these events. Furthermore, the inclusion of training opportunities at future Road-E-O's will serve to enhance professionalism for all international Road-E-O participants.

What follows in this document are the rules governing all International Road-E-Os and guidelines for Chapter Road-E-Os. Questions on the manual should be directed to SWANA Headquarters. Recommendations for changes can also be presented to SWANA Headquarters in writing. All proposed changes will be discussed at the annual Road-E-O Meeting of the International Road-E-O Committee held each year at WASTECON®.

PLANNING FOR A LOCAL OR INTERNATIONAL ROAD-E-O

Organization of the Road-E-O

Each year, chapters that plan to sponsor a Road-E-O must establish a procedure to conduct this event. The more time allowed for preparation, the easier the actual competition will go. In preparation for this event, a Road-E-O committee should be established. Included on this committee should be a Chairperson, Site Coordinator, Materials Coordinator and an Awards & Publicity Coordinator. The roles of these individuals, as well as some of the issues relating to eligibility and financial matters concerning the committee, are as follows:

1. Financing: The chapter may finance the Chapter Road-E-O from its reserves or may charge a competition fee. Solicitation of event sponsors is also permitted.

2. The Road-E-O Chairperson oversees the general planning and implementation of the Road-E-O. The Chair also works with the Site Coordinator to ensure that the chapter acquires the necessary insurance from Headquarters or other sources and that proof of insurance is forwarded to SWANA Headquarters in advance of the event. Insurance coverage is required for all chapters whether inside or outside the United States. Other certificates may also be required on a local level.

   Using the following "Major Items of Expense to be Considered," as a guideline, the Chairperson will assign the arrangement of the following event necessities to the Site, Materials or Awards & Publicity Coordinators.

3. The Site Coordinator's responsibilities are to locate an adequate site for the Road-E-O, set up course markers, oversee the delivery and removal of all needed equipment and secure the necessary insurance from Headquarters or other sources, and forward proof of insurance to SWANA Headquarters in advance of the event. Insurance coverage is required for all chapters whether inside or outside the United States.

4. The Materials Coordinator is responsible for determining all equipment and materials needed, and arranging for them to be borrowed, rented or purchased.

5. The Awards and Publicity Coordinator's role is to secure biographical information on contestants and arrange for news releases to local media and SWANA Headquarters. The chapter will determine awards and prizes for the Road-E-O winners. It is also strongly suggested that a professional photographer be arranged at best or, at least, a committee member should be assigned to photograph the events of the day.

   It is strongly suggested that trophies and/or plaques be given to all 1st, 2nd, and 3rd place winners of the competition.

Major Items of Expense to be Considered

The following are the primary items of expense that may be incurred when hosting a Road-E-O.

1. Pylons, barriers, fences and lumber (rented, borrowed or purchased)
2. Materials for making the course (tape, barrels, measuring sticks or paint)
3. Any liability and property damage insurance coverage, provided through SWANA Headquarters or other source
4. Awards and mementos (such as trophies, cash awards, t-shirts and caps)
5. Spectator grandstands or seats
6. A public address system
7. Field course space rental (if rental is required)
8. Restroom facilities
9. Publications and promotional materials (as needed)
10. Refreshments and refreshment stand equipped to accommodate participants throughout the day
11. A scoreboard (some chapters use 2 laptops with paper scoring sheets entered into spreadsheets & use 1 sheet for trucks and another for the landfill competitions)
12. Tents for cover and tables and chairs for scorekeepers
13. A photographer.

It may be possible to borrow a number of the needed items from regional sources such as local police departments, construction companies and highway departments. Organizations such as the local Chamber of Commerce, unions, Jaycees, civic associations, church groups, etc. may be knowledgeable sources of information and support. The local Red Cross will usually provide first aid equipment, an ambulance and an attendant.

It is suggested that umbrellas, rain gear and water stations be provided to the judges on the day of the event.

Awards

1. First, second and third place shall be awarded to the winners of each class of competition. It is strongly suggested each winner should receive a permanent award in the form of a trophy or other item emblematic of the competition. A perpetual award could be rotated within each chapter.
2. In addition, the International Road-E-O first place winner in each category shall be the International Champion for that category.

COMPETITOR QUALIFICATIONS

In order to compete in the Chapter Road-E-O, participants must meet the following general qualifications:

1. **Competitor Status:** Competitors must be employed in the solid waste management field in which they are competing at the time of the Road-E-O, and must have worked in the solid waste management field for a minimum of one year. Potential competitors that are not employed in the solid waste management field (i.e. landfill construction contractor employees) are not eligible to participate in the SWANA event. In addition, the competitors must be a member or work for a public or private sector entity who has at least one member of SWANA in good standing.
2. **Safety Record:** Competitors must have had no chargeable accidents, moving or traffic violations within one year prior to the Chapter Road-E-O. In the event a chapter first or second place winner experiences a chargeable accident or receives a moving or traffic violations citation between the chapter event and the International Road-E-O, that competitor will be eligible for the International Road-E-O. However, they will not be eligible for their chapter's next Road-E-O. Eligibility should only be affected once per chargeable accident, moving or traffic violations.
3. **Work Attendance:** Competitors must have a satisfactory work attendance record.

The three eligibility categories were designed to eliminate unprofessional employees as competitors and to establish Road-E-O participants as positive examples of employees who are sincere and dedicated to doing the job the best way possible.

In the Appendices of this manual, you will find the appropriate application materials for International and chapter events. The application should be read carefully, and completed in full, as it contains detailed information on the requirements for the international competitor. No incomplete applications will be accepted nor will those submitted without the correct entry fee.

WHO CAN PARTICIPATE IN THE INTERNATIONAL ROAD-E-O

Only the **first** and **second** place winners for each type of equipment from a chapter can go on to compete in the annual International Road-E-O. Selections of those competitors will be based upon scores and times achieved in the Chapters' Road-E-Os. If the first place winner is unable to attend the International Road-E-O, the second place winner will compete in their place, and the third place winner may compete in place of the second place winner. If the second place winner is unable to attend, the third place winner may compete in place of the second place winner.

Contestants for the International Road-E-O can only participate in one event. Those competing in the International Road-E-O will be representing both their chapter and their employer, whereas those who compete in the Chapter Road-E-O will only be representing their employers.

INTERNATIONAL COMPETITOR COSTS

The costs involved in conducting the International Road-E-O will be borne by the hosting SWANA Chapter. However, all entry fees and associated travel expenses will have to be borne by the chapters and/or the competitor's organization or employer. The host chapter will provide all equipment necessary for holding each event listed in this manual that has at least three (3) entrants for the International Road-E-O. In the event that there are less than three entrants for an event, the host will have the discretion to make reasonable attempts to see if the entrants can be added to a similar event.

GENERAL ROAD-E-O RULES

The Road-E-O Manual is the guideline for chapters to set up their Road-E-Os. If a chapter chooses to modify their Road-E-O course to their specific needs, that is perfectly acceptable. The International Road-E-O guidelines must be strictly adhered to as presented in the Road-E-O Manual.

A pre-trip inspection and safety exam will be mandatory for all competitors in Chapter Road-E-Os. This is not necessary at the International Road-E-O.

The following rules apply for all events at International and Chapter Road-E-Os

1. Public and Private sector organizations with SWANA members, and SWANA Chapters, may nominate employees as contestants. The committee should screen records and determine who is eligible to compete. All competitors are subject to approval by the Road-E-O Committee and may be disqualified for any reasonable cause up to the day of the competition.
2. Participants may not consume alcoholic beverages during the competition or arrive in a condition not conducive to operating trucks or heavy equipment. In the event a course rerun is necessary to break a tie, any evidence of alcohol consumption will disqualify the competitor.
3. Bypassing an event (station) during the driving portion of a Road-E-O will result in disqualification. Participants & judges should be notified of this prior to the event.
4. Speeding will not be allowed in the competition and may result in disqualification from the competition at the discretion of the Chief Judge. If a driver locks his or her brakes or lifts a wheel off the ground, this may be grounds for termination from the competition. While time is important to the competition, safety should always be the primary concern.
5. Seat belts and where applicable, safety harnesses, shall be worn during the truck and heavy equipment events. If this is not followed, there will be a two-point deduction taken off the competitor's score. This requirement is intended to reinforce the safety concerns surrounding truck and heavy equipment events.

6. The host chapter must mark off the area where children are prohibited at the competition site to prevent them from climbing on the equipment or running loose in these areas at any point during the day. An announcement should be made over the P.A. system prior to the commencement of the competition indicating what the markers mean and requesting compliance from spectators.

7. Judges (both Chief Judges and others) for the competitions should be selected ahead of time and should be educated on their duties/responsibilities. Chapters are encouraged to recruit out of town guests as event judges if possible. Where possible, it is suggested that judges from different chapters be paired together.

8. The Road-E-O Chair is responsible for seeing that the Chief Judges have a Road-E-O Manual. The Chief Judges are then responsible for distributing copies of the scoring rules and scorekeeping binders, broken down by category, to all judges prior to the start of the competition.

9. Field judges should be assigned specific duties at an individual obstacle. There must be two timekeepers and two scorekeepers on each track.

10. Explanations and judging assignments can be accomplished prior to the day of the competition, when judges and volunteers are required to conduct a judges orientation.

11. Final competitor scores should be tabulated twice by two separate scorekeepers for accuracy.

12. Scores from the courses should be called in to the committee and recorded by another, impartial scorekeeper, preferably not affiliated with the hosting chapter, to prevent the implication of local bias in scoring.

13. In the event two or more contestants have the same final score in the first, second, or third place positions, the following should apply:
    - *For ties occurring in the final score, the tie breaker shall be the least amount of time lapsed.*
    - *For ties occurring in the final score and time lapsed, the tie breaker shall be the toss of a coin, heads being the winner. The decision of which contestant will be heads and which contestant will be tails shall be the Chief Judge.*

14. The Chief Judge reserves the right to make any necessary rules or course changes. It should be made clear to competitors that any questions regarding discrepancies in their scoring should be directed to the Chief Judge prior to the close of the event. Decisions made by the Chief Judge are final.

15. Following the Road-E-O, competitors shall be provided a copy of their scores.

16. Participants may not discuss any event test with other participants or the judges prior to the completion of the Road-E-O except during the pre-event course walk-through (see #18).

17. The Road-E-O course will be marked off and set up as much as possible prior to the start of the event. Barricades and barrels will be at the site ahead of time.

18. A course walk-through with the competitors will be conducted prior to the Road-E-O. During the walk-through of the obstacle courses, only the Chief Judge or the International Road-E-O Chair should discuss the scoring principles with the competitors. It is a good practice to have the judges for that course attend the walk through so that both judges and competitors hear the same discussions. It is strongly suggested that the discussions during the walk through be video recorded.

INTERNATIONAL ROAD-E-O RULES

All rules under "General Road-E-O Rules" will also apply to International Road-E-Os.

1. A commitment to obtain needed corporate funding must be made by the host chapter.
2. The host chapter, four months prior to the International Road-E-O, should provide all chapters that stage Road-E-Os with:
   - Directions and shuttle information from the local airport.
   - Registration, hotel and other accommodation details
   - A map to each of the competition sites
3. The host chapter, 30 days prior to the event, should provide chapters that stage Road-E-Os with:
   - A map of the course layout showing the sequence of events
   - A list of the types of trucks and heavy equipment to be used during the competition
4. The host chapter should arrange for press coverage at the International Road-E-O. Copies of press coverage should be forwarded by the host chapter to SWANA Headquarters to use while assisting the host chapter to promote the event among the international membership via the SWANA website and publications.
5. SWANA Headquarters should be notified regarding a commitment of the sites for the competition, and the hosting chapter should have selected a hotel within four months prior to the event and times for various activities so that it can go on the announcements sent out to Chapter Presidents and Chapter Road-E-O Chairs.
6. The best available equipment should be obtained for the competition. Such equipment should be able to pass state inspections.

   Recommended standards:
   - **Rear Loader:** Tandem axle, wheelbase approximately 205"
   - **Automatic/Side Loader:** Tandem axle, wheelbase approximately 205"
   - **Front-end Loader:** Tandem axle, wheelbase approximately 205"
   - **Transfer tractor/trailer:** 223" wheelbase, with 24-36" king pin setting 45-50 ft.
   - **Roll-Off:** 223" wheelbase
   - **Track Machines** (loader/dozer)
   - **Landfill Compactors**
   - **Scrapers** (conventional/self loading), or **articulated dump trucks** where scrapers are not available
   - **Articulated front wheel loader**
7. There should be an equal amount of time for each participant to familiarize themselves with the equipment. The hosting committee will determine the amount of time based upon the number of participants and equipment.
8. At least three contestants will be required to hold an International Road-E-O event. If less than three contestants register for any given event, the event will be cancelled.
9. It is mandatory that trophies for all winners of the International Road-E-O be provided to the 1st, 2nd, and 3rd place winners.

SWANA TRUCK DRIVERS' ROAD-E-Os

INTRODUCTION

Overview

The Truck Drivers' Road-E-O has several categories of competition. The Road-E-O will be organized on a standard procedure and is open to all chapters. Each chapter that participates in the Road-E-O will, utilizing the standard procedure, conduct a competition anytime during the year prior to the cut off registration date for the international competition. Costs for the Chapter Road-E-O will have to be borne by the chapter and the competing organizations (fees may be charged). The driver will be required to conduct a pre-trip inspection that may include identification of planted defects. If planted defects are included, a trained mechanic with a service vehicle should be made available to not only plant the defects but to also correct them after the inspections are completed. A pre-trip inspection shall be performed at the chapter level only.

Equipment

For the Chapter Road-E-O, the host city/company/chapter will provide the equipment. The host chapter will supply the equipment for the International Road-E-O.

PLANNING DETAILS

Competitive Tests

The Road-E-O is designed to be a competitive test. It is meant to measure a driver's skill behind the wheel, knowledge of safety regulations and knowledge of equipment used.

The Chapter Road-E-Os will consist of a written exam, a CDL pre-test inspection including the air brake procedure, and a driving skills course for each participant. The scores from each of these factors will be combined to determine which driver has the highest score, and thus, becomes the Chapter Champion. Chapter Champions and second place finishers from each event are eligible to compete at the International Road-E-O.

International Level: The International Road-E-O will consist of a driving skills course. The driver will operate a truck through an obstacle course made up of specific driving scenarios. The driver should demonstrate safety habits and smoothness of operation and be graded on both while driving through the course.

It is highly suggested that two identical courses run simultaneously throughout the event in order to accommodate all competitors within a reasonable amount of time determined based on the number of participants.

Contestants may only compete in one event, in order to accommodate all contestants within a reasonable amount of time.

DRIVER QUALIFICATIONS

In addition to the general qualifications noted at the beginning of this manual, persons entering the Truck Drivers' Road-E-O should have been driving for the past 12 months in the solid waste industry.

TYPE OF EQUIPMENT TO BE USED

The competition will be open to drivers of all types of collection and transfer equipment; no container pickup test will be required. The following categories of equipment are allowed:

- Rear loaders, to include drivers of straight trucks
- Transfer Tractor/Trailer
- Automatic/manual side loaders (right or left-hand drive)
- Roll-Off,
- Front-end loaders.

For the International Road-E-O, all drivers for the different categories of equipment must compete with the same piece of equipment furnished by the host chapter. Recommended truck specifications for the International Road-E-O can be found in the introductory section of the manual.

Depending on availability the Host Chapter may allow opportunity to test drive equipment. The event organizers will post the times when test driving will end prior to the start of the event. On vehicles with dual drive, the committee should designate a side prior to the event.

COMPETITION

Mechanics

Mechanics will be given a written exam and opportunity to exercise trouble-shooting techniques.

Driving Skills Examination

The driving skills examination will be accomplished along a prescribed course **(page 14)** and will demonstrate the driver's skills to:

- Stop and start the equipment
- Negotiate the obstacle
- Back up the equipment
- Exhibit general safe driving skills

Judging

Judging is the single most important aspect of the selection of competitors and champions. The Road-E-O will require judges for each event in the competition. Timekeepers and scorekeepers are also required to start and time each competition. Appendices C and I include copies of the scorekeeper's sheet.

In addition, a Chief Judge should be appointed by the Road-E-O Committee to make on-site clarifications of rules, etc. The Chief Judge provides the final word in the competition.

Scoring Principles

The Road-E-O is predicated upon safety, testing knowledge, driving skills and employee capabilities. Appendices D & J summarize the scoring principles. Appendices E & K include the cumulative scorecards for each competitor.

Operational Skills

The competition is a timed driving skill course to test the driver's ability to maneuver, professionally, skillfully and safely while doing so with using minimal time. The driving competition consists of seven events:

1. Off-set
2. Serpentine
3. Alley backup
4. Right turn
5. Parallel parking
6. Straight line
7. Stop-line

The **full course diagram** illustrates the layout and timing for the course. A discussion of each event follows.

