

Teaching learner drivers with disabilities

An operation manual for driving instructors



*Torbjörn Falkmer, Lars Gustavsson,
Benny Nielsen and Björn Peters*

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Preface

The present manual is one of the outcomes of an EU-project with the title ODIGO. It was carried out within the Horizon initiative. As part of the ODIGO/HORIZON project *Körkort Handikapp*, Lernia in Kävlinge (formerly AmuGruppen, Kävlinge) in Sweden were requested to produce an operation manual for driving instructors, to be used in driver education for persons with special needs (PSN).

The ODIGO/HORIZON project was carried out in collaboration between Lernia, INIOHOS-NIRH and TRD in Athens, Greece and VTI in Linköping, Sweden. The present manual was produced in collaboration between Benny Nielsen (Lernia), Torbjörn Falkmer & Björn Peters, Gunilla Sjöberg (VTI), Lars Gustavsson (STR¹), and Sue Vernon, Mary Hill (Banstead Mobility Centre, UK) and Anna Stina Ponsford, (who formerly worked at Banstead Mobility Centre, now working for Traffic Medicine Center at Karolinska Institutet in Stockholm).

The present manual is aiming at providing knowledge about PSN and to support driving instructors that educate PSN. In the introduction of the manual, the requirements demanded of a driving school facility and some general aspects of teaching are considered. In the following driver education exercises are presented. In those, references to Appendix 1 are inserted, in which specific aspects of the driver education with respect to PSN are discussed. This appendix also includes an introduction to the area of education and PSN. In addition, a section called “Disabilities and vehicle adaptation” is enclosed, in order to provide an orientation within the field of PSN and vehicle adaptation. In the last section a suggestion for a lay out of logbook sheets for driver education is enclosed.

The authors hope that the manual will be a useful tool, both for acquiring knowledge about PSN and as a practical educational tool in the actual driver education.

¹ Sveriges Trafikskolors Riksförbund, the driving education exercises in the present manual are based on “Praktisk lärarhandledning”, produced by Lars Gustavsson and Hans Sandqvist for STR, 1991, ISBN 91 86874-10-1, © TSA.

The driving school

A driving school must possess the following facilities to operate the full driver-training programme:

Classroom

The classroom is used for the theoretical part of driver training. An appropriate number of students (5-10) should each have a seat in the classroom and space for taking notes, filling in test sheets etc.

- For students with special needs, make sure tables and furniture are not in the way of wheelchairs. Adjustable height tables and chairs can be very useful. The toilet should of course be accessible for wheelchairs. Make sure that persons with special needs, (PSN), can open entrance doors (possibly with automatic operation). Doorframes should be sized to fit wheelchairs and high thresholds should be removed.

Office

An office should be connected to the classroom for administrative purposes. The syllabus and training programme should be posted in the office and the driving instructor should hold a student progress card for each candidate being trained.

- For students with special needs, make sure tables and furniture are not in the way of wheelchairs.

Training car

The training car should be of a model commonly used on the roads. It should permit good all-round vision, have left and right hand mirrors, and interior mirrors for both the driver and instructor. It should also have a dual control system for the clutch and brake (if using an ordinary gearbox) or brake and ignition switch (if using automatic gearbox) to enable the instructor to intervene if necessary. The training car must be inspected regularly for faults and be maintained in roadworthy condition at all times.

- For students with special needs, make sure that the student has full access to the vehicle and the vehicle controls. The vehicle should be adapted in collaboration with a medically trained person having adequate knowledge of the student's special needs. Following individual adaptation of the vehicle, the driving instructor must supervise the appropriateness of the adaptation continuously. The driving instructor is responsible for the vehicle being adequately equipped for the student before starting each lesson.
- Entering and leaving the training car, using a wheelchair for transport and the ordinary seat for driving, implies a transfer process that should be practised mainly in the rehabilitation phase. However, the training car should be able to accommodate the wheelchair or other technical aid for mobility.
- Several methods and technical aids can be used to assist transfer to the driving seat in the training car. However, it is important for these to be tested and evaluated by a medically trained person together with the student. Inside the

vehicle, the instructor may assist the entry/exit operation and also draw the student's attention to any grab handles provided. In some cases, extra grab handles will be needed in the training car.

- If a choice has to be made between different activities, the emphasis in driving education should be put on vehicle manoeuvring and traffic behaviour, not entry and exit of the vehicle. The latter may be practised outside the driving school.

How to avoid occupational diseases and injuries as a driving instructor.

The seat

Be very careful how you adjust your seat. If you do not have a specially designed seat, use a hard support for the back or a seat cushion. The most common type of accident involving driving school cars is a rear-end impact. Therefore, it is important to adjust your headrest correctly.

The mirrors

Your rear and side mirrors should be adjusted to give an optimal view of other traffic and also to reduce the risk of long term muscular injuries in your neck and back.

Exercise

Take regular exercise. You will feel fresher during the day if you take a short walk between lessons.

Exhausts

When standing in a traffic queue, the fan will draw exhaust fumes into your car. To avoid this, open the sunroof or the car window instead.

Filling up

A driving instructor uses approximately 3,000 - 5,000 litres of fuel a year. Petrol contains about 2,000 more or less toxic compounds. To minimise the effects of these, do not stand too close to the fuel pump when filling up.

Environment

Turn off the engine when stopping for longer periods.

Testing and evaluation

For students with special needs (PSN), it is important that driving schools perform a test and/or an evaluation before training begins. This is to ensure that the driving school has the necessary equipment for performing training or adapting the training car. The evaluation form can later be used when the PSN requests a company to adapt a car.

Adult teaching in driving schools

Learning and motivation

Man is born lazy. He has no desire to get involved in an activity unless he finds it useful and important. So if you want him to listen to you and learn something you will not be successful unless he actually wants to listen and tries to understand what you are saying.

This is called motivation.

Three basic conditions for learning are:

1. Students must be motivated
2. Students must consider the programme useful
3. Students must be attentive

The way in which the training is organized and carried out will therefore influence the motivation of the student.

Is the theoretical information too theoretical? Is the course going too fast? Is the classroom unsatisfactory? And so on.

If the student forms such impressions, or if he does not feel he is making any progress, he will most certainly not be motivated and the training will not be successful.

Motivation is important in all training

Teaching involves transmitting your message to another person by means of words, text, drawings etc.

The keyword in all communication is clarity – both of the message and the means used to put it across.

This means that sentences must be short, precise and clearly delivered. Drawings must be simple and readable, and difficult words must be avoided.

To sum up:

Check continuously that your message has been understood.

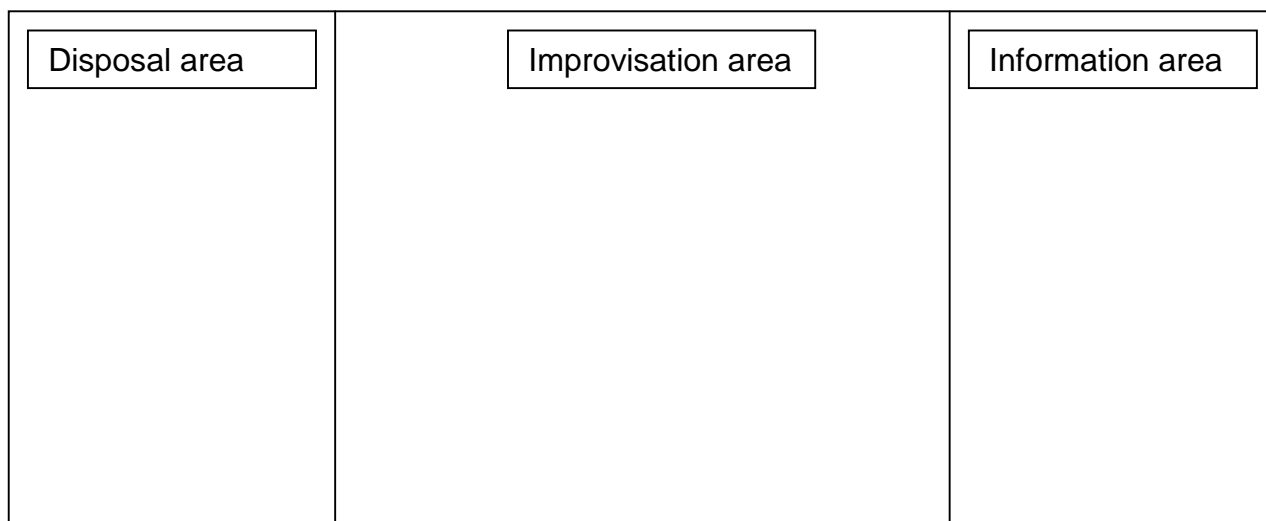
For students with special needs, see Introduction to Appendix 1

Teaching aids

For classroom teaching, the blackboard/whiteboard has proven value. Make sure that your blackboard/whiteboard is of good standard and that what you write on it is legible from every angle. Also, make good use of it.