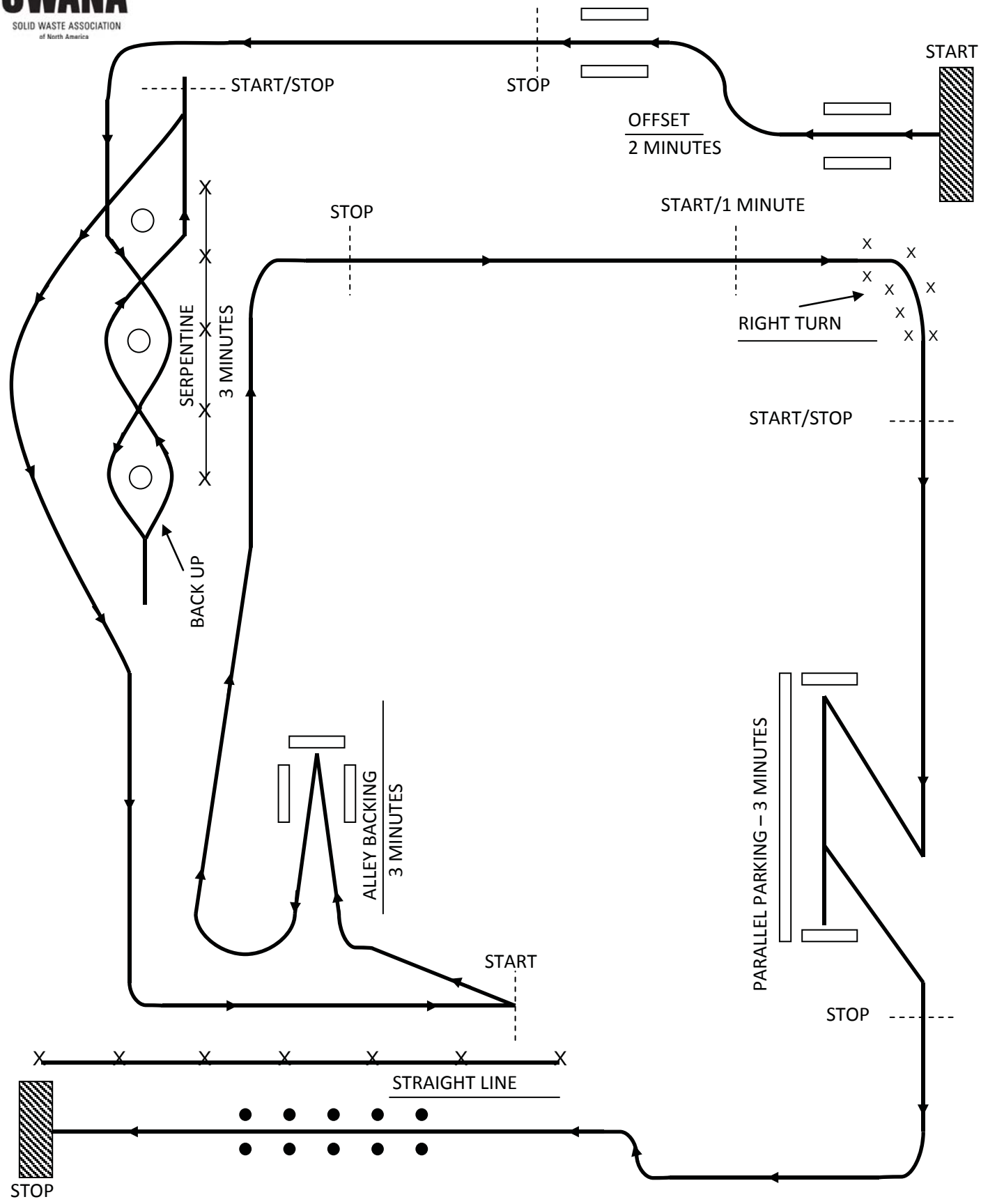
All drivers will begin at the starting line and maneuver through each obstacle without crossing curb lines or striking any barriers. Each event is timed (timing begins at the entry into the event) and the driver must complete the event within the time limit or receive demerits.

Demerits consist of between five points and fifteen points depending on the event and type of demerit. Whenever it becomes necessary for the judge to stop a driver because he/she has run over or damaged any course equipment, there will be a ten-point demerit assessed against the driver.

The total course time will be 12 minutes. Any driver going over the total time limit will receive zero points for the course. Each event in the course has its own time limit. The first demerit starts as soon as the overtime begins.

The starter or timekeeper shall start the time as soon as the flag is dropped. The driver then proceeds from one problem to the next with professionalism, skill and safety. The truck course shall be physically marked for the use of time scoring to coincide with markings on each course figure. The actual trucks shall be physically marked at the midpoint of the front, back, and side for the purposes of scoring in the parallel parking.

FULL COURSE DIAGRAM



START and STOP markings indicate where timing begins and ends for a particular event.

ROAD-E-O EVENTS

OFF-SET EVENT

The driver is required to maneuver the vehicle between one set of barricades, turn sharply and go between a second set of barricades. The movement must be continuous, no stops or repositioning of vehicles is permitted without being assessed a demerit.

PURPOSE

This event sets up a situation where the driver must watch all four corners of the unit to see that the barricade does not get scraped or bumped.

SCORE

50 points is a perfect score.

DEMERITS

-5 points for each instance of stopping or repositioning the vehicle.
-15 points for each instance of hitting or scraping a barricade.

TIME

No score if over **two minutes**.

PROBLEM DIMENSIONS

Four barricades, each 10 feet long, are used in sets of two. Place the sets off center from one another, so that the width between the two sets is equal to the length of the vehicle, and so that one barricade in each set is in line with the other.

The width between barricades in the same set is 11 feet for all vehicles, except for tractor trailer. Barricades for tractor trailers should instead be set at 12 feet wide.

BARRIERS

Barriers extend 8 feet, 6 inches into street from curb. Barriers consist of any item at least four feet in height and can be made as shown in the diagram of parallel parking barriers (see page 21):

2 pieces - 1" x 4' x 10'
2 pieces - 2" x 4' x 2'6"
2 pieces - 2" x 4" x 4'4"
2 pieces - 1" x 4' x 2'6"

EQUIPMENT NEEDED

Two barricades and approximately 30 feet of three-inch masking tape (to mark the curb). Barricades should be roughly four feet high with suggested dimensions. Since the barricades serve simply to define parking space, any equivalent equipment may be used in place of the barricades recommended herein. For construction purposes, barricade sides can be made in 10' sections, each section with two upright standards of 2" x 4" to provide a foot. The barricades should have two length-wise rails of 1" x 4" lumber, the first about 30 inches from the ground and the second with its top edges flush with the top end of the standards.

SERPENTINE EVENT (for all categories of equipment)

The driver is required to weave in and out of the barrels in a continuous motion without stopping and without touching a barrel or running over street curb lines. The driver must go through the problem in a forward and reverse motion. The event should be completed in its entirety before moving on to the Alley Backup event.

PURPOSE

This event tests the driver's ability to maneuver a vehicle in and out of tight places in a forward and backward motion. It simulates conditions that might be encountered when wrecked vehicles on the highway cause jams and the driver must drive into and then back out of the situation.

SCORE

50 points is a perfect score.

DEMERITS

-**5 points** for each instance of stopping.
-**15 points** for hitting a barrel or crossing the curb line of the street.

TIME

No score if over **three minutes.**

PROBLEM DIMENSIONS

The distance between each barrel, center to center, should be:

- Straight truck - 32 feet
- Tractor semi-trailer - 36 to 50 feet depending on the type and size of equipment (for example, a 45-foot trailer uses a 45-foot distance while a 50-foot trailer would use a 50-foot distance)

WIDTH OF STREET

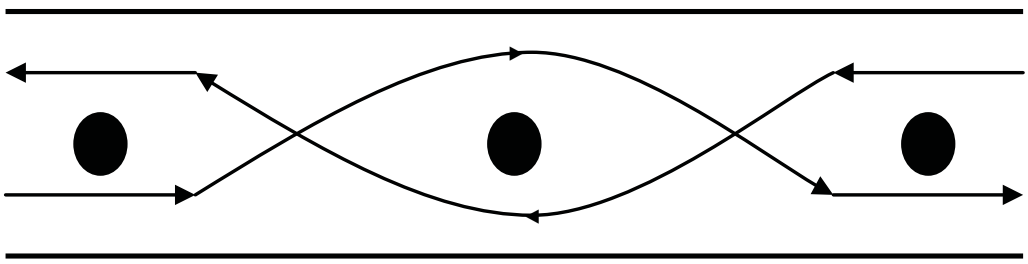
50 feet

BARRIERS

Any oil drum or similar object will serve as barriers.

SPECIAL LIMITATIONS

Tractor-trailers will not be required to drive the course in reverse. Instead, they will be required to drive a straight line, equivalent in distance to the serpentine, in reverse.



RIGHT HAND EVENT

The driver is required to drive the vehicle in a continuous movement through a close right hand turn.

PURPOSE

This event tests the driver's ability to maneuver the vehicle through close turns without impacting on curbs, walls, abutments or parked vehicles.

SCORE

50 points is a perfect score.

DEMERIT

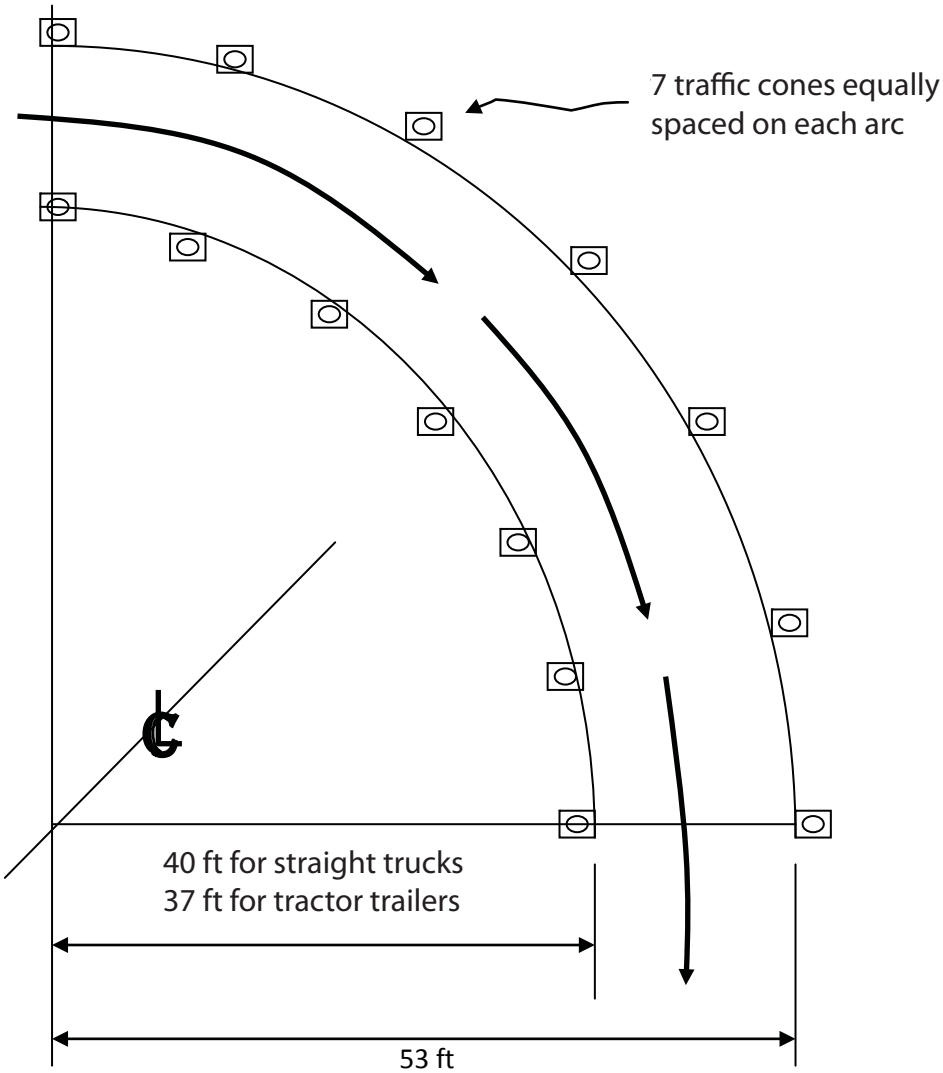
-5 points for each instance of hitting a cone.

TIME

No score if over one minute.

SUGGESTED DIMENSIONS

Cones are 12 feet apart; the width of the road centerline, cone-to-cone is 13 feet.



STRAIGHT LINE EVENT

The driver is required to run the right wheels of the vehicle between two rows of markers without stopping and without touching or displacing any of the markers.

PURPOSE

This event determines the driver's ability to locate the right wheels of the vehicle at any position on the road.

SCORE

50 points is a perfect score.

DEMERIT

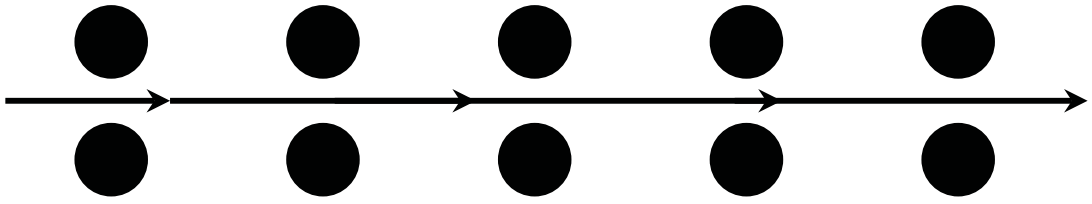
-5 points for each instance of striking, touching or running over any marker, or for straddling or passing around any markers.

PROBLEM DIMENSIONS

Width of path is overall width of widest duals plus six inches, measured from inside to inside of the markers. Distance between pairs of markers is ten feet or more depending on space available and set on a slight angle within the course.

BARRIERS

Markers may consist of sponge rubber or tennis balls three inches in diameter. The best markers are square plastic blocks or hardwood blocks. If wood is used, you need several extra ones because they will break if run over. The driver must remain seated at all times.



STOP LINE EVENT

The driver is required to approach a line in a continuous movement, and to stop the vehicle with the front bumper within six inches of the line. The driver is not allowed to lean out of the window or rise up off the seat to judge distance.

PURPOSE

This problem tests the driver's ability to judge the location of the front bumper and gives the driver an opportunity to improve judgement through practice.

SCORE

50 points	within 6 inches of line
45 points	within 6 to 9 inches of line
40 points	within 9 to 12 inches of line
35 points	within 12 to 15 inches of line
30 points	within 15 to 18 inches of line
25 points	within 18 to 24 inches of line
No score	over 24 inches from the line, or if the bumper is over the line

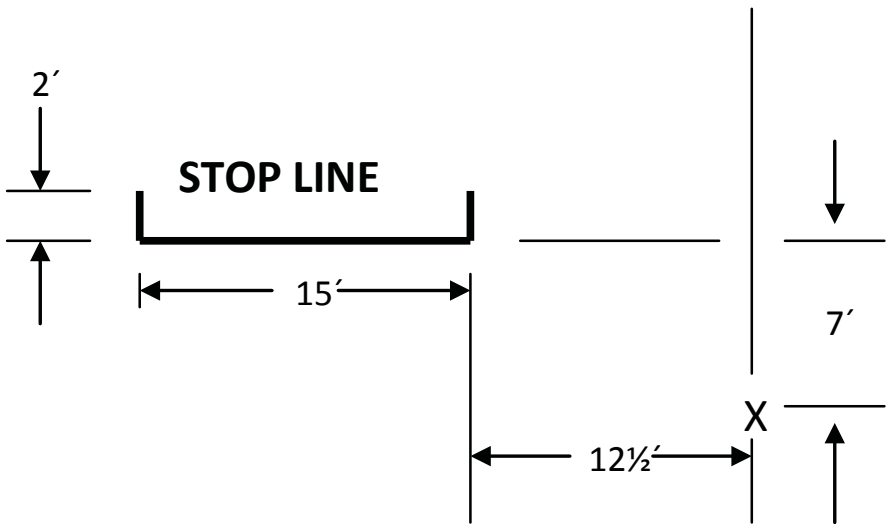
POSITION MEASUREMENT

From the closest point on the bumper, excluding bumper bolts, etc.

BARRIERS

Use a 15-foot strip of masking tape as the stop line.

The stop line (bold lines below) can be marked by a 15-foot strip of three-inch masking tape. To prevent contestants from veering off to the side for a better view of the line, two-foot strips of tape shall be run back at right angles to necessitate the vehicle stopping laterally within the marked space.



PARALLEL PARKING EVENT

PURPOSE

This event tests the driver's ability to maneuver the vehicle backward into a close space.

SCORE

50 points	within 6 inches of curb
45 points	within 6 to 9 inches of curb
40 points	within 9 to 12 inches of curb
35 points	within 12 to 15 inches of curb
30 points	within 15 to 18 inches of curb
25 points	within 18 to 24 inches of curb
No score	over 24 inches, bumper is over curb, or body overhangs curb at middle of truck

POSITION MEASUREMENT

For scoring purposes, measurements will be taken from the midpoint of the body (marked on the front, side and back prior to the competition's commencement) for straight trucks and for semi-trailers at the middle of the trailer (there will be no score if the body overhangs the curb for either type of truck). In the straight truck class, the driver must fit the truck completely into the parking space. The semi-trailer driver must spot the trailer in the space with the tractor in a jack-knife position. The measurement, from the midpoint as marked, shall determine position score.

DEMERITS

-15 points for each instance of striking the curb with rear wheels, except when unparking.
-15 points for each instance of striking or brushing the front or rear barrier.
-5 points for each instance of crossing the curb line on the far side of the street.
-5 points for each instance of taking more than one free pull-up in getting in and more than one free pull-up in getting out.

TIME AND PROBLEM DIMENSIONS

No score over three minutes.

WIDTH OF STREET

40 feet

LENGTH OF PARKING SPACE

- Straight truck - length of vehicle plus eight feet.
- Tractor semi-trailer - length of semi-trailer plus six feet.