Do not overfill the blackboard with information. Use large letters and clean the blackboard frequently after checking that everything has been understood by all the students.

Blackboard/whiteboard



When using the blackboard, use a pointer to indicate the relevant information more precisely. Face the students – never face the blackboard/whiteboard while you are talking.

Posters, illustrations or text are very useful and may either be produced by you in advance or obtained from others. Make sure illustrations or text are large and legible, even from the back of the classroom.

Magnetic boards or so-called **Flannelographs**, on which texts or figures can be stuck, are also very useful teaching aids.

Overhead projectors are very popular in modern classroom teaching. One advantage of the overhead projector is that the teacher himself can use speed markers to produce his own illustrations or copy them from other sources. As with other technical aids, do not overfill the overhead with information.

Slide projectors are popular for showing photographic slides. However, series of training slides are often not produced by the teacher himself but obtained from elsewhere. The risk is that the contents are not completely in agreement with the teaching programme, showing unfamiliar situations etc. Slide projectors also call for a completely dark room so that all the details on the slides can be seen.

Videos and video recorders are more advantageous. TV is also popular for classroom teaching due to its small size and flexibility, and also to increasing access to teaching materials. Such materials can be produced by the teacher himself or obtained from elsewhere.

To sum up:

Many aids are available for classroom teaching. Use them as a complement and make sure the information they contain actually relates to the topic in question.

For students with special needs, see Introduction to Appendix 1

The teacher

What makes a good teacher? How should he teach and behave in order to be successful? There is no simple answer to this question, but let us take a brief look at different types of teacher.

The authoritative teacher:

- Takes the initiative and tells his students what to do
- Controls the lessons without consulting the students
- Make decisions on his own
- Criticises and praises without explaining why
- Demands silence in class

The reluctant teacher

- Is rather passive
- Answers questions only when asked
- Lets the students work on their own

The democratic teacher

- Adapts his teaching to the learning speed of the students
- Makes use of constructive student initiatives
- Plans some of the lessons together with the students
- Assists the students in solving problems

From this simplified description, it is easy to identify the democratic approach to teaching as the alternative to be recommended.

To sum up:

The teacher must help the student to feel responsible, motivated, co-operative and critical about his learning and progress.

For students with special needs, see Introduction to Appendix 1

Objectives of the lesson

Some of the conditions for successful teaching have been introduced above. Finally, a few words must be said on the need for an overall teaching plan. Before starting any kind of teaching, the teacher must have clearly identified and planned what he is

going to teach. If this is not clear to the teacher, it will not be clear to the student either. This criterion is best met by following the overall program for training drivers, supplemented by an individually adapted plan for each student

To sum up:

For the training programme to be successful the driving instructor must have a plan and the student must be familiar with it.

For students with special needs, see Introduction to Appendix 1

Teaching methods

Demonstrations

The fastest way of explaining the object of the exercise is to demonstrate the exercise in practise. By doing so, you will avoid any misunderstandings. The student does not always understand a verbal instruction in the way that the driving instructor intends. A common cause of misunderstanding instructions is that the driving instructor has not made the object of the exercise clear to the student.

Instruction practice

Instruction practice entails supporting the student with comments *before* he or she acts incorrectly. By providing hints in advance, the student will achieve success in practical work. The student will benefit from this method later on during training.

Independent driving

In this phase, the driving instructor should act as a “silent passenger” and confirm that the student has reached the obligatory goals. Do not interfere with or disturb the student. At the end of the practice session, the driving instructor should let the student analyse his driving performance and together with the driving instructor decide whether the goal has been achieved or not. The driving instructor should thereafter give his opinion on the student's driving performance. Do not forget to give positive criticism first. Fill in the progress card together with the student. Inform the student about the objective of the next practice session and assign homework if any.

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Exercise 18	Driving in darkness

EXERCISE 0

It is very important for both the driver → instructor and the student to fully understand the objectives of the exercise.

By choosing the correct training area, the student will progress faster in his training.

Objective: The student should be able to.....

Training area: Parking area

This phrase is used for each exercise. Basically, you should not continue to the next exercise if the student fails, unless you have a special reason

The student should learn:

- to use the steering wheel correctly. *Place both hands on the steering wheel in the "quarter to three" position.*
- to use clutch correctly.

The different elements in each exercise do not necessarily have to be followed in a particular sequence. However, there is a logical design of the sequence in the exercises. Try to follow the exercises step by step, unless you have a special reason. Each exercise should start with a demonstration followed by exercises. Finally, the student should be able to manage the exercise on his own, i.e. independent driving. Study the chapter "teaching methods". *Text written like this (in italics) contains hints and explanations for the driving instructor.*

EXERCISE 1

Seating adjustments

Objective: The student should be seated comfortably behind the steering wheel and reach the pedals and switches without difficulty. After practise, the student should know the adjustment possibilities of the seat and the correct usage of control switches in the car.

Training area: Inside the car

For students with special needs, see Exercise 1, Appendix 1

The student should learn:

- about hazards when opening the door. *Check rear view mirrors before opening the door.* PIC 1.1
- how to find the correct sitting position in the seat and carry out simple routine checks before starting from the kerb. PIC 1.2
- the correct usage and position of control switches. *The student should be able to find the control switches without looking at them.*
- how to use the safety belt correctly. *Explain to the student why he should use the safety belt. The safety belt should not be twisted or damaged. Make sure that the passengers are also using safety belts. Explain why loose objects can be a hazard when braking.* PIC 1.3
- how to adjust the rear view mirrors correctly to obtain an optimum view to the rear. PIC 1.4
- that even with the rear view mirrors correctly adjusted, there are blind spots that should be checked before starting from the kerb or changing lanes, etc. PIC 1.5

PIC 1.1



PIC 1.4



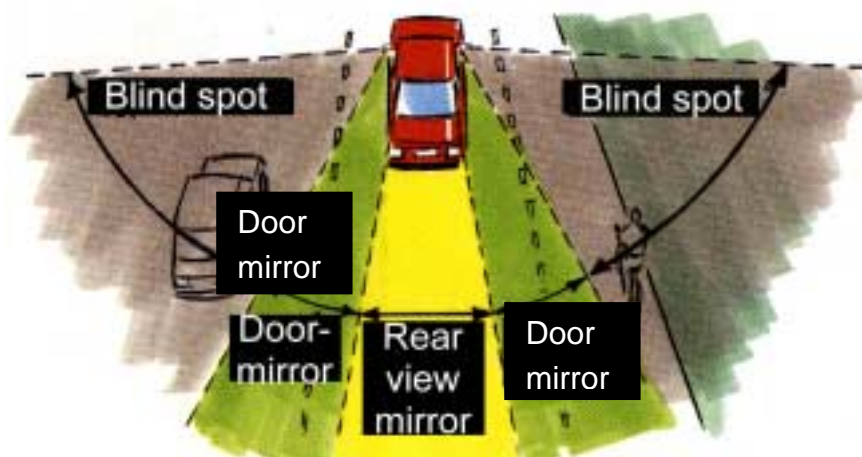


PIC 1.2



PIC 1.3





PIC 1.5

EXERCISE 2

Manoeuvre training

Objective: The student should obtain necessary skill in manoeuvring the car. After practise, the student should be able to start from the kerb and stop the car smoothly. The student should also know how to steer and control the car at low speeds (Edging along).

Training area: Closed area or a large empty parking area

For students with special needs, see Exercise 2, Appendix 1

The student should learn:

- how to get ready before starting from the kerb. *The correct sequence before starting from the kerb.*
- how to place his hands on the steering wheel and how to steer correctly.
- how to observe traffic before starting from the kerb. *Stress the blind spots.*
- how to start smoothly.
- how to drive very slowly straight on. *Edging along.*
- how to drive very slowly and steer at the same time. *Edging along and steering.*
- how to bring the car to a completely stop correctly. *The correct sequence before stopping. Explain precautions before leaving the car (parking brake).*

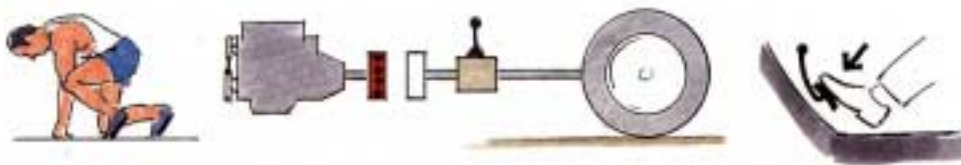
Note: Edging is a term that describes when the driver controls the speed with the clutch, i.e. driving very slowly. This part is very important when the student later practises parking and reversing. For students driving a car with an automatic gearbox, it is also important to control the car at very low speeds. PIC 2.1

➤ For students with special needs, see Exercise 2, Appendix 1

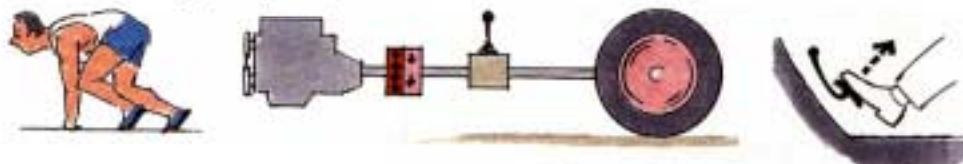
Gear shifting



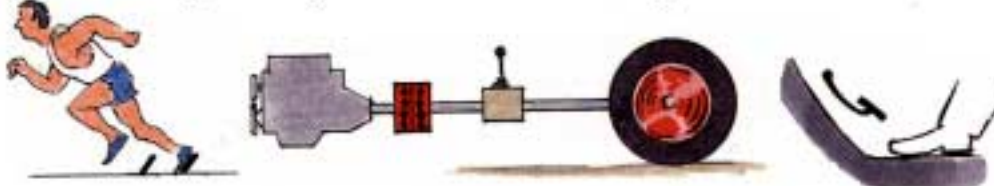
Engine disconnected from driving-wheel



Engine partly connected to driving-wheel



Engine fully connected to driving-wheel



PIC 2.1

EXERCISE 3

Changing gear and braking gently

Objective: The student should be able to understand the relation between speed and correct gear in order to drive safely, economically and smoothly. The student should know the position of the different gears and when to change gear. The student should also be able to use the braking pedal, gear lever, clutch and accelerator while looking at the road.

Training area: Long roads with little or no traffic

For students with special needs, see Exercise 3, Appendix 1

3 a) Changing up and braking gently

The student should learn:

- how to find the position of the different gears, first while standing still and later when the car is moving without looking at the gear lever.
- changing up at the correct speed. *Exercise distinct acceleration before changing gear. Make sure that the student is looking at the road when changing gear. Increase pace gradually in order to go through all the gears.* PIC 3.1
- the correct sequence when stopping. *Check the rear view mirrors before braking, at first stopping smoothly and later giving the student a stopping, for example a road sign. The student should be able to stop exactly at the stopping smoothly. Exercise from different speeds.* PIC 3.2

Note: For students driving a car with an automatic gearbox, some of the training with shifting gears is of course unnecessary.

3 b) Changing down

The student should learn:

- to change down. *Practise changing down to different years, until the student can do this smoothly.*
- to choose the correct gear. *Let the student decide the suitable gear according to speed and when to change to a lower gear. The student should first decide what speed to use and after that the correct gear.*

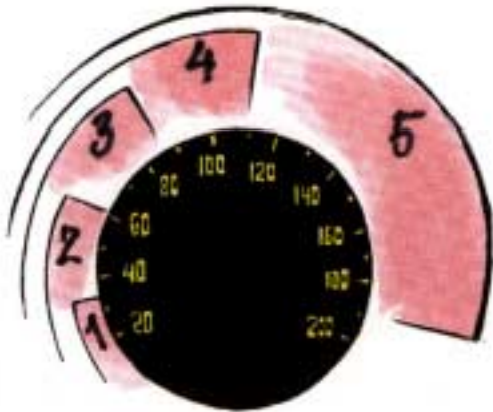
Note: Practise 3 b) on a straight road at first.

3 c) Changing down and turning

The student should learn:

- to adjust speed when approaching a junction, choose correct gear before crossing, accelerate and change gear up after crossing. *Start practising right-hand turns. After a while, the student can practise turning left and going straight ahead. A common error is that the student approaches the junction too fast.* PIC 3.3
- to scan correctly when approaching crossings. *Give the student hints on where and how to look when approaching the junction, within the junction and when leaving the junction.*