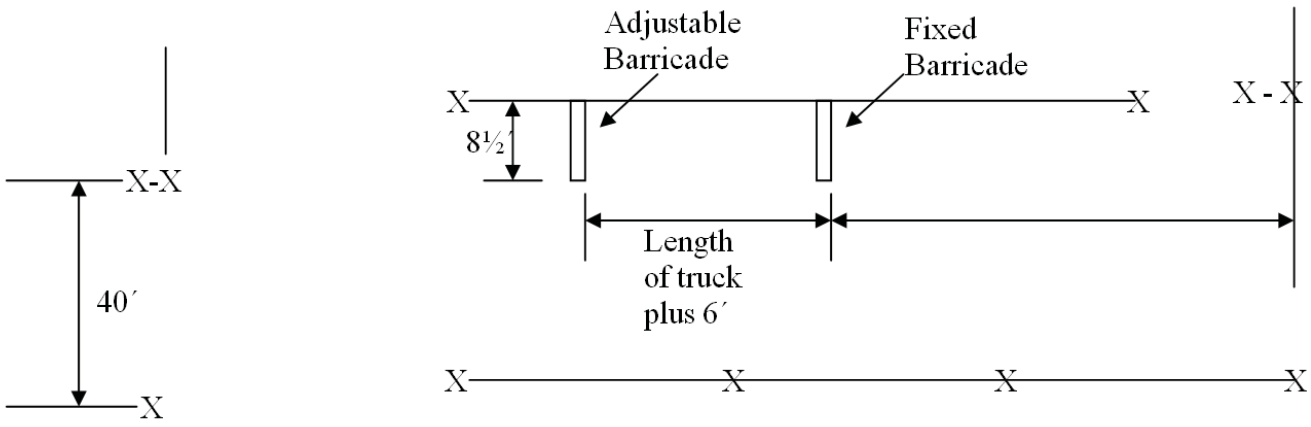
BARRIERS

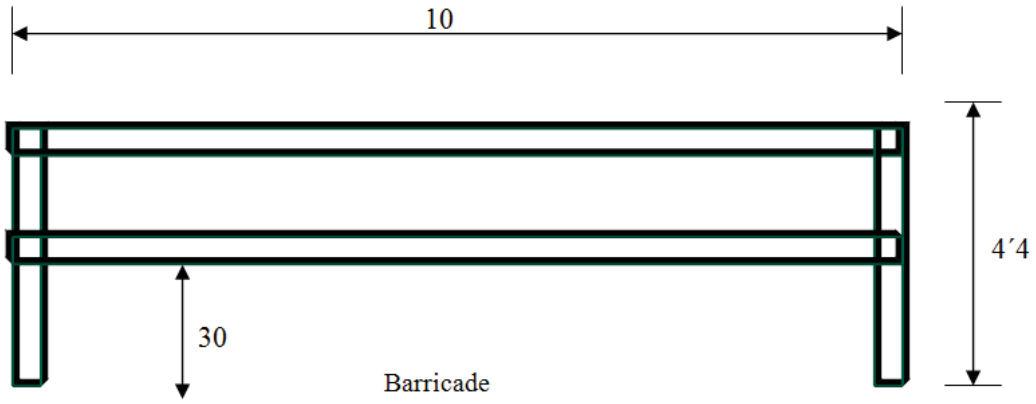
Extend 8 feet, 6 inches into the street from the curb. Barriers can consist of any item at least four feet in height. They can be made, as shown in the accompanying diagram, of:

2 pieces - 1″ x 4′ x 10′ 2 pieces - 2″ x 4″ x 4′4″
2 pieces - 2″ x 4′ x 2′6″ 2 pieces - 1″ x 4′ x 2′6″

EQUIPMENT NEEDED

Two barricades and approximately 30 feet of three-inch masking tape (to mark the curb). Barricades should be roughly four feet high with suggested dimensions depicted in the illustration. Since the barricades serve simply to define parking space, any equivalent equipment may be used in place of the barricades recommended herein. For construction purposes, barricade sides can be made in 10 foot sections, each section with two upright standards of 2" x 4" to provide a foot. The barricades should have two length-wise rails of 1" x 4" lumber, the first about 30 inches from the ground and the second with its top edges flush with the top end of the standards.





2 pcs – 1" x 4" x 10′ for side rails

2 pcs 2" x 4" x 4′4" for barricade stands

2 pcs. 2" x 4" x 2′6" for barricade feet

2 pcs. 1" x 4" x 2′6" For barricade stand

ALLEY BACKUP EVENT

The driver is required to back the vehicle in continuous movement through a simulated alley without touching side barriers or the rear barrier, and must come within a certain distance of the rear barrier.

PURPOSE

This event tests the driver's ability to maneuver the vehicle backwards through a narrow space and to judge the distance to the rear of the vehicle.

SCORE

TRACTOR TRAILERS ONLY	
50 points	within 6 inches of line
45 points	within 6 to 12 inches of line
40 points	within 12 to 18 inches of line
35 points	within 18 to 24 inches of line
30 points	within 24 to 30 inches of line
25 points	within 30 to 36 inches of line
20 points	within 36 to 42 inches of line
15 points	within 42 to 48 inches of line
10 points	within 48 to 54 inches of line
5 points	within 54 to 60 inches of line
No score	over 60 inches, or bumper is over the line

ALL OTHER VEHICLES	
50 points	within 6 inches of line
45 points	within 6 to 9 inches of line
40 points	within 9 to 12 inches of line
35 points	within 12 to 15 inches of line
30 points	within 15 to 18 inches of line
25 points	within 18 to 21 inches of line
20 points	within 21 to 24 inches of line
15 points	within 24 to 27 inches of line
10 points	within 27 to 30 inches of line
5 points	within 30 to 33 inches of line
No score	over 33 inches or bumper is over the line

DEMERIT

-5 points for each instance of incidental/minor running over the curb line of the street.
-5 points for each instance of taking more than one free pull up backing in.
-15 points for striking a side barricade.
-50 points for each instance of intentional/flagrant running over the curb line of the street.
No score for hitting the rear barricade.

TIME

No score over **three minutes**

SUGGESTED DIMENSIONS

The problem is set up in a rectangular shape opening on a 40 foot wide street, or a 50 foot wide street when using 40 foot semi-trailers (a 70 foot wide street should be used for a 53 foot semi-trailer & 50 foot semi-trailer). The rectangle is 20 feet deep and can be made by using four 40 foot barricades, two on each side. One 10 foot barricade is used at the end of the obstacle to simulate a wall. If space does not permit widening the street, the event should then be set up at a 45-degree angle.

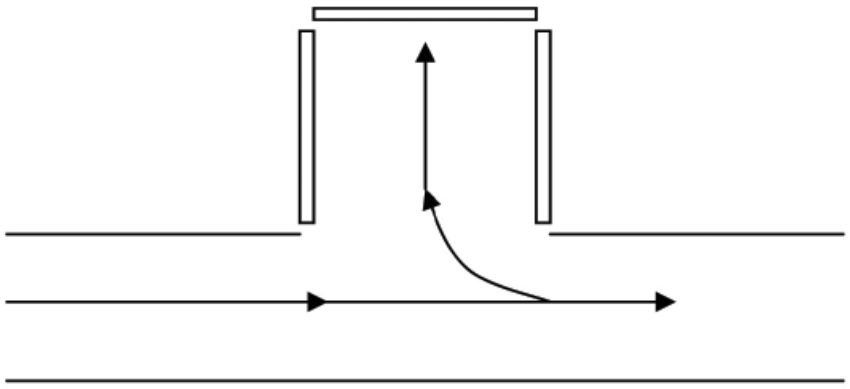
WIDTH OF RECTANGLE

Straight truck - 10 feet
Tractor semi-trailer - 12 feet

The contestant is required to drive up the street past the problem and cut the vehicle back into the rectangle. Judges should measure the problem at rear center of the vehicle body to the rear barricade.

BARRIERS

Use the same barricades as illustrated in the parallel-parking problem.



APPENDIX A

INTERNATIONAL ROAD-E-O CONTESTANT'S APPLICATION FORM

NOTE
Only first and second place chapter winners will be allowed to participate in the International Road-E-O for each competition category.

Contestant's Name	Date
Home Address	
Telephone	
Are you the chapter's (city's/company's, if not in a chapter) first place winner? **(yes/no)**	Is the contestant or the contestant's employer a SWANA member? **(yes/no)**

EMPLOYEE CERTIFICATIONS	
Employer	
Work Address	Telephone
Length of employment ***(dates)***	The employee has been employed as a driver/mechanic for ***(dates)***
Equipment employee operates ***(type and manufacturer)***	Has the employee's attendance been satisfactory? ***(yes/no)***
Will your Road-E-O chair or a past judge be attending the competition? ***(If yes, state name and phone number)***	
I certify the employee has had no chargeable accidents or moving violations within the last 12 months _____ *Employer signature*	

DEADLINES	
At-large chapter contestants	
Chapter contestants	

COMPETITION CATEGORY (contestant to compete in; select ONLY ONE)					
TRUCK DRIVER		***LANDFILL EQUIPMENT MANAGER***		***MECHANIC***	
	Rear Loader		Compactor		Truck
	Side Loader		Track/Dozer		Landfill
	Front Loader		Scraper (or Articulated Truck)		
	Roll-Off		Articulated Loader		
	Transfer Tractor/Trailer				

CHAPTER CERTIFICATION	
Pre-Trip Inspection Score	
Driving Competition Score	
Written Exam Score	
Time	

Certified by Road-E-O Chair:	
_____ *Signature*	
Print Name/Title	Telephone

Applications must be submitted to the _____ chapter by
chapter name

_____ for at-large competitors. Non-certified forms will be rejected. A late fee of $_____ will be
date

charged for any application received after the deadline.

THE APPLICATION FORM MUST BE COMPLETED AND MUST BE ACCOMPANIED BY:

1. International Road-E-O participant Request and Release **(see page 26)**.
2. Entry fee of $_____ for each driver made out to _____
chapter name

   chapter SWANA.

APPENDIX B

INTERNATIONAL ROAD-E-O
PARTICIPANT REQUEST AND RELEASE FORM

I, _____, hereby request the opportunity to
print name

participate in the _____ International Road-E-O sponsored by
type of equipment

_____ at _____ on _____.
chapter name *location* *date*

In consideration of the opportunity to participate in the Road-E-O Program, I do hereby for myself, my heirs, personal representatives and assigns, release and discharge the Solid Waste Association of North America (SWANA) and the sponsor, their respective agents, employees and officers, from all claims, demands, suits, actions and causes of action of any kind for bodily injuries sustained by me and for damage to and/or loss of personal property arising out of my participation in the program.

I understand that participation in the program involves certain inherent risks and potential hazards, which I have considered and which I knowingly assume.

I have read this Request and Release and understand all of its terms, and I execute it voluntarily.

_____

Signature

APPENDIX C

SCOREKEEPER'S SHEET

Name of Scorekeeper	
Date of Competition	
Class of Competition	

Contestants	Time Finished

APPENDIX D

SCORING PRINCIPLES

Scoring

The Road-E-O contestant must prove to be a superior refuse truck driver by exhibiting knowledge of the job, the equipment, and by demonstrating operational skills. The International Champion for each category of competition is selected on the basis of total cumulative points. The maximum possible total cumulative points derived are:

Event	Maximum Points
Off-Set	50 points
Serpentine	50 points
Alley Backup	50 points
Right Hand Turn	50 points
Parallel Parking	50 points
Straight Line	50 points
Stop Line	50 points
CDL Pre-Trip Inspection/Air Brake Procedures	81 points
TOTAL CUMULATIVE	**431 Points**

Time Penalty

The Operational Skills Test is comprised of problems that are designed to simulate conditions that characterize everyday operations. The Road-E-O events are worth a maximum of 50 points each. Judging of contestants in the Field Tests is based upon the driver's ability to follow instructions, to limit stops and changes of direction to those permitted by the rules, to avoid hits and instances of going out of bounds, and to position the vehicle close to measuring points in certain problems. Properly performing these tasks for each event can result in 50 points per event from which demerits are recorded (points are subtracted) for errors. In addition, the Road-E-O driver must meet the time requirement of twelve minutes. There is a grace period in which the driver is given two minutes to complete the course. Demerits are given based on how much extra time the driver needs. Any driver going over the allowable two-minute grace period will be disqualified and will receive zero points.

Tie Breaker

In the event two or more contestants have the same final score in the first, second or third place positions, the following should apply:

- For ties occurring **in the final score**, the tiebreaker shall be the least amount of time lapsed.
- For ties occurring **in the final score and time lapsed**, the tiebreaker shall be decided with the toss of a coin, heads being the winner. The decision of which contestant will be heads and which contestant will be tails shall be that of the chief judge.

Adjudication

Questions, challenges of scoring and interpretation of the rules shall be adjudicated by the Chief Judge, whose decisions shall be final.

APPENDIX E

TRUCK DRIVER ROAD-E-O CONTESTANT'S CUMULATIVE SCORECARD

Contestant's Name	
Employer	
Work Address	

Equipment Class	
	Rear Loader
	Side Loader
	Front Loader
	Transfer Tractor/Trailer
	Roll-Off

Event	**Score**
Off-Set	
Serpentine	
Alley Backup	
Right Hand Turn	
Parallel Parking	
Straight Line	
Stop Line	
CDL Pre-Trip Inspection/Air Brake Procedures	
RESULTANT SCORE (add above score)	
FINAL CUMULATIVE SCORE (include demerits)	

Time	
Recorder	*Print name*
	Signature
Reviewer	*Print name*
	Signature
Date	

APPENDIX F

CHAPTER ROAD-E-O CONTESTANT'S APPLICATION FORM

Contestant's Name	Date
Home Address	
Telephone	
Is the contestant or the contestant's employer a SWANA member? ***(yes/no)***	

EMPLOYEE CERTIFICATIONS	
Employer	
Work Address	Telephone
Length of employment ***(dates)***	The employee has been employed as a driver/mechanic for ***(years/dates)***
Equipment employee operates ***(type and manufacturer)***	Has the employee's attendance been satisfactory? ***(yes/no)***
I certify the employee has had no chargeable accidents or moving violations within the last 12 months. *Employer signature and title*	

COMPETITION CATEGORY (contestant to compete in; select ONLY ONE)					
TRUCK DRIVER		***LANDFILL EQUIPMENT MANAGER***		***MECHANIC***	
	Rear Loader		Compactor		Truck
	Side Loader		Track/Dozer		Landfill
	Front Loader		Scraper (or Articulated Truck)		
	Roll-Off		Articulated Loader		
	Transfer Tractor/Trailer				

DEADLINE FOR APPLICATION	
RETURN APPLICATIONS TO	

APPENDIX G

CHAPTER ROAD-E-O PARTICIPANT REQUEST AND RELEASE FORM

I, _____, hereby request the opportunity to
print name

participate in the _____ Chapter Road-E-O sponsored by
type of equipment

_____ at _____ on _____.
chapter name *location* *date*

In consideration of the opportunity to participate in the Road-E-O Program, I do hereby for myself, my heirs, personal representatives and assigns, release and discharge the Solid Waste Association of North America and the sponsor, their respective agents, employees and officers from all claims, demands, suits, actions and causes of action of any kind for bodily injuries sustained by me and for damage to and/or loss of personal property arising out of my participation in the program.

I understand that participation in the program involves certain inherent risks and potential hazards, which I have considered and which I knowingly assume.

I have read this Request and Release and understand all of its terms, and I execute it voluntarily.

_____

Signature

APPENDIX H

SWANA TRUCK DRIVER'S SAMPLE EXAM

(actual test will be in a sealed envelope)

1) **When making a right turn in a truck, the driver should position the vehicle**
   a. as close to the right curb as practicable
   b. in the center of the road to prevent the rear tires from hitting the curb
   c. with the left wheels just over the center line
   d. as close to the left curb as practicable

2) **How much warning is required by D.O.T. regulations for turning or changing lanes?**
   a. 25' b. 50' c. 75' d. 100' e. 125'

3) **Which of the following traffic violations is most likely to result in a fatal accident?**
   a. following too close
   b. speeding
   c. improper passage
   d. disregarding a stop sign

4) **Gross weight means**
   a. the legal operating weight of the truck
   b. the tare weight of the truck
   c. the loaded weight of the truck
   d. the empty weight of the truck

5) **The maximum height of a motor vehicle may not legally exceed what height?**
   a. 11' b. 14' c. 12' d. 13'6" e. 12'8"

6) **A truck driver leaving an alley prior to crossing the sidewalk should**
   a. slow down and proceed
   b. beep their horn and continue forward
   c. stop, look right and left, then proceed?

7) **A red traffic sign means**
   a. construction ahead
   b. stop
   c. motorist services
   d. information?

8) **How can backing accidents be avoided?**
   a. depend on rear view mirror and sound horn
   b. depend on audible backup warning device
   c. rear view mirror and someone to guide

9) **What safety measure should be taken if a driver stops to help another whose rig is on fire; where should you park your rig?**
   a. parallel with unit on fire
   b. up grade
   c. down grade

10) **In a right hand turn, centrifugal force will tend to pull your truck to**
   a. the right
   b. not at all, no change
   c. the left

1. **A** 2. **D** 3. **C** 4. **A** 5. **D** 6. **C** 7. **B** 8. **C** 9. **B** 10. **C**

APPENDIX I

SCOREKEEPER'S SHEET

Name of Scorekeeper	
Date of Competition	
Class of Competition	

Contestants	Time Finished	Total Points

APPENDIX J

SCORING PRINCIPLES

Scoring

The Road-E-O contestant must prove to be a superior refuse truck driver by exhibiting knowledge of the job, the equipment and by demonstrating operational skills. The International Champion for each category of competition is selected on the basis of total cumulative points. The maximum possible total cumulative points derived are below.

Event	Maximum Points
Off-Set	50 points
Serpentine	50 points
Alley Backup	50 points
Right Hand Turn	50 points
Parallel Parking	50 points
Straight Line	50 points
Stop Line	50 points
CDL Pre-Trip Inspection/Air Brake Procedures	81 points
TOTAL CUMULATIVE	431 Points

Time Penalty

The Operational Skills Test is comprised of problems that are designed to simulate conditions that characterize everyday operations. The Road-E-O events are worth a maximum of 50 points each. Judging of contestants in the Field Tests is based upon the driver's ability to follow instructions, to limit stops and changes of direction to those permitted by the rules, to avoid hits and instances of going out of bounds and to position the vehicle close to measuring points in certain problems. Properly performing these tasks for each event can result in 50 points per event from which demerits are recorded (points subtracted) for errors. In addition, the Road-E-O driver must meet the time requirement of twelve minutes. There is a grace period in which the driver is given two minutes to complete the course. Demerits are awarded based on how much extra time the driver needs. Any driver going over the allowable two-minute grace period will be disqualified and will receive zero points.