PIC 3.1

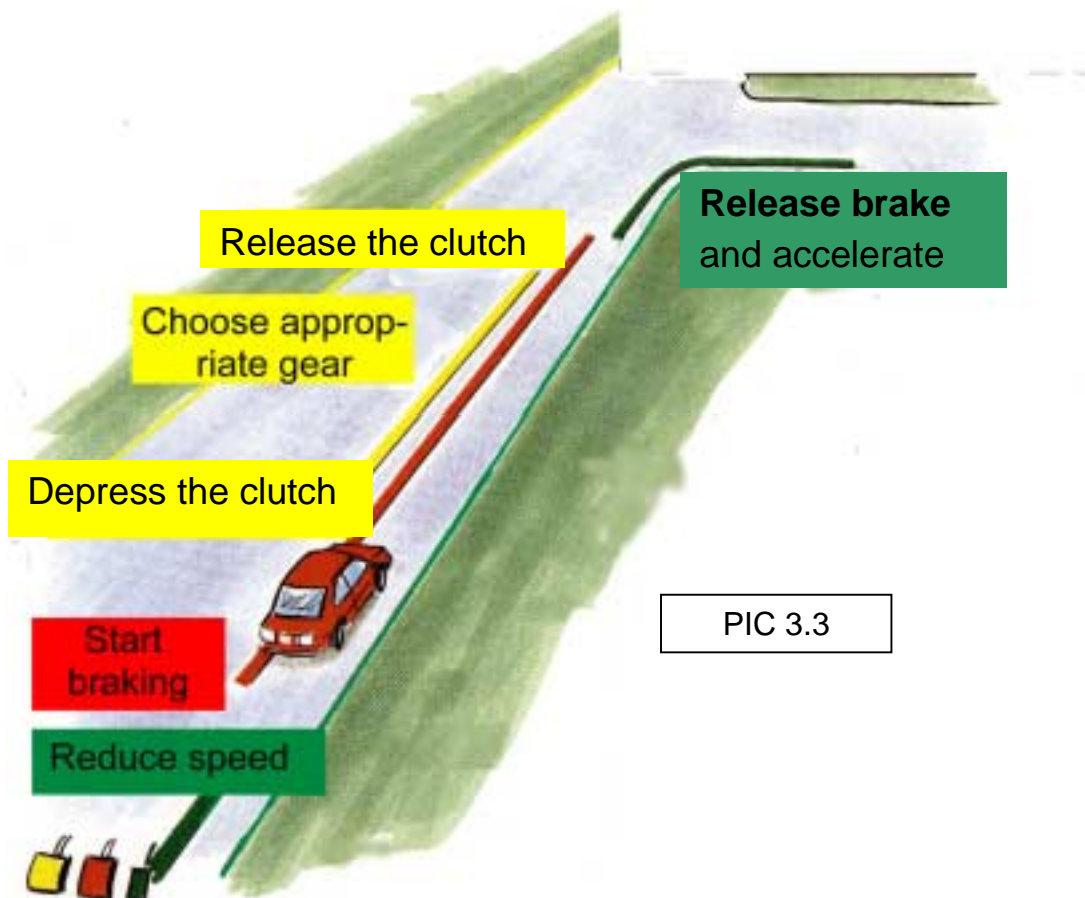


Shift gear at appropriate speed

PIC 3.1

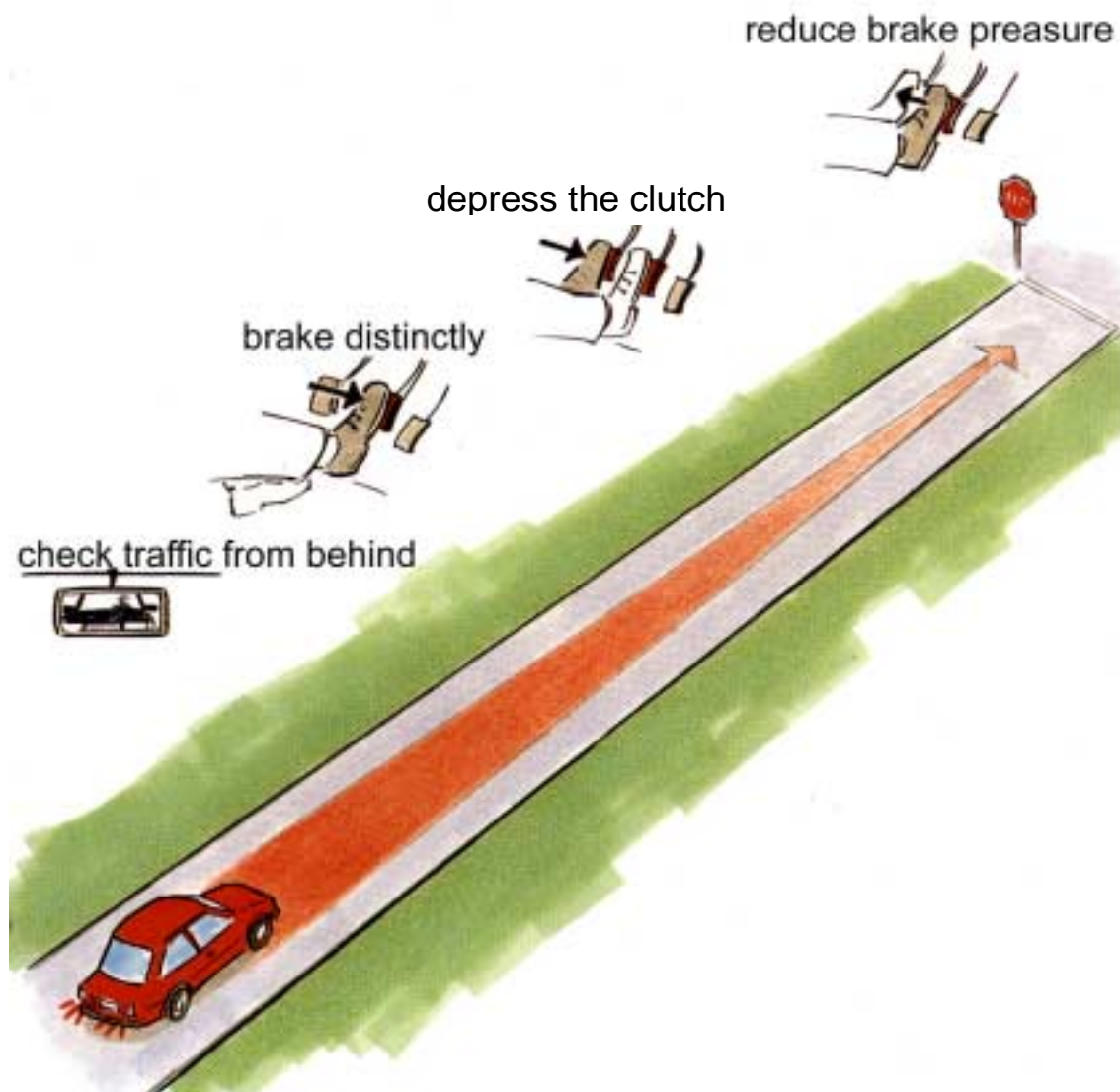


Listen to the speed of the engine



PIC 3.3

PIC 3.2



EXERCISE 4

Starting on hilly roads

Objective: Exercise the different techniques to be used when starting on hilly roads. The student should be able to start on an uphill road using the parking brake and also using the brake pedal. The student should be able hold the car still for a few seconds and observe traffic before starting.

Training area: Hilly roads

For students with special needs, see Exercise 4, Appendix 1

4 a) Starting from the kerb using the parking brake

The student should learn:

- how to keep the car still when releasing the parking brake.
- to observe other traffic before starting from the kerb.
- where this technique can be useful.

4 b) Starting from the kerb using the foot brake

The student should learn:

- how to start on roads with a slight gradient.
- how to quickly reduce the brake pedal pressure and adjust the accelerator and clutch in order to keep the car still.
- to observe other traffic before starting from the kerb.
- where this technique can be useful.

Note: Students driving a car with an automatic gearbox should also practise this exercise as the car can roll backwards depending on the gradient.

EXERCISE 5

Reversing

Objective: The student should be able to “feel” the car in terms of turning radius, length and width. The student should be able to sit correctly while reversing in order to obtain the best possible view to the rear. The student should also be able to estimate length, width and turning-centre of the car. The student should be able to control the car in narrow places with varying obstacles.

Training area: Closed area, parking lot or road with kerbs but no traffic. Use cones to create obstacles.

For students with special needs, see Exercise 5, Appendix 1

5 a) Reversing

The student should learn:

- to sit correctly while reversing. *Avoid reversing using mirrors only.*
- how to reverse in a straight line. *Explain problems in detecting small objects behind the car.* PIC 5.1
- how to control steering and reversing at the same time. *Explain turning point.* PIC 5.2
- reversing in a straight line after turning.

5 b) Precision driving

The student should learn:

- to estimate the length of the car. PIC 5.3
- to estimate the width of the car. PIC 5.4
- that the front wheels and rear wheels move differently. PIC 5.5
- to predict the path that the wheels will take.

5 c) 3-point turns and parallel transfers

The student should learn:

- how to make a U-turn. *Start practising on a wide road. The turning radius of the training car + 1 meter.*
- how to make a 3-point turn. *Practise on narrow roads.* PIC 5.6
- how to make parallel transfers. *If the student learns how to control parallel transfers, he will never have any problems when parking.*