Tie Breaker

In the event two or more contestants have the same final score in the first, second or third place positions, the following should apply:

- For ties occurring **in the final score**, the tiebreaker shall be the least amount of time lapsed.
- For ties occurring **in the final score and time lapsed**, the tiebreaker shall be the toss of a coin, heads being the winner. The decision of which contestant will be heads and which contestant will be tails shall be that of the chief judge.

Adjudication

Questions, challenges of scoring and interpretation of the rules shall be adjudicated by the Chief Judge whose decisions shall be final.

APPENDIX K

SWANA CHAPTER ROAD-E-O CONTESTANT'S CUMULATIVE SCORECARD

Contestant's Name	
Employer	
Work Address	

Equipment Class	
	Rear Loader
	Side Loader
	Front Loader
	Transfer Tractor/Trailer
	Roll-Off

Event	**Score**
Off-Set	
Serpentine	
Alley Backup	
Right Hand Turn	
Parallel Parking	
Straight Line	
Stop Line	
CDL Pre-Trip Inspection/Air Brake Procedures	
RESULTANT SCORE (add above score)	
FINAL CUMULATIVE SCORE (include demerits)	

Time		
Recorder	*Print name*	*Signature*
Reviewer	*Print name*	*Signature*
Date		

APPENDIX L

PRE-TRIP INSPECTION PROCEDURES

The Pre-Trip Inspection tests the contestant's ability to perform a CDL Pre-Trip, with the Air Brake Procedure as required by law. The contestant should conduct the Pre-Trip Inspection on the type of equipment to be driven on the Field Test Course.

Judging Procedures

1. One point will be given for each item correctly identified during the Pre-Trip.
   Total possible points: 56
2. The Air Brake Procedure is an "all or nothing" category. All seven steps will need to be followed to earn the 25 points. Should the contestant miss one or more items, zero points will be awarded.

Twenty minutes will be given to perform the entire Pre-Trip. Should a contestant go beyond the 20 minutes, the judge will stop the test and add the points earned.

Pre-Trip Inspection

The driver is required, by Federal law, to perform a CDL Inspection before driving a piece of equipment. While the maintenance crew or department is responsible for giving the driver a vehicle that is in top mechanical condition, it is the driver who must assure, at the start of the trip that the vehicle assigned is in good condition.

The following is page a detailed checklist for completing an inspection.

PRE-TRIP INSPECTION CHECKLIST

ENGINE COMPARTMENT	
Oil level	
Coolant level	
Power steering fluid/belt	
Water pump/belt	
Alternator/belt	
Air compressor/belt	
Any leaks/hoses	

ENGINE START	
Clutch/gearshift	
Temperature	
Oil pressure builds	
Amp meter/volt meter	
Air brakes test	
Steering play	
Mirror & windshield	
Wipers/washers	
Lighting indicators	
Horn(s)	
Heater/defroster	
Safety belt/emerg. equip	

FRONT SUSPENSION	
Spring	
Spring mounts	
Shock absorber	
Rims	
Hub oil seal	
Tires - 2/32 wear	
Lug nuts	

FRONT BRAKE	
Slack adjuster	
Chamber	
Hoses	
Drums	

** Not all trucks are equipped with these items.*
Points are automatic when these items are not applicable.

DRIVER/FUEL AREA	
Door & mirror	
Fuel tank/leaks	
Battery/box	

REAR WHEELS	
Rims	
Tires - 2/32 wear	
Axle seals	
Lug nuts	
Spacers *	

REAR SUSPENSION	
Springs	
Spring mounts	
Shock absorbers	

REAR BRAKE	
Slack adjuster	
Chambers	
Hoses	
Drum	

FRONT OF VEHICLE	
Lights	
Steering box/hoses	
Steering linkage	

UNDER VEHICLE	
Drive shaft	
Exhaust system	
Frame	

REAR OF VEHICLE	
Light/reflectors	
Mud flap/splash guard *	
Doors, tiles, lifts	

CITY OF MESA VEHICLE ONLY	
Differential lock	
Rear body lift hinges	

APPENDIX M

PRE-TRIP INSPECTION SCORECARD

Contestant's Name
Equipment Class ***(rear loader, side loader, front loader, roll-off, transfer tractor/trailer)***
Judge

EVENT	POINTS REWARDED	
CDL Pre-Trip		56 possible points
Air Brake Procedure		25 possible points
Combination Vehicle (Transfer/Trailer Truck Only)		34 possible points

AIR BRAKE TEST

1	***TEST AIR LEAKAGE RATE.*** With a fully charged air system (typically 120 psi 800 kPa) turn off the engine, release the parking brake, and check the air pressure loss rate. The loss rate should be less than two psi (13.8 kPa) in one minute for a single vehicle, and less than three psi (20.7 kPa) in one minute for combination vehicle. Now apply the foot brake firmly (about 90 psi (620 kPa) if you have an application gauge. After the initial pressure drop, the air pressure should not fall more than three psi in one minute for a single vehicle, not more than four psi (27.6 kPa) for combination vehicles.	
2	***TEST LOW PRESSURE WARNING SIGNAL.*** Turn the electrical power on and step on and off the brake pedal to reduce air tank pressure. The low air pressure warning signal must come on before the pressure drops to less than 60 psi (410 kPa) in the air tank (or tank with the lowest air pressure, in dual systems).	
3	***CHECK THAT THE SPRING BRAKES COME ON AUTOMATICALLY.*** Continue to step on and off the brake pedal to reduce the air tank pressure. The "parking brake" knob should pop out when the air pressure falls to the manufacturer's specification (usually in a range between (20-40 psi/137-280 kPa). This causes the spring brakes to come on.	
4	***TEST PARKING BRAKE.*** Fasten seat belt. Allow vehicle to move forward slowly. Apply parking brake. If it does not stop vehicle, it is faulty; get it fixed. ***OR*** Put the parking brake on, and gently pull against it in a low gear to test that the parking brakes will hold. If a combination vehicle you must test both the tractor and the trailer parking brakes.	
5	***CHECK RATE OR AIR PRESSURE BUILDUP.*** Start the engine. When the engine is at operating rpm, the pressure should build from 85 to 100 psi (580-689 kPa) within 45 seconds in dual air sytems. In single air systems (pre-1975), typical requirements are pressure buildup from 50 to 90 psi (340-620 kPa) within three minutes with the engine at an idel speed of 600-900 rpm.	
6	***AIR COMPRESSOR GOVERNOR CUT-IN AND CUT-OR PRESSURES.*** Run the engine at a running idle. The air governor should cut-out the air compressor at the manufacturer's specified pressure With the engine idling and the parking brakes released, step on and off the brake to reduce the air tank pressure. The compressor should cut-in at about the manufacturer's specified cut-in pressure. (The pressure should begin to rise on your gauge.)	
7	***TEST SERVICE BRAKE STOPPING ACTION.*** Go about five miles per hour. Push brake pedal firmly. Check for side to side "pull".	

COMMENTS

_____

_____

_____

_____

_____

Award one (1) point for each box checked

TOTAL POINTS (Air Brake): _____

COMBINATION VEHICLE TEST

TRACTOR ONLY	
Air/electric lines	
Catwalk	
Lights/reflectors	

COUPLING SYSTEM	
Mounting bolts	
Safety latch/locking jaws	
Platform/frame	
Release arm	
Kingpin/apron/gap	
Pintle eye	
Sliding 5th wheel locking pin. dogs *	
Cross chains	
Emergency breakaway *	

TRAILER WHEELS (FRONT & REAR)	
Rims	
Tires (2-32)	
Axle seals	
Lug nuts	
Spacers *	

REAR OF TRAILER	
Lights/reflectors	
Doors/ties/lifts	
Splash guards	
Mud flaps	

TRAILER	
Air/electric connection	
Header board	
Lights/reflectors	

SIDE OF TRAILER	
Landing gear	
Frame, tandem release	
Lights/reflectors	
Doors/ties/lifts *	

TRAILER SUSPENSION	
Springs/air/torque	
Spring mounts	

TRAILER BRAKES	
Slack adjuster	
Brake chamber	
Brake hoses/lines	
Brake drums/lines	

** Not all trucks are equipped with these items. Points are automatic when these items are not applicable.*

SANITARY LANDFILL EQUIPMENT OPERATORS' ROAD-E-O

Presented below is an outline for a Sanitary Landfill Equipment Operators' Road-E-O. The program is designed not only to test the "operator's skill" with a given unit of equipment, but also the knowledge relative to "operator maintenance and safety" of the machine.

QUALIFICATION

In addition to the general qualifications noted at the beginning of the manual, persons entering the Road-E-O must have a minimum of one year's experience in a landfill environment on the type of equipment (track machine, compactor, scraper, articulated front wheel loader, articulated truck) that the individual proposes to use in the competition. If the type of equipment that an eligible competitor qualified for in their chapter event is not available in the International Road-E-O, then the competitor has the option of competing in one of the other events of their choosing. Competitors are to compete in one event only.

TYPES OF EQUIPMENT

The following types of equipment will be part of the competition:

- Track Machines (dozer)
- Landfill Compactors
- Scrapers (conventional/self loading) or articulated truck
- Articulated front wheel loader

Due to the wide variety of makes and models of machines, it behooves the sponsoring entity to advise potential competitors well in advance what machines will be on-site for their use (year, make and model).

COMPETITOR'S POSITION

The contestants will draw lots for their respective starting position, as being first or last in the competition might be considered advantageous.

CONTEST LOCATION

It is suggested that, by necessity, most of the Chapter Road-E-O will have to be conducted on a member's landfill. Sufficient space must be available so that the equipment can travel at normal/safe operating speeds (particularly the scrapers) and that soils are available for excavation. A possible exception might be during the International Road-E-O when vendors might be willing to provide demo machines and a suitable vacant land area is available for the contest.

CONTEST DESCRIPTION

At the chapter level, the Road-E-O will be divided into two sections for each type of equipment being employed. The sections shall consist of : (1) Operator Maintenance and Safety Check, and (2) Equipment Operating Skills Test. The total points earned for both sections for all types of equipment will be the same so that an overall "Champion" (the individual who has earned the most total points on any one machine) can be selected. The sheet before the Inspection Scorecard indicates the suggested items for inclusion in the Maintenance and Safety Check.

At the international level, the Road-E-O consists of only one section, the Equipment Operating Skills Test. The operator will drive a piece of machinery through a test course made up of specific problems. The operator should demonstrate safety habits and smoothness of operation and will be graded on both.

COURSE RULES

1. Drivers may not open doors or stick their heads out of windows during the competition.
2. Participants must be present at the appointed hour for the walk-through. Participants must also be present when it is their turn to compete.
3. A timer will time each contestant with a stopwatch by observing each contestant run the entire course. The Timer has the discretion to "stop-the-watch" for unusual, but specified interruptions. Such interruptions may include equipment breakdowns, spectators on the course, destruction of a prop, weather related issues or being blocked by the vehicle ahead. The Chief Judge will specify exactly what circumstances justify a "stop-the-watch" action.
4. Tie Breaker - In the event two or more contestants have the same final score in the first, second or third place positions, the following should apply:
   - For ties occurring in the final score, the tie breaker shall be the least amount of time lapsed.
   - For ties occurring in the final score and time lapsed, the tie breaker shall be the toss of a coin, heads being the winner. The decision of which contestant will be heads and which contestant will be tails shall be that of the chief judge.

OPERATOR MAINTENANCE AND SAFETY CHECK

As a group, the contestants are to be advised that:

- A ten (10) minute time limit is in effect with a three (3) minute warning. The judge stops the contestant at the end of the ten (10) minute period, regardless of whether they are finished or not.
- They must consider their inspection of the machine at the start of their work day after returning from a two week vacation. In effect, they would have no idea of what might have happened to the machine during their absence.
- They must tell the judge what they are "checking" or "observing" as they go about their inspections. The judge must be thoroughly familiar with the scorecard so as not to impede the contestants in their time.

  Example: A contestant must tell the judge that he/she is going to grease the unit and the judge will mark the score sheet accordingly.

EQUIPMENT OPERATING SKILLS TEST

For individual events (i.e. compactor, track machine, scraper, articulated truck, articulated front wheel loader), the respective contestants should be walked through the course set up to test their skills. The actual course layout will be a function of the make and model of the particular machine used in the contest and the terrain on which it is being held. Basic operating skills such as maneuvering in "tight quarters," loading machine (if appropriate), accuracy, speed, etc., will be tested. The two course layouts that follow are offered for consideration.

The maximum points which can be earned for all the courses should be the same (50 points each). Scoring of the Skills Test will be accomplished by a head judge with the assistance of station judges using a predetermined method for notifying the head judge of scoring at each particular station. The station judges should be discreet in their scoring, as to not cause any undue stress on the competitor. A stop watch will be necessary to record elapsed time for each contestant. A tape measure or other measuring device will be required at the blade drop station. The Scorecards that follow will be used for the respective types of equipment employed in the contest. The total Skills Test score will be added up on the tally sheet, which is to be maintained by the Contest Scorer.

LANDFILL OPERATORS' VEHICLE INSPECTION SCORECARD

Contestant	
Employer	Date

WALKAROUND (10 MINUTE TIME LIMIT *with a 3 minute warning***)**		
ENGINE	**TOTAL POINTS**	**MAXIMUM PTS.**
Oil level		3
Inspect belts		2
Coolant level in radiator		3
Radiator clean		1
Air filter indicator		2
Check for any leaks		2
Exhaust manifold clean of debris		1
Pre-cleaner screen (if equipped)		1

HYDRAULIC SYSTEM	**TOTAL POINTS**	**MAXIMUM PTS.**
Oil level (some check hot/some cold)		3
Inspect hose, lines and connection		2
Check for any leaks		2

TRANSMISSION	**TOTAL POINTS**	**MAXIMUM PTS.**
Oil level		3
Inspect hose, lines and connection		2
Check for any leaks		2

LUBRICANT AND FUEL	**TOTAL POINTS**	**MAXIMUM PTS.**
Grease daily items (simulated-grease gun on machine)		2
Fuel lines/tanks (simulated-drain condensate)		1

SAFETY ITEMS	**TOTAL POINTS**	**MAXIMUM PTS.**
Fire extinguisher		2
Glass clean		2
Lights in place and working		2
Back-up alarm operable		2

SIMULATED START-UP/SHUT DOWN (3 MINUTE TIME LIMIT)		
START-UP PROCESS	**TOTAL POINTS**	**MAXIMUM PTS.**
Fasten seat belt		2
Check mirror		2
Check Pressure Gauges (after simulated start)		2
Allow time for components to reach operating temperature (simulated) and test system (trans and hydraulic)		2

SHUT DOWN PROCESS	TOTAL POINTS	MAXIMUM PTS.
Allow time for machine to cool (10 minutes simulated) and inspect for leaks and for damaged/worn items		2

OVERALL SCORE		50

LANDFILL OPERATORS' VEHICLE INSPECTION SCORECARD

Presented below is a brief description of a suggested Skills Test Course which compactors and track machines might use. Also included is a proposed scoring system and a course diagram.

The competitor **must** put on their seat belt. This is worth **2 points**. The competitor is encouraged to get comfortable with the equipment's controls and to notify the head judge when they are ready to begin the course.

The following are general requirements when competing on the course:

1. The blade of the machine must be kept in a position that does not provide an unfair advantage when going between the barrels. At no time should the blade be above the height of the barrels when going between the barrels.
2. Competitors are allowed to adjust their equipment when they are entering a station which can include stopping, going in reverse, going forward to get a better angle. Because the competition is based on being safe when an operator has a bad angle in their daily operations we would want them to adjust and get a better angle. The time it takes to make adjustments will affect their time. However, on the station where the competitor is performing the blade drop it should be in one continuous motion and the blade must not be above the height of the barrel.
3. The competitor loses associated points at any station if they come in contact with the barrel while going through the station. The competitor also loses points if soil they disturb with the machine comes in contact with the barrel as they go through the station. The blade of the machine should not come in contact with the ground other than at the blade drop, back drag, and possibly the barrel roll stations.

STATION 1

The timing begins when equipment's front end breaks the plane of the starting barrels. The contestant starts out going forward and proceeds to their right to Station 1, located fifty feet (seventy five feet for compactor) from the center of the starting barrels. Station 1 barrels are four (4) inches wider than the machine. The competitor must go through the two barrels without coming in contact with them with the machine or any soil disturbed and the rear end of the machine must break the plane of the barrels to receive four (4) points. The competitor then goes in reverse through Station 1, and receives four (4) points if the machine or any soil disturbed do not come in contact with the barrels.

STATION 2

The competitor then proceeds in reverse to Station 2, one hundred feet (one hundred and fifty feet for compactor) from Station 1. The competitor must have the front of the machine break the plane of the barrels without either the machine or any soil disturbed coming in contact with the barrels to receive the four (4) points. The competitor then proceeds going forward through the barrels. The competitor receives four (4) points if the machine or any soil disturbed do not come in contact with the barrels.

STATION 3

Fifty feet (seventy five feet for compactor) from Station 2, the first barrels are four (4) inches wider than the machine. Points going in are two (2) points if no contact with barrels occurs. The middle barrel used for the out of bounds barrel is twice the machine's length. The competitor is to go to their left after going through the first set of barrels and the rear end of machine should break the plane of first set of barrels without going

out of bounds. The competitor is to then go in reverse until the front end of machine has passed the plane of the second set of barrels without going out of bounds. Performing this maneuver correctly results in four (4) points. The competitor then goes forward through the second set of barrels spaced four (4) inches wider than the machine. If no contact with the barrel occurs, the competitor receives two (2) points.

Articulated Loader Only - After entering the first set of barrels at Station 3, the competitor picks up a load of soil. The competitor then goes in reverse between the second set of barrels and then goes forward through the third set of barrels and drops of soil. Completing this maneuver successfully without coming in contact with any barrels results in four (4) points. The competitor would then go forward through the fourth set of barrels.