PIC 5.1

**Movement of
the front**

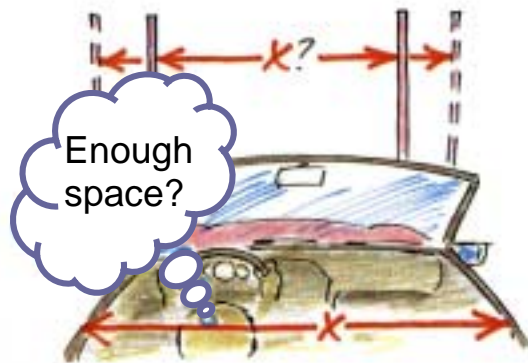


Turning point

Movement of
the front

Turning point





PIC 5.4



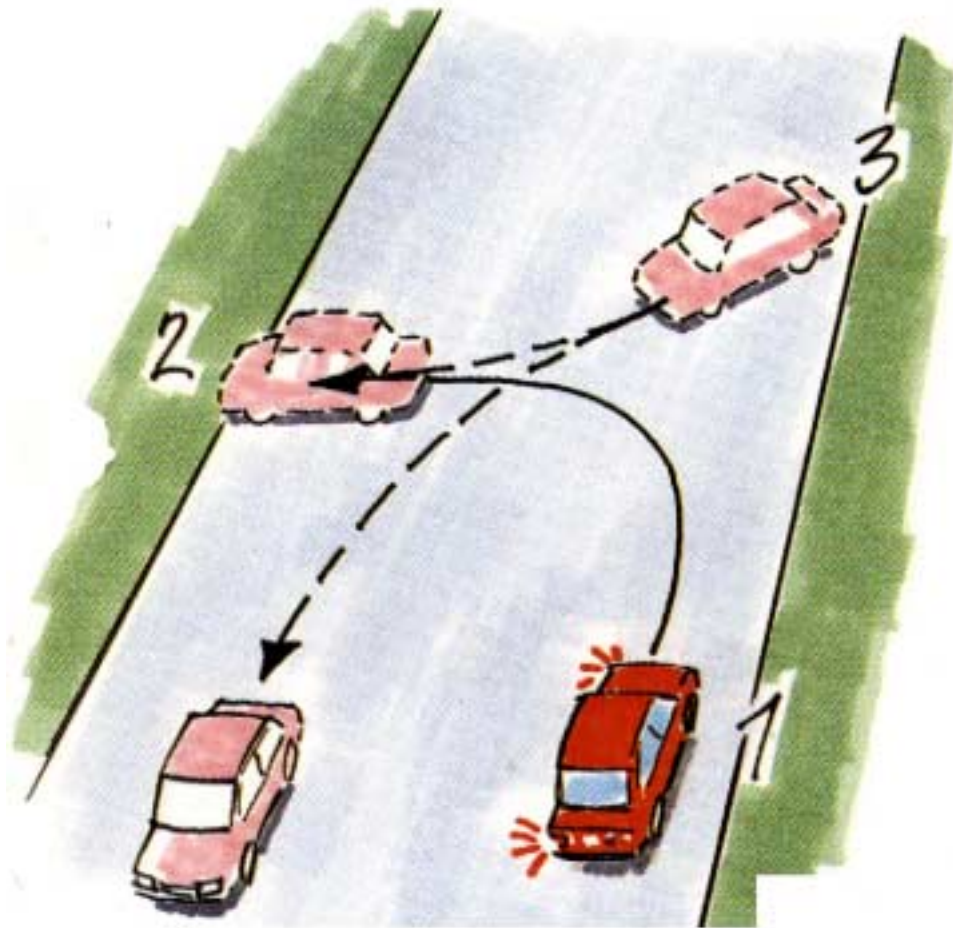
PIC 5.3



PIC 5.5

Rear wheels do not
follow the front wheels

1. Check traffic around you
2. Turn and edge
3. Make sure road is clear



PIC 5.6

EXERCISE 6

Co-ordination

Objective: Check that the student has handled the previous exercises without difficulty. The student should be able to control the car and observe other traffic and road users without the car wandering off course. The student should also be able to control switches and indicators without the car wandering off course

Training area: The same areas as in Exercise 1-5

The student should learn:

- to control switches and indicators while driving.
- to understand where to look.
- to use the mirrors while driving.

EXERCISE 7

Accelerations and hard braking

Objective: After this exercise, the student should understand “defensive” driving and understand the importance of adapting to the correct speed in different traffic situations. The student should also be aware that having his foot on the brake can influence the course of events.

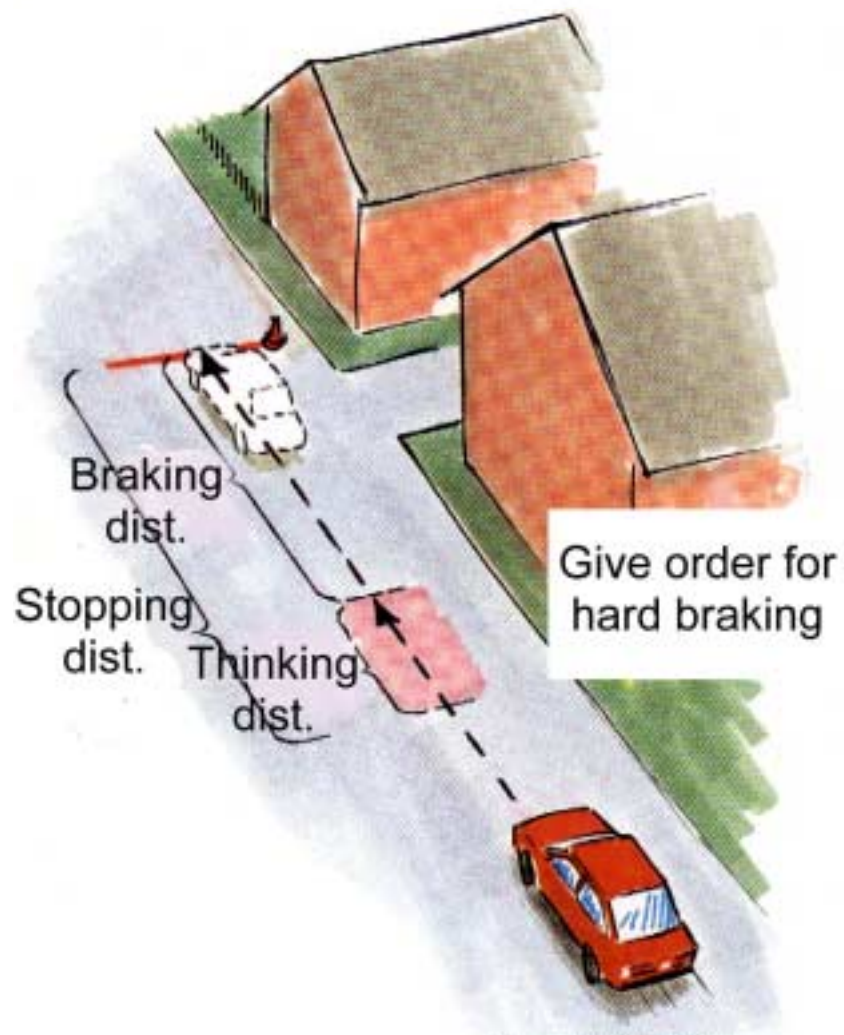
The student should be able to accelerate rapidly to higher speeds and stop the car in the shortest distance possible.

Training area: Long, straight road with no traffic

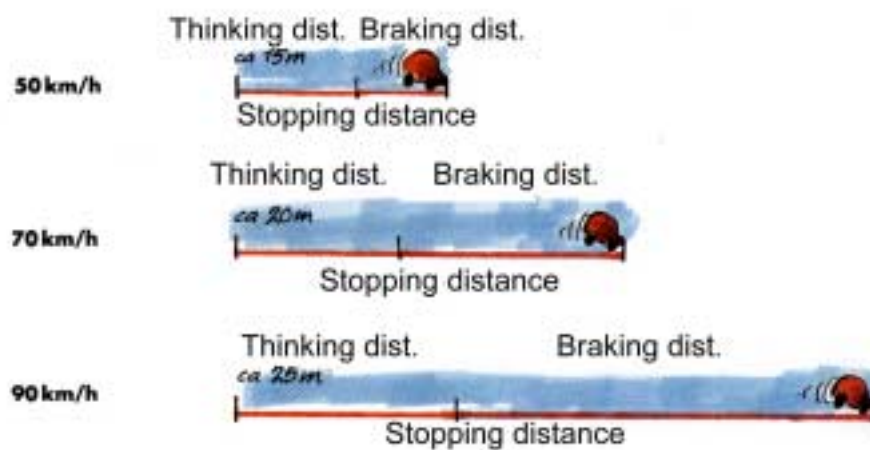
For students with special needs, see Exercise 7, Appendix 1

The student should learn:

- how to use the power of the engine when accelerating
- how to brake hard from different speeds: 50km/h, 70km/h, 90km/h. *Simulate a situation where the student has to brake very hard. Practise on different road surfaces and if the car is equipped with ABS, remove the fuse to disconnect the ABS system. Measure the stopping distance with “foot on brake” and without “foot on brake”.* PIC 7.1



PIC 7.1



PIC 7.1

EXERCISE 8

Driving on roads with less traffic

Objective: Exercise 8 is a summary of Exercises 1-7. The student should have developed a defensive, safe, economical and smooth way of driving. The student should be able to co-ordinate all exercises from 1-7 in a more complicated traffic environment. The student should be able to detect junctions, road signs and road users. The student should also be able to adjust to the correct speed in different traffic environments, without driving too slowly. The student should at this pace practise the different rules at junctions.

Training area: Rural area with sufficient road users and a junction.

For students with special needs, see Exercise 8, Appendix 1

The student should learn:

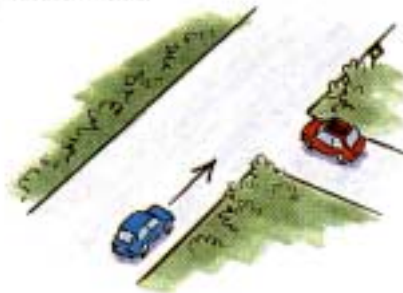
- how to practise different basic rules at junctions. *Start the exercise by explaining rules for driving straight ahead and also making, right hand turns and left hand turns at junctions.* PIC 8.1
- how to scan and look for essential features in traffic. *Stress the importance of scanning active. Also stress the advantage of first looking to the left when entering a junction.*
- to apply basic positioning at junctions when driving straight ahead and also when turning left and right. PIC 8.2
- to practise systematic sequences such as: mirrors, signal position when turning.
- to detect critical situations. *Emphasise keeping a safe distance to unprotected road users.* PIC 8.3
- to seek eye contact with other road users. PIC 8.4

Note: This exercise contains several important elements. Practise these step by step. Do not continue with any further exercise if the student fails Exercise 8

Right of way rule



Primary road rule



Exit rule



Turning rule



PIC 8.1



PIC 8.2

PIC 8.3



What's behind the bush?