STATION 4

Fifty feet (75 feet) from Station 3, the machine in one continuous motion is to approach the blade drop. Barrel going forward with the blade of the machine below the top of the barrel. The competitor should bring the blade in firm contact with the soil leaving a mark in the soil. The judge will then wave the competitor off to continue onto Station 5. The judge will measure from the center of the blade mark in the soil to the barrel. If the measurement is 0-6" (0-12" for dozer and compactor) the competitor will receive four (4) points. If the measurement is +6"–12" (+12"-24" for dozer and compactor) the competitor will receive two (2) points. If the measurement exceeds 12" (24" for dozer and compactor) or the competitor comes in contact with the barrel then the competitor will receive no points.

STATION 5

Fifty feet (seventy five feet for compactor) from Station 4, the barrels are four (4) inches wider than the machine. The competitor enters the barrels going in reverse. The blade/bucket must be in "light" contact with the ground from the entrance of Station 5. Points going in are two (2) if no contact with first set of barrels occurs. Points going out are two (2) if no contact with second set of barrels occurs. The blade/bucket must be raised while between the exit barrels.

STATION 6

Fifty feet (seventy five feet for compactor) from Station 5, the barrels are eight (8) inches wider than the machine. The competitor is to push the drum set up between the first set of barrels fifty feet (seventy five feet for compactor) without crushing it, and leave it between the second set of barrels. The machine then backs out of the station either right or left and circles around to push drum back between the first set of barrels. The competitor receives four (4) points for pushing drum between the two sets of barrels without crushing the drum or coming in contact with any barrel. The competitor receives four (4) points for returning the drum back to its original location without crushing the drum or coming in contact with any barrel.

STATION 7

Fifty feet (seventy five feet for compactor) from Station 6, the barrels are two machine lengths apart. The competitor is to go in reverse from Station 6 and proceed to the outside of the first barrel of Station 7. The competitor is to then go between the first and center barrel. The competitor receives two (2) points if they complete this maneuver successfully without hitting any barrel. The competitor is to then perform a 360 degree turn around the middle barrel. If the competitor completes this maneuver without hitting the barrel they will receive four (4) points. The competitor is to then proceed between the middle barrel and the third barrel going to the outside of the third barrel. If the competitor completes this maneuver without hitting any barrels they will receive two (2) points. The competitor is to then proceed to the finish line while still going in reverse. The timing of the clock stops when the front of the machine breaks the plane of the start barrels.

SWANA LANDFILL EQUIPMENT OPERATORS' CUMULATIVE SCORECARD

EQUIPMENT OPERATING SKILLS TEST: COMPACTOR, ARTICULATED LOADER & TRACK MACHINE

Contestant name	
Position number	
Employer name	
Date	

STATION		POINTS EARNED	MAXIMUM POINTS
Station 1	Forward		4 pts
	Reverse		4 pts
Station 2	Forward		4 pts
	Reverse		4 pts
Station 3	Forward		2 pts
	Reverse		4 pts
	Forward		2 pts
Station 4	Forward to stop		4 pts, 0" - 6" 2 pts, 6" - 12" 0 pts, 12" +
Station 5	Forward		2 pts
	Reverse to stop		2 pts maximum blade measure
Station 6 (compactor or track machine)	Forward down		4 pts, 1 each barrel push
	Forward back		4 pts, 1 each barrel push
Station 7	Reverse		2 pts, first barrel
			4 pts, circle barrel
			2 pts, last barrel
Seat belt	Completed		2 pts, if seat belt used
TOTALS			50
TOTAL LAPSE TIME		*minutes*	*seconds*

SKILLS TEST COURSE: SCRAPERS

Presented below is a brief description of a suggested Skills Test Course which scrapers might use. Also included is a proposed scoring system and a course diagram.

START		The machine must be behind the barrels initially, no points awarded. The stop watch is started when the front of the machine passes the barrels.
POINTS	**DIRECTION**	
0		
STATION 1		Seventy-five feet from start, the barrels are eight (8) inches wider than the machine. Points going in -4- must not hit the barrels and the back of the machine must be past the barrels. Points going out -4- must not hit the barrels.
POINTS	**DIRECTION**	
4	< F	
4	X R	
STATION 2		One hundred and fifty feet from Station 1, the barrels are twelve (12) inches wider than the machine. Points backing in -4- must not hit the barrels and the front of the machine must be past the barrels. Points going out -4- must not hit the barrels.
POINTS	**DIRECTION**	
4	X R	
4	< F	
STATION 3		Seventy-five feet from Station 2, the first barrels are eight (8) inches wider than the machine. Points going in -2- must not hit the barrels. The middle barrel is twice the machine's length (2XM). Points backing around -4- must not hit the barrels. The last barrels are eight (8) inches wider than the machine. Points going out -2- must not hit the barrels.
POINTS	**DIRECTION**	
2	< F	
4	X R	
2	< F	
STATION 4 (pan drop)		Seventy-five feet from Station 3, the barrels are eight (8) inches wider than the machine (use the string line at the back of the barrels to measure from the tooth or cutting edge). Points 0 to 6 inches -4-, 12 inches -2-, 12+ inches or across string line -0-, must not hit the barrels.
POINTS	**MEASURE.**	
4	0" - 6"	
2	6" - 12"	
0	12" +	
STATION 5 (load/unload)		Seventy-five feet from Station 4, the barrels are eight (8) inches wider than the machine. The earth between the barrels is to be previously disturbed. The distance between the enter and exit barrels is a function of the loading capabilities of the machine. It must be a heaped load (spill over sides/judge) and be accomplished (load and unload) in the distance between the enter and exit barrels. Points going in -4- must not hit the barrels nor have the pan down. Points loading -2- must be heaped before exiting. The route should be sufficiently long to allow the machine to reach a safe operating speed. Points returning -4- must not hit the barrels. Points unloading -2- must complete dumping between return enter and exit barrels.
POINTS	**DIRECTION**	
4	< F	
2	Load heaped	
4	< Return	
2	Unload	
STATION 6		Seventy-five feet from Station 5, the barrels are twice the machine's length apart (2xM). Points -2- first barrel, points -4- circle barrel, points -2- first barrel, points -4- circle barrel, points -2- last barrel. The contestant must not hit the barrels during any maneuver to score points.
POINTS	**DIRECTION**	
2	< F	
4	< Circle	
2	< F	
FINISH		The back of the machine must pass the barrels for the watch to be stopped. Points -2- if the contestant has used the seat belt.
POINTS	**DIRECTION**	
2	< F Belt	

SKILLS TEST COURSE: ARTICULATED DUMP TRUCK

Presented below is a brief description of a suggested Skills Test Course which articulated dump trucks might use.

START		The machine must be behind the barrels initially, no points awarded. The stop watch is started when the front of the machine passes the barrels.
POINTS	**DIRECTION**	
0		
STATION 1		Seventy five (75) feet from the start, the barrels are four (4) inches wider than the machine. Points going in -2- must not hit the barrels and the back of the machine must be past the barrels. Points going out -2- must not hit the barrels.
POINTS	**DIRECTION**	
2	< F	
2	X R	
STATION 2		One hundred and fifty (150) feet from Station 1, the barrels are four (4) inches wider than the machine. Points going in -2- must not hit the barrels and the back of the machine must be past the barrels. Points going out -2- must not hit the barrels.
POINTS	**DIRECTION**	
2	< F	
2	X R	
STATION 3		Fifty (50) feet from Station 2, the barrels are four (4) inches wider than the machine. Points going in -4- must not hit the barrels and the back of the machine must be past the barrels. Points going out -4- must not hit the barrels.
POINTS	**DIRECTION**	
4	< F	
4	X R	
4	< F	
STATION 4		Seventy five (75) feet from Station 3, the barrels are four (4) inches wider than the machine. Points going in -4- must not hit the barrels and the back of the machine must be past the barrels. Points going out -4- must not hit the barrels.
POINTS	**DIRECTION**	
4	X R	
4	X R	
STATION 5		Seventy five (75) feet from Station 4, the barrels are four (4) inches wider than the machine and off set from each other. Points going in -4- must not hit the barrels and the back of the machine must be past the barrels. Points going out -4- must not hit the barrels.
POINTS	**DIRECTION**	
4	< F	
4	< F	
STATION 6		Fifty (50) feet from station 5, the barrels are two machine lengths apart (2xM). Points -2- first barrel, points -4- circle barrel, points -2- last barrel. The contestant must not hit the barrels during any maneuver to score points.
POINTS	**DIRECTION**	
2	X R	
4	X R	
2	X R	
STATION 7		Fifty (50) feet from station 6, the barrels are four (4) inches wider than the machine.
POINTS	**DIRECTION**	
4	X R	

SWANA LANDFILL EQUIPMENT OPERATORS' CUMULATIVE SCORECARD

EQUIPMENT OPERATING SKILLS TEST: SCRAPERS

Contestant name	
Position number	
Employer name	
Date	

STATION		POINTS EARNED	MAXIMUM POINTS
Station 1	Forward		4 pts
	Reverse		4 pts
Station 2	Forward		4 pts
	Reverse		4 pts
Station 3	Forward		2 pts
	Reverse		4 pts
	Forward		2 pts
Station 4	Forward to stop		4 pts, 0" - 6" 2 pts, 6" - 12" 0 pts, 12" +
Station 5	Forward		4 pts
	Loading		2 pts pan down after barrels and heaped load
	Returning		4 pts between barrels
	Dumping		2 pts dump after barrels and before exit
Station 6	Forward		2 pts, first barrel
			4 pts, circle barrel
			2 pts, last barrel
Seat belt	Completed		2 pts, if seat belt used

TOTALS			50
TOTAL LAPSE TIME		*minutes*	*seconds*

SWANA LANDFILL EQUIPMENT OPERATORS' CUMULATIVE SCORECARD

EQUIPMENT OPERATING SKILLS TEST: ARTICULATED DUMP TRUCK

Contestant name	
Position number	
Employer name	
Date	

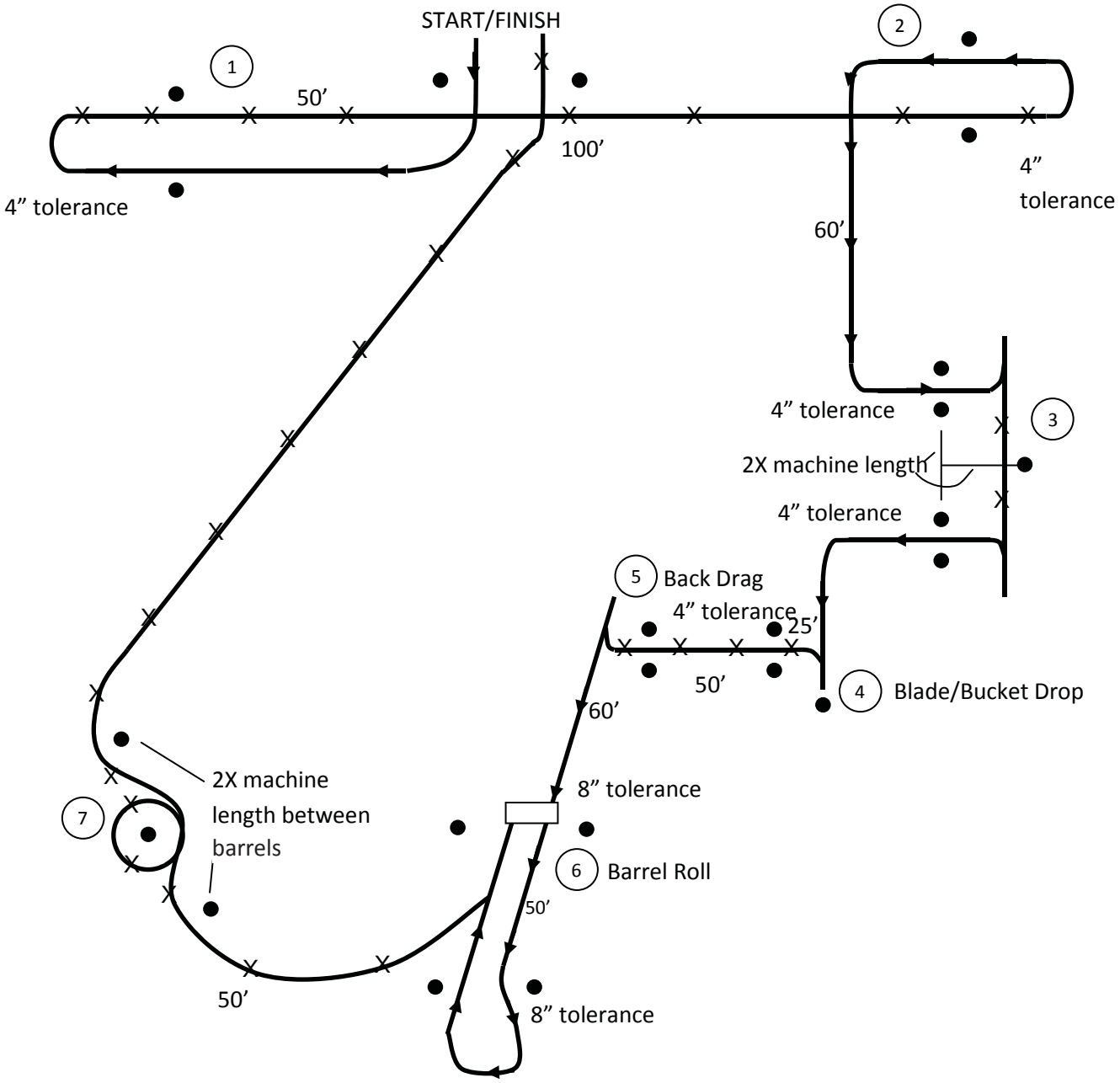
STATION		POINTS EARNED	MAXIMUM POINTS
Station 1	Forward		2 pts
	Reverse		2 pts
Station 2	Forward		2 pts
	Reverse		2 pts
Station 3	Forward		4 pts
	Reverse		4 pts
	Forward		4 pts
Station 4	Reverse		4 pts
	Reverse		4 pts
Station 5	Forward		4 pts
	Forward		4 pts
Station 6	Reverse		2 pts
	Reverse		4 pts
	Reverse		2 pts
Station 7	Reverse		4 pts
Seat belt	Completed		2 pts

TOTALS			50
TOTAL LAPSE TIME		*minutes*	*seconds*

SKILLS TEST COURSE MAP: COMPACTOR & TRACK MACHINE

V = Forward

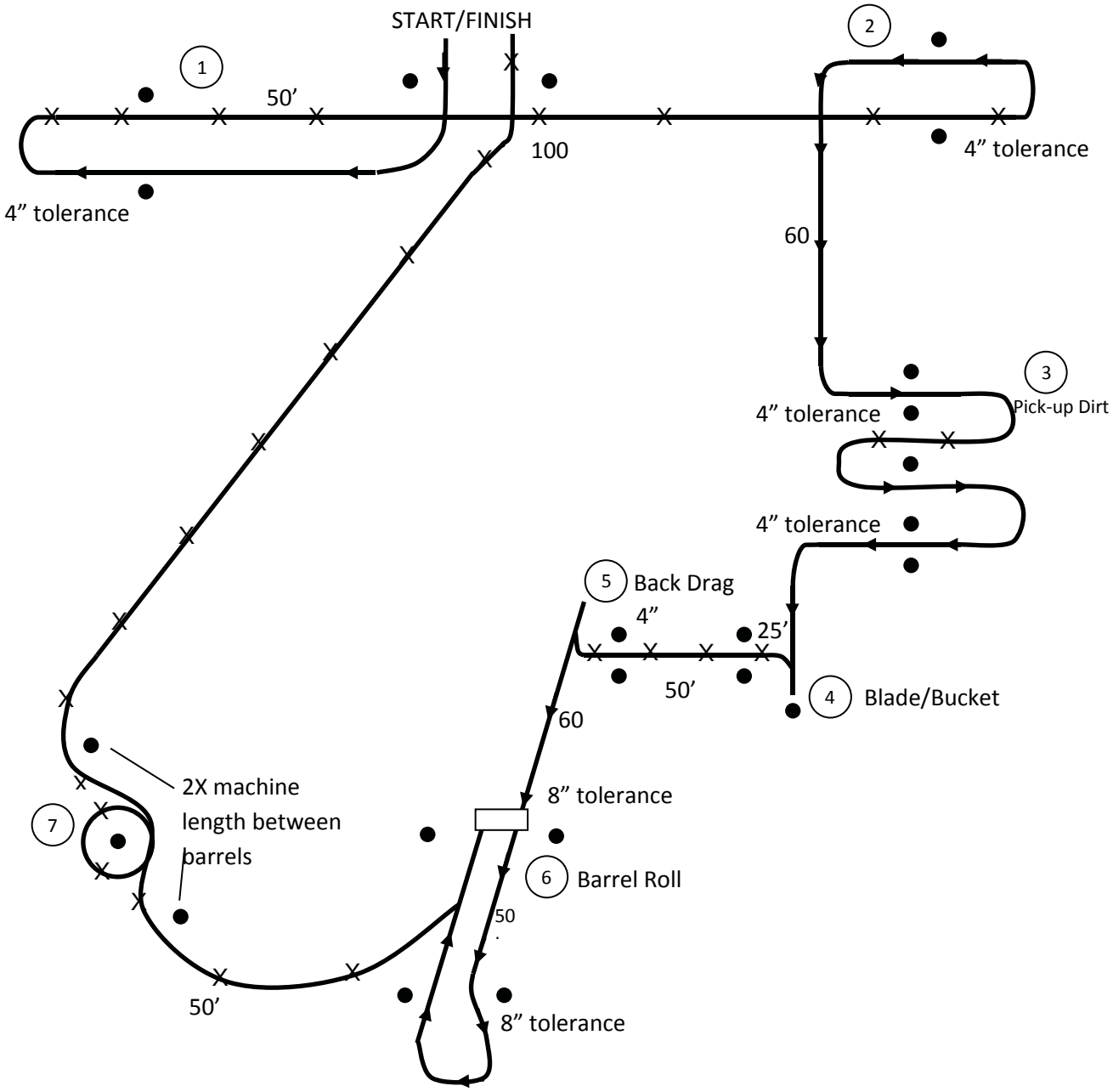
X = Reverse



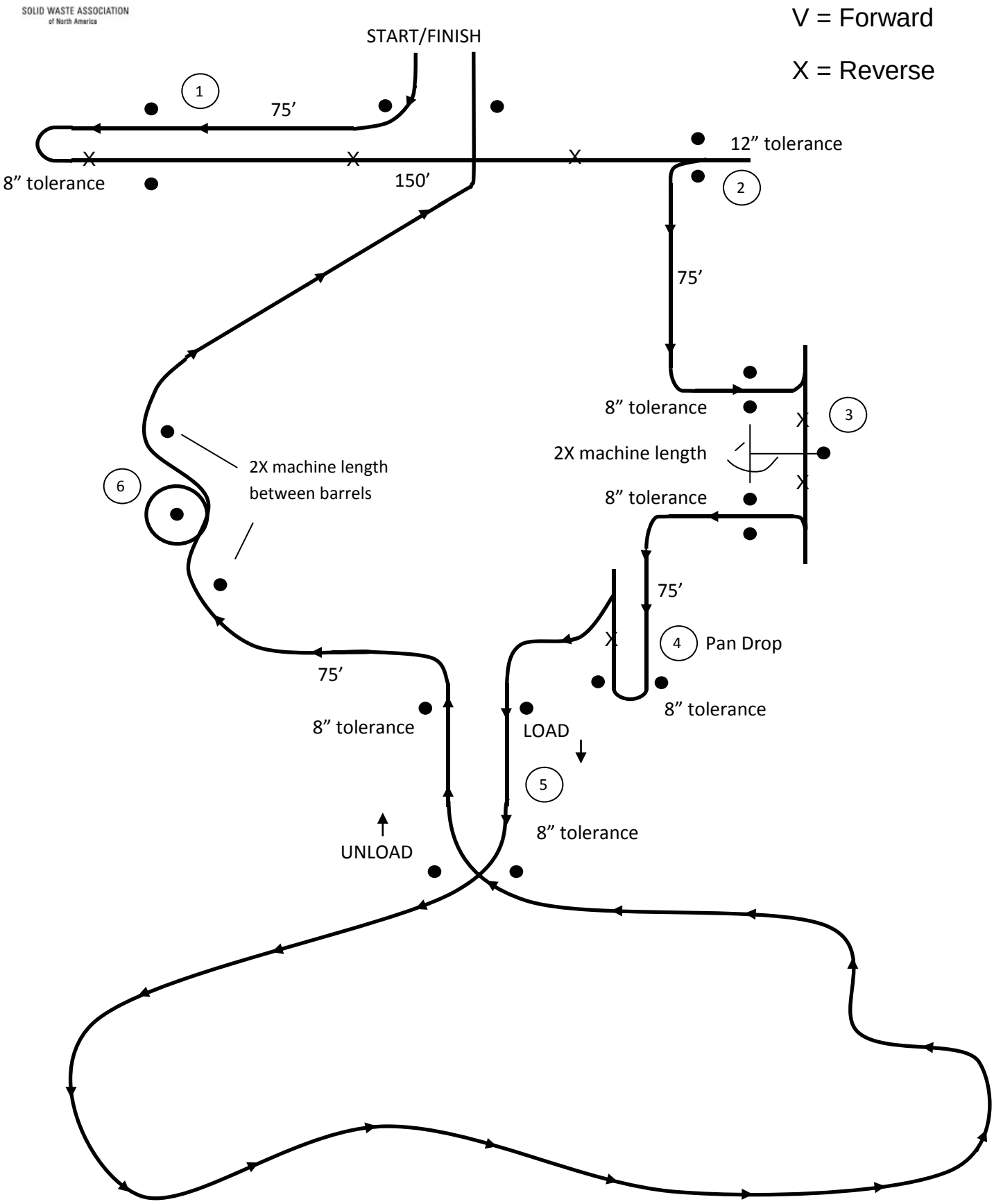
SKILLS TEST COURSE MAP: ARTICULATED RUBBER TIRE LOADER

V = Forward

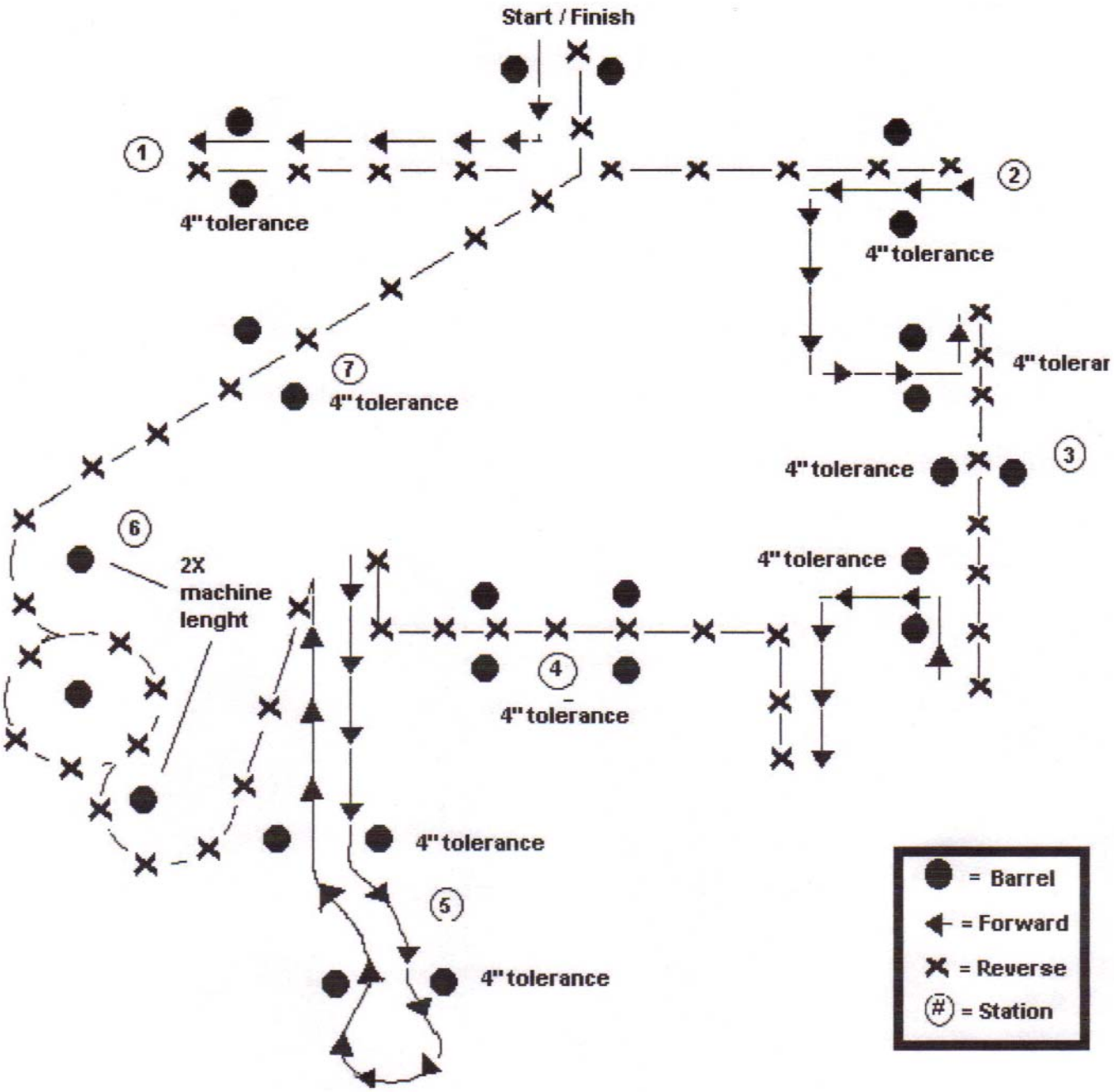
X = Reverse



SKILLS TEST COURSE MAP: SCRAPER



SKILLS TEST COURSE MAP: ARTICULATED DUMP TRUCK



SWANA MECHANICS' ROAD-E-O

INTRODUCTION

The Chapter Mechanics' Road-E-O will consist of three parts and each part will make up the total score for the competition.

The first part will consist of a written test with 50 questions. Each question will be worth two points. The questions will cover shop safety, power train, brakes, hydraulics, electrical and general knowledge of shop operations. The 50 questions will be selected from a list of over 200 questions. The list will be available to all participants so they may have time to prepare for the test. Test questions should be a combination of true/false and multiple choice. Only judges will receive the actual test questions and answers.

The mechanical skills competition will consist of a troubleshooting contest. The contestants will perform actual diagnostic tests on available trucks. In this hands-on event, the contestant will be given a list of vehicle problems and the individual who solves the most problems in the allowed time will be the winner. The troubleshooting contest will be the only component of the International Road-E-O.

The CDL Pre-Trip Inspection with Air Brakes Procedure. One point will be given for each item correctly identified during the inspection. Total possible points 56. The Air Brake is the same as in the truck competition.

GENERAL INFORMATION

Chapter

The Mechanics' Road-E-O will be separated into two events: one for mechanics of collection vehicles and one for landfill (off-road vehicle) mechanics. All contestants must have approval from his/her employing organization. Each agency may have one representative for each category of events.

Each participant must provide their own hand tools to be used for the troubleshooting contest. Mechanics will not be expected to do any major disassembly, so an assortment of wrenches, sockets, screw drivers, pliers, a test light, continuity tester and a volt and ohmmeter should suffice. Any special tools which may be required will be provided on site.

Five trucks, each with a different built-in problem, are needed. However, in all likelihood, the number of vehicles used will depend on what is available. Therefore, it is suggested that the total number of trucks used in the competition will have to be changed based on availability. It is important to locate the trucks at least 40 feet apart. Each contestant will have a turn to work on each piece of equipment.

A judge equipped with a stop watch is needed for each truck. Judges should be persons with a maintenance background. It is very important for timekeepers to keep track of elapsed time during the troubleshooting portion of the competition because the contestants' time scores will be used in the event of a tie breaker.

A contest coordinator is necessary to signal the beginning of each round of competition, keep track of elapsed time and signal when allowed time is up. A coach's whistle works well as a signaling device.

International

At the International Road-E-O, there will also be two separate Mechanics' Road-E-O events: truck mechanics and landfill or heavy equipment mechanics. Each contestant should have been the first place or second place winner at the chapter level and must be sponsored by the chapter in which the contestant is a member (and their employer).

The International Mechanics' Road-E-O will not include a written exam, only a troubleshooting contest and CDL Pre-Trip Inspection with the Air Brake Procedure.

The individual with the highest total score of participants in each of the Mechanic's Road-E-Os (both truck and landfill) will become the SWANA Mechanics' Road-E-O International Champion.

All information that has been stated above for Chapter Road-E-Os applies to the International Road-E-O as well, except where differences are noted.

SWANA MECHANIC'S WRITTEN TEST RULES

1. Contestants are required to take a fifty (50) question general skills test, which will be composed of true/false and multiple choice questions.
2. Smoking will be PROHIBITED during the written test.
3. Contestants will not be allowed to take or carry any reference material or notes to the written test are. Pencils will be furnished.
4. Contestants will be allowed a maximum of 30 minutes to complete the written test.
5. Any form of communication between contestants while taking the written test will result in the automatic disqualification of the contestants involved.
6. Only contestants will be allowed in the written test area.

SWANA MECHANIC'S TROUBLESHOOTING CONTEST RULES

1. Only the competitors and judges are allowed within the marked off area.
2. Each contestant will be assigned a truck number at the beginning of the contest. They will report to their assigned truck.
3. The Timekeeper/Coordinator will indicate to the judges when it is time to get ready and go. At the go signal, the judge will present the contestant with the problem. The Judge will also keep track of time and, if the problem is solved within the allowable time frame, indicate the score and elapsed time on the scorecard.
4. Individual contestants will have 10 minutes to pinpoint the problem. Each contestant is to leave the problem exactly as they found it for the next contestant.
5. After time is up for each round, contestants will move to the next truck, which will have a different problem to solve.
6. Each problem will have a maximum value of 20 points for a total possible of 100 points. In order to get a score of 20 points, the contestant must identify the problem exactly. A judge may award ten points to a contestant who at least identifies the faulty component before the allotted time has elapsed.

7. The judging scorecard is to be turned in to the Scorekeeper as soon as the problem is scored and signed off by the judge. If the problem is not solved within the allowed time, the judge shall mark NO SCORE on the form and turn it over to the Scorekeepers.
8. Major disassembly will not be required for solving any problems. If a competitor starts to disassemble a component that is not defective, the judge shall tell the contestant the problem is not there.
9. Contestants must leave the inspection area once they have completed their inspections.
10. Mechanics who have completed the troubleshooting portion of the Road-E-O must not talk with contestants that have not competed. If this is noted by any Road-E-O official, both contestants will be disqualified.
11. Individual scores will not be given out. The winner will be announced at the appropriate time by the Road-E-O officials.
12. Tie Breaker - In the event two or more contestants have the same final score in the first, second or third place positions, the following should apply:
    - For ties occurring in the final score, the tie breaker shall be the least amount of time lapsed.
    - For ties occurring in the final score and time lapsed, the tie breaker shall be the toss of a coin, heads being the winner. The decision of which contestant will be heads and which contestant will be tails shall be that of the Chief Judge.

PRE-TRIP INSPECTION

Each mechanic will be required to perform a CDL Inspection on a vehicle. Part of the inspection will include the Air Brake Procedure.

SCORING

A maximum of 281 points can be earned in the Mechanic's Competition.

EVENT	MAXIMUM POINTS
Written test	100 points
Troubleshooting test	100 points
Pre-trip	56 points
Air brake	25 points
TOTAL	**281 POINTS**

SWANA MECHANICS' ROAD-E-O: CONTESTANT'S CUMULATIVE SCORECARD

Truck Number	Competitor Number
Individual Name	
Date	Agency
Problem	
Problem solved within allowed time? ***(yes/no)***	Elapsed Time ***(minutes & seconds)***

TEST	**POINTS EARNED**	**MAXIMUM POINTS**
Written Test		50
Pre-Trip		56
Air Brake		

Judge *(printed name)*	*Signature*
Scorekeeper *(printed name)*	*Signature*

SWANA MECHANICS' ROAD-E-O STUDY GUIDE PRACTICE TEST

SHOP SAFETY			
1	Eye protection is optional if you are using a protective shield.	T	F
2	Eye protection should be worn during cleaning operations with compressed air.	T	F
3	When observing someone else drill or grind, only the person performing the work needs eye protection.	T	F
4	Watches and rings are only a hazard if you are working around batteries.	T	F
5	Clean and orderly work areas make for a safer work place.	T	F
6	Horseplay and practical jokes can cause someone to get hurt.	T	F
7	Every employee is responsible for the condition of hand or power tools.	T	F
8	If you have used a defective tool once or twice without getting hurt, it is probably okay to use it one more time.	T	F
9	A safe method for lifting is to bend your knees, not your back.	T	F
10	Clean up spills right away and put oily rags in an open container.	T	F
11	Gas welding goggles are not adequate for arc welding. For arc welding, use a welding hood with the proper lens.	T	F
12	Always close oxygen and acetylene cylinders when work is finished.	T	F
13	Safety stands are optional when working under a vehicle that is supported by a jack.	T	F
14	Tires are only a hazard during the process of inflation.	T	F
15	Before beginning any electrical work which requires the removal of any battery connections, disconnect the ground cable first and connect it last after completing work.	T	F
16	Most batteries are not heavy enough to require proper lifting procedures.	T	F

DRIVE TRAIN/TRANSMISSION			
1	The correct adjustment sequence during a drive axle overhaul is; adjust pinion bearing pre-load, adjust differential carrier bearing pre-load and adjust ring gear and pinion backlash.	T	F
2	Drive shaft vibration after a new universal joint has been installed can be caused by a drive shaft installed out of phase.	T	F
3	If the drive shaft on a truck rotates but the rear wheels do not move, the cause could be a broken differential pinion gear shaft.	T	F
4	When a vehicle with an automatic transmission is sluggish on acceleration, and the engine is sluggish on acceleration, but the engine is properly tuned, it probably has a bad torque converter.	T	F
5	A stall test on an automatic transmission will check the converter starter clutch.	T	F
6	An automatic transmission does not work right. The first thing a mechanic should do is adjust the bands.	T	F
7	If a clutch in a standard transmission application has not enough free play it will cause the clutch to drag when disengaged.	T	F
8	A whining noise from the rear of the vehicle when the accelerator is released, and the vehicle is coasting, is caused by badly worn "U" joints.	T	F
9	If a growling, grinding or screeching noise is heard when the clutch pedal is depressed, the probable cause is a worn or defective clutch release (throwout) bearing.	T	F
10	If a light-duty vehicle clutch does not release properly after installation of a new clutch disc and pressure plate assembly, which are known to be the correct parts, the probable cause is badly worn clutch linkage.	T	F

11	The clutch brake on a heavy duty manual transmission holds the truck on a steep hill.	T	F
12	On an Allison transmission, wrong modulator adjustment could cause upshifts at too low of an engine speed.	T	F
13	A truck with an Allison transmission may be push started.	T	F
14	It is safe to tow a truck with an Allison transmission for five miles without disconnecting the drive line.	T	F
15	The lock up clutch in an Allison automatic disengages the torque converter.	T	F
16	A stuck governor valve on an Allison transmission will produce upshifts at too low a speed.	T	F
17	Low oil will cause an Allison transmission to overheat.	T	F
18	On an Allison transmission, to install a bearing on a shaft, you should preheat to 200 degrees Fahrenheit.	T	F
19	Auxiliary Allison transmission filters are mounted in the oil pan.	T	F
20	Maximum oil temperature in the oil pan of an Allison automatic should be 300 degrees Fahrenheit.	T	F
21	Gasket sealer should be used on the oil pan gasket of an Allison transmission.	T	F
22	Teflon seal rings are used in an Allison automatic.	T	F