PIC 8.4

Seek eye contact with other road users



EXERCISE 9

Care and maintenance of the car

Objective: The student should be aware of the economic aspects and the risks if the car is not kept in a roadworthy condition.

Goal: After this exercise, the student should be aware of the technical principles and equipment of the car. The student should also be able to detect faults and take steps in order to correct the faults.

Training area: Garage or gasoline station etc. Make sure to have the necessary tools and equipment for carrying out this exercise. Try to gather a group of 6-8 students and after instruction, let them work in small groups.

For students with special needs, see Exercise 9, Appendix 1

9 a) Knowledge about the vehicle

The student should learn:

- how to use the instruction manual for the car.
- to understand and use switches and indicators both inside the car and in the engine compartment.
- how to change bulbs, fuses and wiper blades
- how to check and when necessary, re-fill motor oil, brake fluid, battery fluid, cooling water, washer fluid and servo steering fluid
- how to fill up petrol
- to understand and check:
 - braking system
 - steering system
 - wheels and tires
 - lighting and electrical system
 - exhaust system

Note: The oil should be checked regularly in cars equipped with automatic gearboxes

9 b) Routine control before take off

Objective: The student should be able to check that the vehicle is in a roadworthy condition before starting.

Goal: The student should be able to make a simple, systematic routine check before starting.

Training area: Where the exercise starts

The student should learn:

- how to perform a simple routine check.
- to understand the risks of lending cars.
- to perform an extra careful check before driving longer distances.
- that frequent checks pay off; for example, that correct air pressure in tires reduces fuel consumption.

EXERCISE 10

Driving on roads in rural areas

Objective: In this exercise, the student feels what it is actually like to drive a car. At the same time, the driving instructor gets the opportunity to stress that it is important to look far ahead of the car, place the car correctly on the road and adjust speed to the circumstances. The student should be able to detect environmental hazards such as blocked exits, blocked junctions, slow vehicles etc. The student should also know how to drive safely over a railroad crossing.

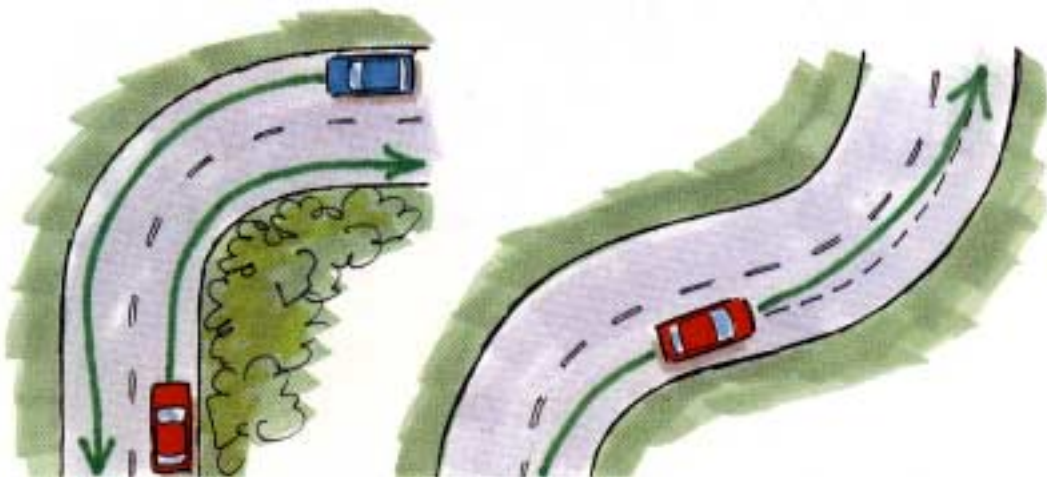
Training area: Narrow and curved roads.

For students with special needs, see Exercise 10, Appendix 1

The student should learn:

- how to brake hard on different surfaces.
- to scan correctly.
- how to place the vehicle correctly on a curve. PIC 10.1
- how to use the correct driving technique, i.e. choose correct speed and gear before entering a curve.
- how to be prepared for unexpected events. PIC 10.2
- how to meet other vehicles on narrow roads. PIC 10.3
- how to pass a railroad crossing safely. Adjust speed to visibility and road surface. Choose correct gear.

Correct positioning through curves



PIC 10.1



PIC 10.2



PIC 10.3

EXERCISE 11

Driving on roads in suburban areas

Objective: The student should be able to place the car correctly before, inside and after junctions and at the same time detect and be aware of other road users. The student should also practise existing rules at junctions correctly.

Training area: Suburban area with junctions of different shapes and sizes. Traffic flow should be more intensive than in earlier exercises in order to apply the rules at junctions.

11 a) Going straight in crossings

The student should learn:

- how to approach the junction. *Emphasise how to scan, how to determine the influence of road condition on braking, traffic signals, road signs, road markings, pedestrian crossings, pedestrians, cyclists and crossing vehicles.*
- how to choose position and how to choose the correct lane. *By scanning the junction in advance, the student will be able to choose position and lane much more easily. Study the student's behaviour when changing lanes. PIC 11.1*
- how to adjust speed when approaching junctions.
- how to apply rules at junctions. *As a driving instructor, you may sometimes think that the student drives very well. But once the driving instructor starts to ask questions about rules etc, he may notice that the student has insufficient knowledge guessing. By asking the student questions is e.g. what rule should be applied at a certain junction, the driving instructor will gain a better idea of the student's knowledge.*

11 b) Turning right at junctions

The student should learn:

- how to position the car correctly when turning right. PIC 11.1-11.2
- to scan correctly. *Wide turns are often the result of incorrect scanning.*
- which car has right of way. *The student is often uncertain about when he should yield to when turning.*
- to anticipate risks when turning right:
 - overtaking cyclists just before turning right PIC 11.3
 - pedestrians on the pedestrian crossing just after turning right

- to prepare for turning right, i.e. mirrors, signals and position or choosing the correct lane.

11 c Turning left at junctions

The student should learn:

- how to position the car correctly when turning left. PIC 11.1-11.2-11.3
- to prepare for turning left, i.e. mirrors, signals and position or choosing the correct lane. *Turning left is much more complicated than turning right. The driver has to observe not only crossing vehicles but also oncoming traffic.* PIC 11.4
- to scan correctly. *The student often concentrates on crossing vehicles and sometimes forgets the oncoming traffic. Stress why it is necessary to look twice, three times or more before deciding that the road is clear. Explain that the student sometimes has to turn his head in order to see pedestrians and cyclists.*
- which rules should be applied when turning left.
- to avoid risks when turning left. *Oncoming vehicles may obstruct other vehicles. Observe the student's attention to the vehicles behind. A common cause of accidents involving vehicles turning left is that the driver of the vehicle left turning has not observed that he or she is just being overtaken by another vehicle. In most cases, it is the driver of the vehicle turning left who is responsible for the accident.* PIC 11.5
- about the problem of estimating speed and distance of the oncoming vehicle. *It is much more difficult to estimate the speed and distance of an oncoming vehicle compared to crossing traffic. For an inexperienced driver, it may also be difficult to judge the difference between a moped and a motorbike. Teach the students to be suspicious and alert in these situations.*

11 d) One way streets

The student should learn:

- to cross may one-way streets safely. *Stress the risk of being hit from the right as the vehicles in a one-way street the may drive on the left side of the street.*
- how to position the car when driving straight ahead and turning right and left in a one-way street. PIC 11.6
- anticipate risks in a one-way street.

11 e) Junctions with traffic signals

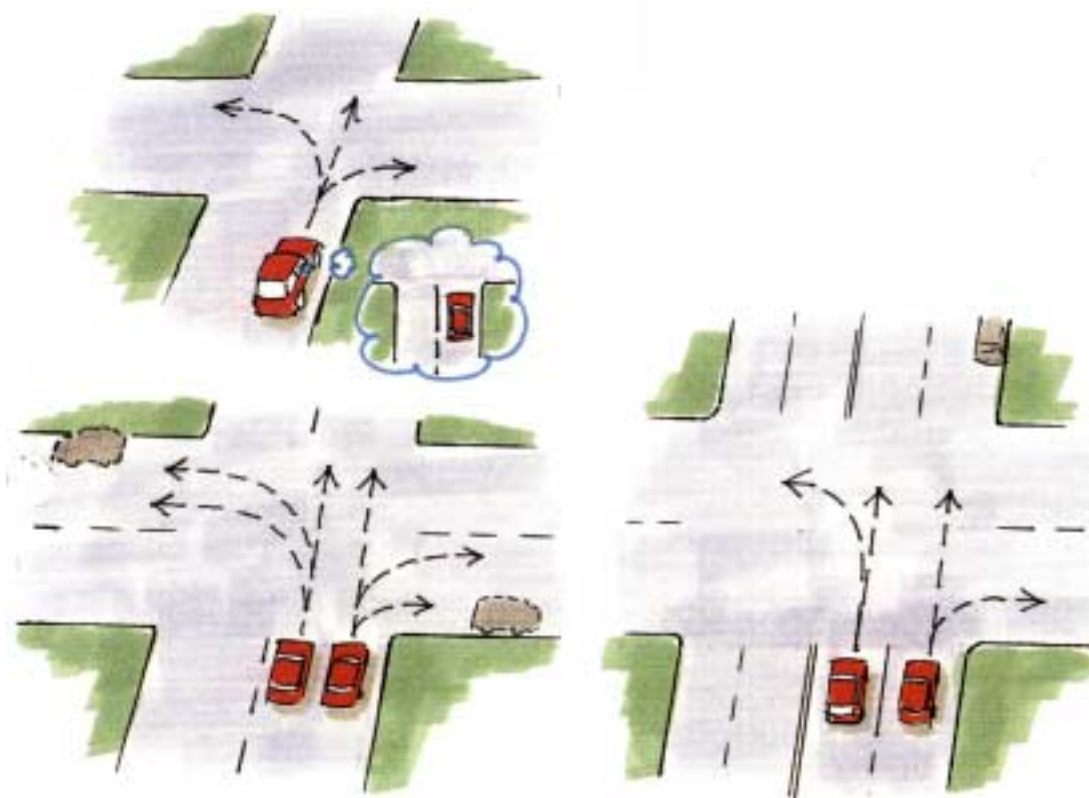
The student should learn:

- what to do if the traffic signal is out of operation or if a policeman is controlling the traffic at a junction with working traffic signals. PIC 11.7
- to determine which other vehicles have a green light. *Most students are uncertain about which other vehicles or road users have a green light at the same time.*
- about the risks at junctions with traffic lights. PIC 11.8

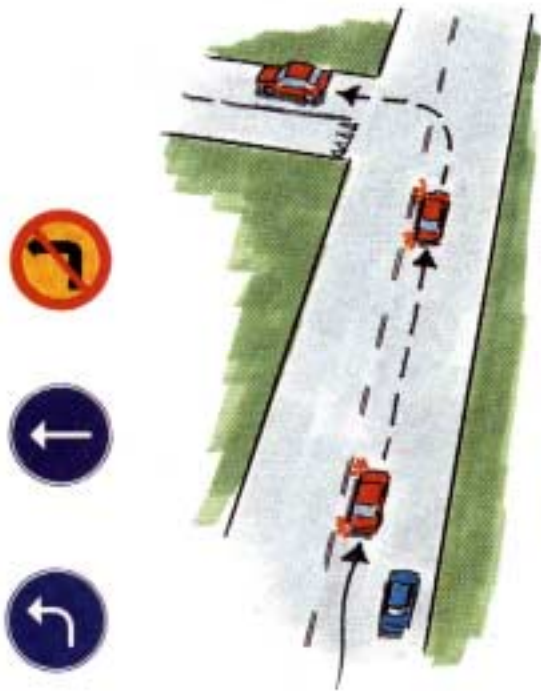
11 f) driving at roundabouts

The student should learn:

- how to approach roundabouts correctly. *Explain the difference between roundabouts and ordinary junctions.*
- to apply rules for negotiating roundabouts.
- how to position the car and signal the intention to drive straight ahead and turn right and left. PIC 11.9