STEERING/SUSPENSION			
1	Hard steering and poor steering return after turns could be caused by replacement kingpins fitted too tight.	T	F
2	A steering gear adjusted too tight is a common cause of steering wheel shimmy at road speeds.	T	F
3	Steering-wheel shimmy at road speeds is probably due to front tires and wheels out of balance.	T	F
4	A feather-edge wear pattern on the front tires is probably caused by wrong toe-in adjustment.	T	F
5	Keeping spring U-bolts tight is an important maintenance operation. They should be periodically retightened with the vehicle empty.	T	F
6	If a shock absorber on the front axle is leaking, the proper procedure is to replace the defective shock absorber.	T	F
7	Worn bushings in a tandem rear-axle suspension can cause drive-shaft vibration.	T	F
8	When a vehicle wanders while driving on level road, the probable cause is too much negative chamber.	T	F
9	To center the steering wheel on a vehicle all you have to do is remove the steering wheel and re-install it.	T	F
10	Too much negative caster on the front wheel will cause the vehicle to pull to the left.	T	F

HYDRAULICS			
1	Hydraulic pumps produce flow not pressure.	T	F
2	A pump usually activates because of a restricted inlet or other conditions that allow air spaces to develop in the incoming fluid.	T	F
3	Improper condition of the hydraulic fluid can cause pump failure.	T	F
4	Pressure control valves are used to limit system pressure.	T	F
5	A check valve is a directional control.	T	F
6	Cylinders convert mechanical power to fluid power.	T	F
7	Misalignment of piston rods can cause leaks.	T	F
8	Oil of too high viscosity can cause a system to work sluggishly when cold and normal when the system warms up.	T	F
9	A pump can generally be used as a motor.	T	F
10	Galvanized pipe is recommended for high pressure hydraulic plumbing.	T	F
11	A hydraulic reservoir:	T	F
	Stores oil	T	F
	Dissipates heat	T	F
	Helps keep oil clean	T	F
12	When trouble shooting a hydraulic system you should:		
	Know the system	T	F
	Operate the machine	T	F
	Inspect the machine	T	F
	Change parts until you find the trouble	T	F
	List the possible causes	T	F
	Reach a conclusion	T	F
	Test your conclusion	T	F
13	The valve that controls a packer blade is called a directional control valve.	T	F
14	A piston pump is a positive displacement pump.	T	F
15	A tall, narrow hydraulic reservoir is better than a short, wide one.	T	F
16	A swash plate is used in a external gear pump.	T	F
17	A typical hydraulic hose on a refuse truck contains two layers of wire braid.	T	F
18	The most common seal in mobil hydraulic systems is the “O” ring.	T	F
19	If you put equal pressure on both ends of a double acting cylinder it will not extend or retract.	T	F

ELECTRICAL			
1	A bad starter relay could cause high starter current draw.	T	F
2	A volt is a measure of current flow.	T	F
3	A vehicle battery is a device for storing energy.	T	F
4	Battery hydrometer readings should be taken immediately after water has been added.	T	F
5	The need to add excessive water to a battery indicates the charging rate is too high.	T	F
6	Diodes can be damaged by an overheated alternator.	T	F
7	A relay is a device that opens or closes another electrical circuit.	T	F
8	The engine will not start if the polarity is reversed in an electrical system with an alternator.	T	F
9	It is ok to replace damaged wire with a lighter gauge wire.	T	F
10	A poor ground can cause lighting problems.	T	F

11	If the battery uses a great deal of water chances are it is being undercharged.	T	F
12	An ammeter measures current flow.	T	F
13	A voltmeter measures electrical pressure.	T	F
14	An ohmmeter measures resistance in a circuit.	T	F
15	A conductor is some thing or material that will conduct electricity.	T	F
16	The most common current used in a vehicle is alternating current.	T	F
17	A battery is a device for storing mechanical energy.	T	F
18	A battery hydrometer show the battery's rated capacity.	T	F
19	The specific gravity of the electrolyte in a fully charged battery is usually 1.260-1.280.	T	F
20	Battery dyrometer readings should be taken when the engine is idling.	T	F
21	A dry-charged battery never needs electrolyte.	T	F
22	When replacing battery cables on tapered-type posts, it is good practice to coat terminals with petroleum jelly or grease.	T	F
23	If polarity is reversed in an electrical system with an alternator, the rectifier diodes will be ruined.	T	F
24	The need to add excessive water to a battery indicates excessive engine idling.	T	F
25	Weak brush-holder springs will cause brushes to short circuit.	T	F
26	A no cranking condition, with the lights staying bright, indicates an open circuit in the cranking system.	T	F
27	An ammeter measures current flowing in an electric circuit.	T	F
28	An ohmmeter may be used for measuring voltage between two points in an electrical circuit.	T	F
29	A starter motor may be operated continuously for more than 90 seconds.	T	F
30	An electrical conductor is made of glass or plastic.	T	F
31	It is good practice to hammer battery cables terminals onto battery posts.	T	F
32	A voltmeter is always connected in series with a part of the circuit being tested.	T	F
33	An ohmmeter should never be connected to an external source of voltage.	T	F
34	High resistance in battery cables or connections is not a cause of slow or sluggish cranking.	T	F
35	A starter shifting in and out, or pulling in, is often caused by high resistance in the starter solenoid.	T	F
36	Voltage loss between the alternator and battery may be due to loss in the wiring.	T	F
37	Battery electrolyte is a solution of hydrochloric acid and water.	T	F
38	While cranking an engine the voltmeter reads low, this probably indicates a bad starter.	T	F
39	Both headlights are dim on high beam and normal on low beam. The probable cause is a poor headlight ground.	T	F
40	The specific gravity of a battery has been determined to be 1.200 @ 80 degrees F. The state of charge is 1/2 charged.	T	F
41	High starter draw could be caused by a bad starter relay.	T	F
42	In an alternator charging system, the output current is high when the battery is fully charged.	T	F
43	A starter motor should not be operated continuously for more than 60 seconds.	T	F
44	The starter motor draws electrical energy from the battery and converts it to kinetic energy.	T	F

EMPLOYEE RELATIONSHIPS: SAFETY			
1	What workers really want is a supervisor who lets them loaf on the job, gives them regular pay raises, and lets them take off all the time they want.	T	F
2	Employees who are at the top of their grade are considered valuable employees to the organization.	T	F
3	A general employee can make a good management transition if they so desire.	T	F
4	Any communications between employees should be accurate, clear, impartial and you should expect some misunderstanding.	T	F
5	If you are giving instructions to a co-worker, make sure they ask questions to find out if the instructions are understood.	T	F
6	In many industrial organizations, competition between departments is considered healthy and is encouraged; but competition does not mean open conflict.	T	F
7	You will be a far better communicator if you know how to listen.	T	F
8	Being tardy is a common human failing, but is a very expensive business habit that should be allowed to continue.	T	F
9	Workers are expected to understand required standards and have the ability to meet those standards in their daily work environment.	T	F
10	A dirty work area provides not only a hazard to the workers but is certain to reduce quality and increase production costs.	T	F
11	Safety isn't simply important to the well being of workers, it is also an important factor in the cost of running the agency.	T	F
12	Human failure (unsafe acts) cause over three quarters of all accidents on the job.	T	F
13	Class C fire extinguishers were developed for small fires involving electrical wiring, controls, panels and motors.	T	F

SHOP TOOLS			
1	A torque wrench measures the size of a nut.	T	F
2	A chassis dynamometer is an electronic analyzer.	T	F
3	A good tool for checking a cooling system is a radiator and pressure-cap tester.	T	F
4	A feeler gauge is recommended for checking tread depth of tires.	T	F
5	A tire-inflation cage prevents slow leaks in tires.	T	F

DIESEL ENGINES			
1	A diesel engine is an external combustion engine.	T	F
2	Actual compression pressure in a diesel engine is approximately 300 psi.	T	F
3	The same amount of air always enters the cylinders of a diesel engine; the amount of fuel is varied to increase proportion of fuel to air.	T	F
4	Centane number is a measure of a guide to a fuel price.	T	F
5	"Waxing" of diesel fuel is caused by agglomeration of paraffin particles found in all diesel fuel, which congeal at low temperatures.	T	F
6	The "cloud point" of a diesel fuel is any temperature below freezing.	T	F
7	Ether is used as a starting aid for diesel engines because it ignites at low temperatures.	T	F
8	The purpose of an after-cooler is to reduce intake-air noise.	T	F
9	Fuel injection occurs well before the piston reaches top dead center on the compression stroke. The reason is to vent air from the fuel-injection system.	T	F
10	To obtain easier starting in cold weather, diesel fuel can be mixed with kerosene.	T	F

11	A consistent engine miss at all speeds, with smoke puffs at every revolution, is caused by a sticking injector nozzle.	T	F
12	A diesel engine converts the greatest percentage of energy to useful work power.	T	F
13	Fuel and air are mixed in the supercharger on a diesel engine.	T	F
14	The typical compression on a diesel engine is 8.5-1.	T	F
15	The actual compression pressure on a diesel engine is approximately 200 psi.	T	F
16	The purpose of an after-cooler on a diesel engine is to increase combustion efficiency and power.	T	F
17	A sticking nozzle can cause a diesel to miss at all speeds.	T	F
18	The rack on a Detroit diesel engine must be set with the engine running.	T	F
19	Cummins engines use a P.T. injection system.	T	F
20	The compression release on a Cummins engine operates by holding the valves open.	T	F
21	Sleeve protussion is the distance the sleeve protrudes into the crankcase.	T	F
22	When using a micrometer, one full turn represents .100.	T	F
23	On a two-cycle diesel engine, it takes two crankshaft revolutions to complete one combustion cycle.	T	F
24	A naturally aspirated diesel increases in power with increased elevation.	T	F
25	Diesel engine turbochargers are driven by a gear on the crankshaft.	T	F
26	A dirty or partially clogged air cleanser causes increased smoke and reduced power.	T	F

AIR BRAKES			
1	When one diagram in the chambers on the same axle fails, both need to be replaced to maintain uniform push-rod length.	T	F
2	Excessive oil in an air brake system is probably caused by worn compressor piston rings.	T	F
3	With the air brakes correctly adjusted and fully applied, the angle between the push rod and the lever should be slightly greater than 90 degrees.	T	F
4	Mechanics should avoid adding 90 degree elbow fittings to the air brake system, adding four elbows is equivalent to 28 feet of hose.	T	F
5	Brake drums that are cracked through the drum, will make one more trip before needing replacing (ok by C.H.P.).	T	F
6	Dash air gauges can always be relied upon to be accurate.	T	F
7	Air loss of more than two pounds per minute, with brakes released on a single vehicle, is a violation of the C.H.P. inspection program.	T	F
8	Brake drag has been traced to poor housekeeping on the floor of the truck cab.	T	F
9	Stop light switches are always piped into a supply reservoir.	T	F
10	Most air brake devices operate on the principle of air pressure versus spring pressure.	T	F
11	The parking brake system receives its air supply from a protected reservoir for that system only.	T	F
12	Low pressure switches are always piped into the delivery or application lines.	T	F
13	Maximum stroke at which a type 30 brake chamber should be adjusted is two inches.	T	F
14	A temporary repair of a brake hose using a piece of tubing and hose clamps is permissible.	T	F
15	Brake hoses must be replaced if worn, chaffed, cut or cracked through the outer cover.	T	F
16	The air governor's sole function is to tell the air compressor when to pump and when to shut off.	T	F
17	By state law, all brake lining to be used on all autos, trucks, trailers and buses must have an edge code plainly visible showing manufacturers code and friction vault, cold and hot.	T	F
18	Air dryers clean and dry the air before it reaches the compressor.	T	F

19	When vehicles are not equipped with air dryers or automatic drain valves, drivers or someone should be instructed to drain the wet tank daily or at least once a week.	T	F
20	Single system foot valves and dual system foot valves may be interchanged on the same vehicle without any problems whatsoever.	T	F
21	Kinked or plugged air compressor discharge lines have been known to cause a pressure build-up so great the cylinder block will be lifted off the crankcase of the compressor and completely destroy the compressor.	T	F
22	The source of air in an air brake system is the governor.	T	F
23	If the water is not drained from air system tanks, it will displace needed air tank capacity.	T	F
24	The front-axle brake limiting valve is designed to give better vehicle control on slippery roads.	T	F
25	The main reason for locating a relay valve near the rear wheel brake chambers on long wheel base trucks is to speed up the operation of the rear brakes.	T	F
26	Excessive oil in the air brake system is probably caused by engine oil pressure being too high.	T	F

COOLING SYSTEM			
1	The maximum freezing protection with a mixture of ethylene glycol and water is obtained with a mixture of 33 1/2% ethylene glycol and 75% water.	T	F
2	The function of a thermostat is to prevent overheating.	T	F
3	When a thermostat fails in the open position the engine runs too hot.	T	F
4	A thermostat installed backwards will cause the engine to run at a lower than normal temperature.	T	F
5	The maximum freezing protection is obtained by a mixture of ethylene glycol and water at the rate of 50% antifreeze and 50% water.	T	F
6	A device for regulating current by means of variable resistance is called a voltage limiter.	T	F
7	Long wire runs, such as from a tractor to trailer taillights, can result in a voltage drop that can be partially or entirely overcome by using heavier-gauge wire.	T	F
8	If a vehicle ammeter shows "charge" when the headlights are turned on after a battery replacement, it indicates a fuse in the charging circuit is blown.	T	F
9	The best freezing and cooling protection is obtained with 100% ethylene glycol in the radiator.	T	F

HYDRAULIC BRAKES			
1	A "split" hydraulic brake system is two separate systems with a duel master cylinder.	T	F
2	Hydraulic-brake parts should be cleaned with gasoline.	T	F
3	When brake drums have been machined (turned) to the maximum limit specified by the vehicle manufacturer or state law, and additional machining is needed to true the drum, it should be exchanged for a rebuilt drum.	T	F
4	If a brake pedal rises and falls or pulsates when brakes are applied, the probable cause is glazed linings.	T	F
5	On a vehicle with disc/drum brakes, the front brakes grab quickly when light pedal pressure is applied. This problem could be caused by a bad proportioning valve.	T	F
6	The purpose of the bar on rear brake applications is to force the shoes into the drum when the parking brakes are applied.	T	F
7	If a hydraulic brake line is leaking, the correct repair would be to replace the leaking line with double flared steel tubing.	T	F

GASOLINE ENGINES			
1	The correct firing order of an in-line six-cylinder engine is 1-5-3-6-4-2.	T	F
2	A cracked or loose intake manifold causes a noticeable drop in oil pressure.	T	F
3	To start a cold engine, a major requirement is a high carburetor-float level.	T	F
4	An increase in compression when heavy oil is put into a cylinder during a compression test indicates worn piston rings.	T	F
5	A piston's size is measured across the top.	T	F
6	A vacuum gauge is useful for analyzing fuel-air ratio.	T	F
7	A recommended tool for measuring the diameter of an engine cylinder is an inside caliper.	T	F
8	A feeler gauge is recommended for checking tread depth of tires.	T	F
9	If piston rings are installed upside down you will have increased oil consumption.	T	F
10	Main bearing oil clearance can be checked with a feeler gauge.	T	F
11	Worn valve guides will cause excessive oil consumption.	T	F
12	A compression test on a in line six-cylinder engine indicates #3 and #4 have 10 psi. The rest all read 130-135 psi. This could be caused by wrong valve timing.	T	F
13	The device used to check ignition timing, with the engine running, is a xenon timing light.	T	F
14	If a timing light flashes before the timing mark lines up with the pointer, the time is too late.	T	F
15	If the timing mark fluctuates, it can indicate a badly worn condenser.	T	F
16	After operation in an engine, the color of the center insulator of a spark plug with the correct hear range should be black.	T	F
17	The distributor points are connected to the primary-coil winding.	T	F
18	The condenser points are connected to the primary-coil winding.	T	F
19	A compression test shows one cylinder very low; when an air-line is connected to that cylinder with a spark plug-hole adapter, air leakage can be heard at the tailpipe. The cause is probably broken piston rings.	T	F
20	The exhaust stroke of the piston fills the cylinder with a combustible mixture of air and fuel.	T	F
21	A carburetor operates on the principle of Ohm's law.	T	F
22	A high fuel level in a carburetor bowl will cause the engine to stall.	T	F
23	A dirty or partially clogged air cleaner will decrease fuel efficiency.	T	F
24	Exhaust-gas recirculation (EGR) is designed to reduce combustion temperature for low NOx emissions.	T	F
25	A catalytic converter prevents fuel-line "vapor lock."	T	F
26	The EGR valve reduces combustion chamber temperatures.	T	F

SWANA MECHANICS' ROAD-E-O PRATICE TEST ANSWER KEY

SHOP SAFETY		
1	Eye protection is optional if you are using a protective shield.	F
2	Eye protection should be worn during cleaning operations with compressed air.	T
3	When observing someone else drill or grind, only the person performing the work needs eye protection.	F
4	Watches and rings are only a hazard if you are working around batteries.	F
5	Clean and orderly work areas make for a safer work place.	T
6	Horseplay and practical jokes can cause someone to get hurt.	T
7	Every employee is responsible for the condition of hand or power tools.	T
8	If you have used a defective tool once or twice without getting hurt, it is probably okay to use it one more time.	F
9	A safe method for lifting is to bend your knees, not your back.	T
10	Clean up spills right away and put oily rags in an open container.	F
11	Gas welding goggles are not adequate for arc welding. For arc welding, use a welding hood with the proper lens.	T
12	Always close oxygen and acetylene cylinders when work is finished.	T
13	Safety stands are optional when working under a vehicle that is supported by a jack.	F
14	Tires are only a hazard during the process of inflation.	F
15	Before beginning any electrical work which requires the removal of any battery connections, disconnect the ground cable first and connect it last after completing work.	T
16	Most batteries are not heavy enough to require proper lifting procedures.	F

DRIVE TRAIN/TRANSMISSION		
1	The correct adjustment sequence during a drive axle overhaul is; adjust pinion bearing pre-load, adjust differential carrier bearing pre-load and adjust ring gear and pinion backlash.	T
2	Drive shaft vibration after a new universal joint has been installed can be caused by a drive shaft installed out of phase.	T
3	If the drive shaft on a truck rotates but the rear wheels do not move, the cause could be a broken differential pinion gear shaft.	T
4	When a vehicle with an automatic transmission is sluggish on acceleration, and the engine is sluggish on acceleration, but the engine is properly tuned, it probably has a bad torque converter.	T
5	A stall test on an automatic transmission will check the converter starter clutch.	F
6	An automatic transmission does not work right. The first thing a mechanic should do is adjust the bands.	F
7	If a clutch in a standard transmission application has not enough free play it will cause the clutch to drag when disengaged.	F
8	A whining noise from the rear of the vehicle when the accelerator is released, and the vehicle is coasting, is caused by badly worn "U" joints.	F
9	If a growling, grinding or screeching noise is heard when the clutch pedal is depressed, the probable cause is a worn or defective clutch release (throwout) bearing.	T
10	If a light-duty vehicle clutch does not release properly after installation of a new clutch disc and pressure plate assembly, which are known to be the correct parts, the probable cause is badly worn clutch linkage.	F
11	The clutch brake on a heavy duty manual transmission holds the truck on a steep hill.	F

12	On an Allison transmission, wrong modulator adjustment could cause upshifts at too low of an engine speed.	T
13	A truck with an Allison transmission may be push started.	F
14	It is safe to tow a truck with an Allison transmission for five miles without disconnecting the drive line.	F
15	The lock up clutch in an Allison automatic disengages the torque converter.	F
16	A stuck governor valve on an Allison transmission will produce upshifts at too low a speed.	T
17	Low oil will cause an Allison transmission to overheat.	T
18	On an Allison transmission, to install a bearing on a shaft, you should preheat to 200 degrees Fahrenheit.	T
19	Auxiliary Allison transmission filters are mounted in the oil pan.	F
20	Maximum oil temperature in the oil pan of an Allison automatic should be 300 degrees Fahrenheit.	F
21	Gasket sealer should be used on the oil pan gasket of an Allison transmission.	F
22	Teflon seal rings are used in an Allison automatic.	T

STEERING/SUSPENSION		
1	Hard steering and poor steering return after turns could be caused by replacement kingpins fitted too tight.	T
2	A steering gear adjusted too tight is a common cause of steering wheel shimmy at road speeds.	F
3	Steering-wheel shimmy at road speeds is probably due to front tires and wheels out of balance.	T
4	A feather-edge wear pattern on the front tires is probably caused by wrong toe-in adjustment.	T
5	Keeping spring U-bolts tight is an important maintenance operation. They should be periodically retightened with the vehicle empty.	F
6	If a shock absorber on the front axle is leaking, the proper procedure is to replace the defective shock absorber.	F
7	Worn bushings in a tandem rear-axle suspension can cause drive-shaft vibration.	T
8	When a vehicle wanders while driving on level road, the probable cause is too much negative chamber.	F
9	To center the steering wheel on a vehicle all you have to do is remove the steering wheel and re-install it.	F
10	Too much negative caster on the front wheel will cause the vehicle to pull to the left.	F

HYDRAULICS		
1	Hydraulic pumps produce flow not pressure.	T
2	A pump usually activates because of a restricted inlet or other conditions that allow air spaces to develop in the incoming fluid.	T
3	Improper condition of the hydraulic fluid can cause pump failure.	T
4	Pressure control valves are used to limit system pressure.	T
5	A check valve is a directional control.	T
6	Cylinders convert mechanical power to fluid power.	F
7	Misalignment of piston rods can cause leaks.	T
8	Oil of too high viscosity can cause a system to work sluggishly when cold and normal when the system warms up.	T
9	A pump can generally be used as a motor.	F
10	Galvanized pipe is recommended for high pressure hydraulic plumbing.	F

11	A hydraulic reservoir:	
	Stores oil	T
	Dissipates heat	T
	Helps keep oil clean	T
12	When trouble shooting a hydraulic system you should:	
	Know the system	T
	Operate the machine	T
	Inspect the machine	T
	Change parts until you find the trouble	F
	List the possible causes	T
	Reach a conclusion	T
	Test your conclusion	T
13	The valve that controls a packer blade is called a directional control valve.	T
14	A piston pump is a positive displacement pump.	T
15	A tall, narrow hydraulic reservoir is better than a short, wide one.	T
16	A swash plate is used in a external gear pump.	F
17	A typical hydraulic hose on a refuse truck contains two layers of wire braid.	T
18	The most common seal in mobil hydraulic systems is the "O" ring.	T
19	If you put equal pressure on both ends of a double acting cylinder it will not extend or retract.	F

ELECTRICAL		
1	A bad starter relay could cause high starter current draw.	F
2	A volt is a measure of current flow.	F
3	A vehicle battery is a device for storing energy.	T
4	Battery hydrometer readings should be taken immediately after water has been added.	F
5	The need to add excessive water to a battery indicates the charging rate is too high.	T
6	Diodes can be damaged by an overheated alternator.	T
7	A relay is a device that opens or closes another electrical circuit.	T
8	The engine will not start if the polarity is reversed in an electrical system with an alternator.	F
9	It is ok to replace damaged wire with a lighter gauge wire.	F
10	A poor ground can cause lighting problems.	T
11	If the battery uses a great deal of water chances are it is being undercharged.	F
12	An ammeter measures current flow.	T
13	A voltmeter measures electrical pressure.	T
14	An ohmmeter measures resistance in a circuit.	T
15	A conductor is some thing or material that will conduct electricity.	T
16	The most common current used in a vehicle is alternating current.	F
17	A battery is a device for storing mechanical energy.	F
18	A battery hydrometer show the battery's rated capacity.	F
19	The specific gravity of the electrolyte in a fully charged battery is usually 1.260-1.280.	T
20	Battery dyrometer readings should be taken when the engine is idling.	F
21	A dry-charged battery never needs electrolyte.	F

22	When replacing battery cables on tapered-type posts, it is good practice to coat terminals with petroleum jelly or grease.	T
23	If polarity is reversed in an electrical system with an alternator, the rectifier diodes will be ruined.	F
24	The need to add excessive water to a battery indicates excessive engine idling.	F
25	Weak brush-holder springs will cause brushes to short circuit.	F
26	A no cranking condition, with the lights staying bright, indicates an open circuit in the cranking system.	T
27	An ammeter measures current flowing in an electric circuit.	T
28	An ohmmeter may be used for measuring voltage between two points in an electrical circuit.	F
29	A starter motor may be operated continuously for more than 90 seconds.	F
30	An electrical conductor is made of glass or plastic.	F
31	It is good practice to hammer battery cables terminals onto battery posts.	F
32	A voltmeter is always connected in series with a part of the circuit being tested.	F
33	An ohmmeter should never be connected to an external source of voltage.	T
34	High resistance in battery cables or connections is not a cause of slow or sluggish cranking.	F
35	A starter shifting in and out, or pulling in, is often caused by high resistance in the starter solenoid.	F
36	Voltage loss between the alternator and battery may be due to loss in the wiring.	T
37	Battery electrolyte is a solution of hydrochloric acid and water.	F
38	While cranking an engine the voltmeter reads low, this probably indicates a bad starter.	F
39	Both headlights are dim on high beam and normal on low beam. The probable cause is a poor headlight ground.	T
40	The specific gravity of a battery has been determined to be 1.200 @ 80 degrees F. The state of charge is 1/2 charged.	T
41	High starter draw could be caused by a bad starter relay.	F
42	In an alternator charging system, the output current is high when the battery is fully charged.	F
43	A starter motor should not be operated continuously for more than 60 seconds.	T
44	The starter motor draws electrical energy from the battery and converts it to kinetic energy.	T

EMPLOYEE RELATIONSHIPS: SAFETY		
1	What workers really want is a supervisor who lets them loaf on the job, gives them regular pay raises, and lets them take off all the time they want.	F
2	Employees who are at the top of their grade are considered valuable employees to the organization.	T
3	A general employee can make a good management transition if they so desire.	F
4	Any communications between employees should be accurate, clear, impartial and you should expect some misunderstanding.	T
5	If you are giving instructions to a co-worker, make sure they ask questions to find out if the instructions are understood.	T
6	In many industrial organizations, competition between departments is considered healthy and is encouraged; but competition does not mean open conflict.	T
7	You will be a far better communicator if you know how to listen.	T
8	Being tardy is a common human failing, but is a very expensive business habit that should be allowed to continue.	F
9	Workers are expected to understand required standards and have the ability to meet those standards in their daily work environment.	T
10	A dirty work area provides not only a hazard to the workers but is certain to reduce quality and increase production costs.	T
11	Safety isn't simply important to the well being of workers, it is also an important factor in the cost of running the agency.	T
12	Human failure (unsafe acts) cause over three quarters of all accidents on the job.	T
13	Class C fire extinguishers were developed for small fires involving electrical wiring, controls, panels and motors.	T

SHOP TOOLS		
1	A torque wrench measures the size of a nut.	F
2	A chassis dynamometer is an electronic analyzer.	F
3	A good tool for checking a cooling system is a radiator and pressure-cap tester.	T
4	A feeler gauge is recommended for checking tread depth of tires.	F
5	A tire-inflation cage prevents slow leaks in tires.	F

DIESEL ENGINES		
1	A diesel engine is an external combustion engine.	F
2	Actual compression pressure in a diesel engine is approximately 300 psi.	F
3	The same amount of air always enters the cylinders of a diesel engine; the amount of fuel is varied to increase proportion of fuel to air.	F
4	Centane number is a measure of a guide to a fuel price.	F
5	"Waxing" of diesel fuel is caused by agglomeration of paraffin particles found in all diesel fuel, which congeal at low temperatures.	T
6	The "cloud point" of a diesel fuel is any temperature below freezing.	F
7	Ether is used as a starting aid for diesel engines because it ignites at low temperatures.	T
8	The purpose of an after-cooler is to reduce intake-air noise.	F

9	Fuel injection occurs well before the piston reaches top dead center on the compression stroke. The reason is to vent air from the fuel-injection system.	F
10	To obtain easier starting in cold weather, diesel fuel can be mixed with kerosene.	F
11	A consistent engine miss at all speeds, with smoke puffs at every revolution, is caused by a sticking injector nozzle.	F
12	A diesel engine converts the greatest percentage of energy to useful work power.	T
13	Fuel and air are mixed in the supercharger on a diesel engine.	F
14	The typical compression on a diesel engine is 8.5-1.	F
15	The actual compression pressure on a diesel engine is approximately 200 psi.	F
16	The purpose of an after-cooler on a diesel engine is to increase combustion efficiency and power.	T
17	A sticking nozzle can cause a diesel to miss at all speeds.	T
18	The rack on a Detroit diesel engine must be set with the engine running.	F
19	Cummins engines use a P.T. injection system.	T
20	The compression release on a Cummins engine operates by holding the valves open.	T
21	Sleeve protussion is the distance the sleeve protrudes into the crankcase.	F
22	When using a micrometer, one full turn represents .100.	F
23	On a two-cycle diesel engine, it takes two crankshaft revolutions to complete one combustion cycle.	F
24	A naturally aspirated diesel increases in power with increased elevation.	F
25	Diesel engine turbochargers are driven by a gear on the crankshaft.	F
26	A dirty or partially clogged air cleanser causes increased smoke and reduced power.	T

AIR BRAKES		
1	When one diagram in the chambers on the same axle fails, both need to be replaced to maintain uniform push-rod length.	F
2	Excessive oil in an air brake system is probably caused by worn compressor piston rings.	T
3	With the air brakes correctly adjusted and fully applied, the angle between the push rod and the lever should be slightly greater than 90 degrees.	F
4	Mechanics should avoid adding 90 degree elbow fittings to the air brake system, adding four elbows is equivalent to 28 feet of hose.	T
5	Brake drums that are cracked through the drum, will make one more trip before needing replacing (ok by C.H.P.).	F
6	Dash air gauges can always be relied upon to be accurate.	F
7	Air loss of more than two pounds per minute, with brakes released on a single vehicle, is a violation of the C.H.P. inspection program.	F
8	Brake drag has been traced to poor housekeeping on the floor of the truck cab.	T
9	Stop light switches are always piped into a supply reservoir.	F
10	Most air brake devices operate on the principle of air pressure versus spring pressure.	T
11	The parking brake system receives its air supply from a protected reservoir for that system only.	F
12	Low pressure switches are always piped into the delivery or application lines.	F
13	Maximum stroke at which a type 30 brake chamber should be adjusted is two inches.	T
14	A temporary repair of a brake hose using a piece of tubing and hose clamps is permissible.	F
15	Brake hoses must be replaced if worn, chaffed, cut or cracked through the outer cover.	T
16	The air governor's sole function is to tell the air compressor when to pump and when to shut off.	T
17	By state law, all brake lining to be used on all autos, trucks, trailers and buses must have an edge code plainly visible showing manufacturers code and friction vault, cold and hot.	F

18	Air dryers clean and dry the air before it reaches the compressor.	F
19	When vehicles are not equipped with air dryers or automatic drain valves, drivers or someone should be instructed to drain the wet tank daily or at least once a week.	T
20	Single system foot valves and dual system foot valves may be interchanged on the same vehicle without any problems whatsoever.	F
21	Kinked or plugged air compressor discharge lines have been known to cause a pressure build-up so great the cylinder block will be lifted off the crankcase of the compressor and completely destroy the compressor.	T
22	The source of air in an air brake system is the governor.	F
23	If the water is not drained from air system tanks, it will displace needed air tank capacity.	T
24	The front-axle brake limiting valve is designed to give better vehicle control on slippery roads.	T
25	The main reason for locating a relay valve near the rear wheel brake chambers on long wheel base trucks is to speed up the operation of the rear brakes.	T
26	Excessive oil in the air brake system is probably caused by engine oil pressure being too high.	F

COOLING SYSTEM		
1	The maximum freezing protection with a mixture of ethylene glycol and water is obtained with a mixture of 33 1/2% ethylene glycol and 75% water.	F
2	The function of a thermostat is to prevent overheating.	T
3	When a thermostat fails in the open position the engine runs too hot.	F
4	A thermostat installed backwards will cause the engine to run at a lower than normal temperature.	F
5	The maximum freezing protection is obtained by a mixture of ethylene glycol and water at the rate of 50% antifreeze and 50% water.	F
6	A device for regulating current by means of variable resistance is called a voltage limiter.	F
7	Long wire runs, such as from a tractor to trailer taillights, can result in a voltage drop that can be partially or entirely overcome by using heavier-gauge wire.	T
8	If a vehicle ammeter shows "charge" when the headlights are turned on after a battery replacement, it indicates a fuse in the charging circuit is blown.	F
9	The best freezing and cooling protection is obtained with 100% ethylene glycol in the radiator.	F

HYDRAULIC BRAKES		
1	A "split" hydraulic brake system is two separate systems with a duel master cylinder.	T
2	Hydraulic-brake parts should be cleaned with gasoline.	F
3	When brake drums have been machined (turned) to the maximum limit specified by the vehicle manufacturer or state law, and additional machining is needed to true the drum, it should be exchanged for a rebuilt drum.	F
4	If a brake pedal rises and falls or pulsates when brakes are applied, the probable cause is glazed linings.	F
5	On a vehicle with disc/drum brakes, the front brakes grab quickly when light pedal pressure is applied. This problem could be caused by a bad proportioning valve.	T
6	The purpose of the bar on rear brake applications is to force the shoes into the drum when the parking brakes are applied.	T
7	If a hydraulic brake line is leaking, the correct repair would be to replace the leaking line with double flared steel tubing.	T

GASOLINE ENGINES		
1	The correct firing order of an in-line six-cylinder engine is 1-5-3-6-4-2.	F
2	A cracked or loose intake manifold causes a noticeable drop in oil pressure.	F
3	To start a cold engine, a major requirement is a high carburetor-float level.	F
4	An increase in compression when heavy oil is put into a cylinder during a compression test indicates worn piston rings.	T
5	A piston's size is measured across the top.	F
6	A vacuum gauge is useful for analyzing fuel-air ratio.	F
7	A recommended tool for measuring the diameter of an engine cylinder is an inside caliper.	F
8	A feeler gauge is recommended for checking tread depth of tires.	F
9	If piston rings are installed upside down you will have increased oil consumption.	T
10	Main bearing oil clearance can be checked with a feeler gauge.	F
11	Worn valve guides will cause excessive oil consumption.	T
12	A compression test on a in line six-cylinder engine indicates #3 and #4 have 10 psi. The rest all read 130-135 psi. This could be caused by wrong valve timing.	F
13	The device used to check ignition timing, with the engine running, is a xenon timing light.	T
14	If a timing light flashes before the timing mark lines up with the pointer, the time is too late.	F
15	If the timing mark fluctuates, it can indicate a badly worn condenser.	F
16	After operation in an engine, the color of the center insulator of a spark plug with the correct hear range should be black.	F
17	The distributor points are connected to the primary-coil winding.	T
18	The condenser points are connected to the primary-coil winding.	F
19	A compression test shows one cylinder very low; when an air-line is connected to that cylinder with a spark plug-hole adapter, air leakage can be heard at the tailpipe. The cause is probably broken piston rings.	F
20	The exhaust stroke of the piston fills the cylinder with a combustible mixture of air and fuel.	F
21	A carburetor operates on the principle of Ohm's law.	F
22	A high fuel level in a carburetor bowl will cause the engine to stall.	F
23	A dirty or partially clogged air cleaner will decrease fuel efficiency.	T
24	Exhaust-gas recirculation (EGR) is designed to reduce combustion temperature for low NOx emissions.	T
25	A catalytic converter prevents fuel-line "vapor lock."	F
26	The EGR valve reduces combustion chamber temperatures.	T

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