PIC 11.1



PIC 11.4



PIC 11.3



PIC 11.2



Do not forget to check the traffic before you turn

PIC 11.3

PIC 11.5



Watch out for oncoming traffic when turning left

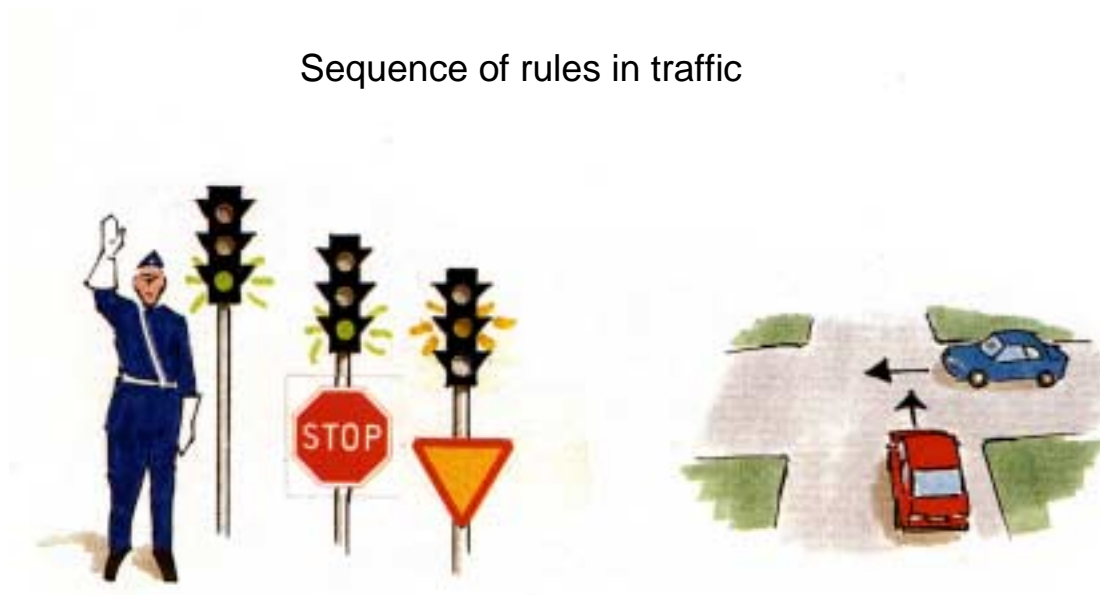


Watch out for oncoming traffic turning left



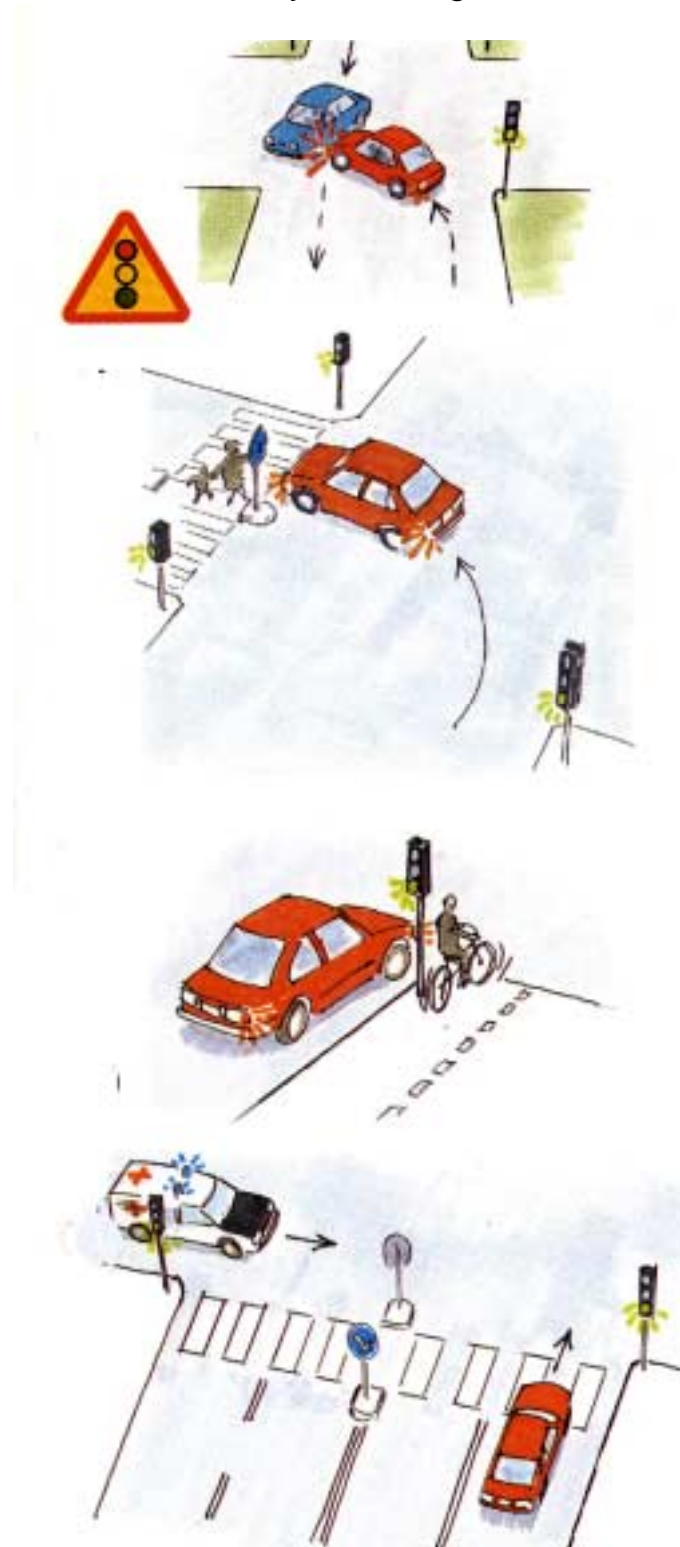
PIC 11.6

Sequence of rules in traffic

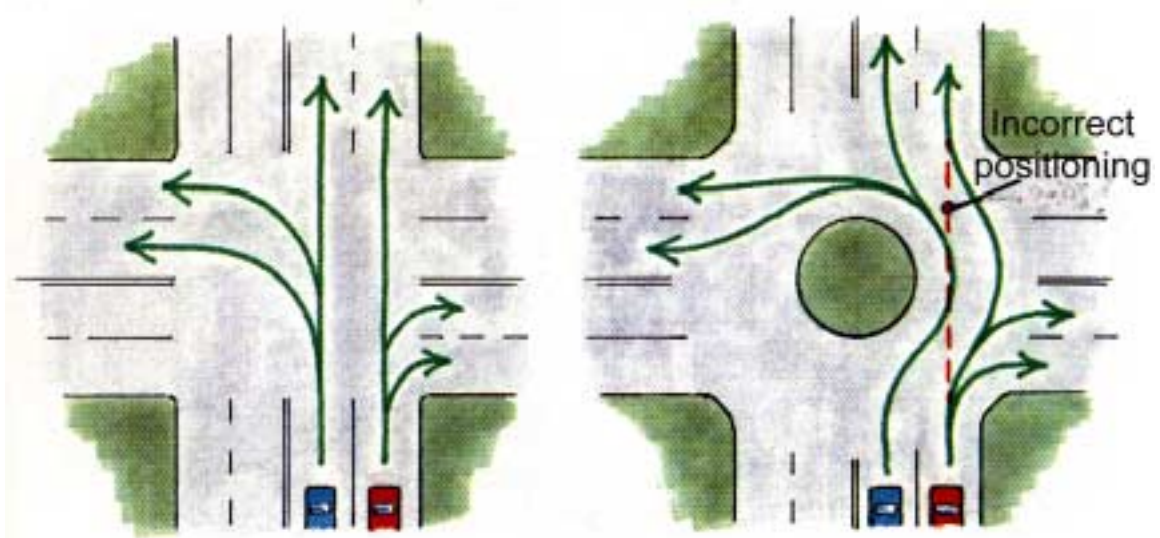


PIC 11.7

Risks at junctions controlled by traffic signals



PIC 11.8



PIC 11.9

EXERCISE 12

Driving on roads with several lanes

Objective: The student should learn how to pass other vehicles and how to change lanes in a safe way. The student should also be able to keep a correct distance to vehicles in front and at the side.

Training area: Roads with frequent traffic. The roads should have at least two lanes in each direction.

The student should learn:

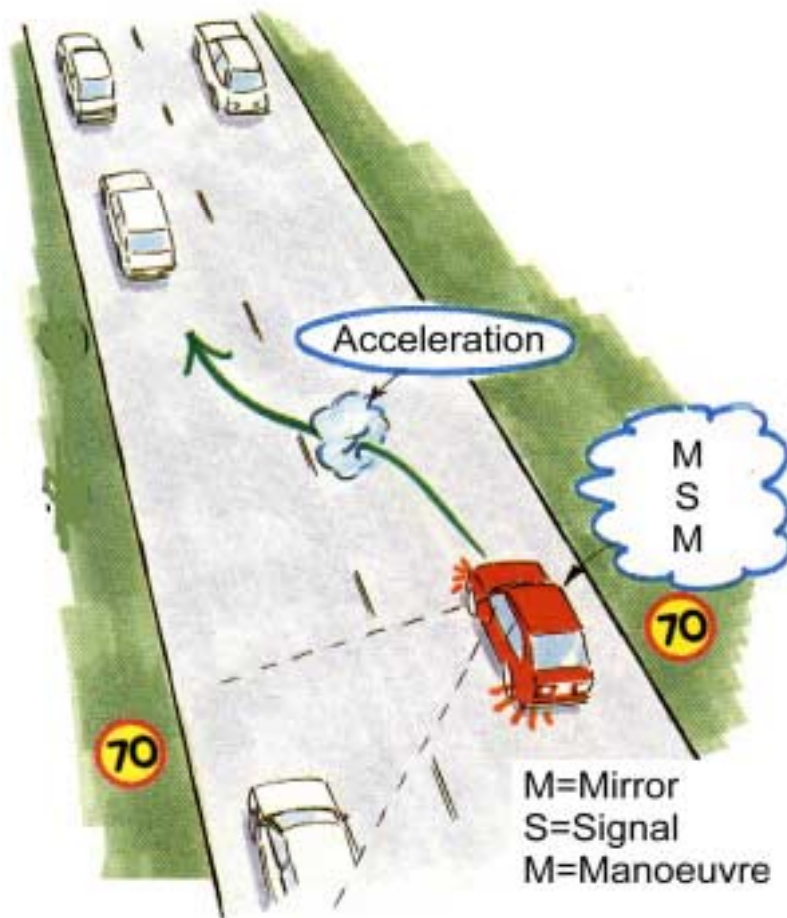
- to choose the correct lane for the intended direction. *When driving on roads with more than one lane, the right lane is mostly used for right turns and driving straight ahead. The left lane is used for left turns and overtaking.*
- to keep a correct distance to vehicles in front. *Students often drive too close to the vehicle in front. Try to explain the importance of keeping a safe distance to the vehicle in the front.* PIC 12.1
- the 3-second rule. *A good method to keep a correct distance to the vehicle in front.*
- how to change lanes. *Stress the importance of correct observation around the car, including blind spots, signalling and speed adjustment.* PIC 12.2
- to be aware of the risks when passing other vehicles to the right.

Keep a safe distance to the car in front of you



PIC 12.1

Procedure when changing lanes



PIC 12.2

EXERCISE 13

Turning and parking in traffic

Objective: The student should be aware of the risks when turning and parking in traffic. The student should be able to park, turn and reverse in traffic.

Training area: Different types of junctions for reversing and turning. Parking lots for parking.

For students with special needs, see Exercise 10, Appendix 1

13 a) Turning

The student should learn:

- to turn at a 3-way junction. PIC 13.1
- to turn at a 4-way junction. PIC 13.2
- to be aware of the risks when reversing and turning in traffic. PIC 13.3-13.4

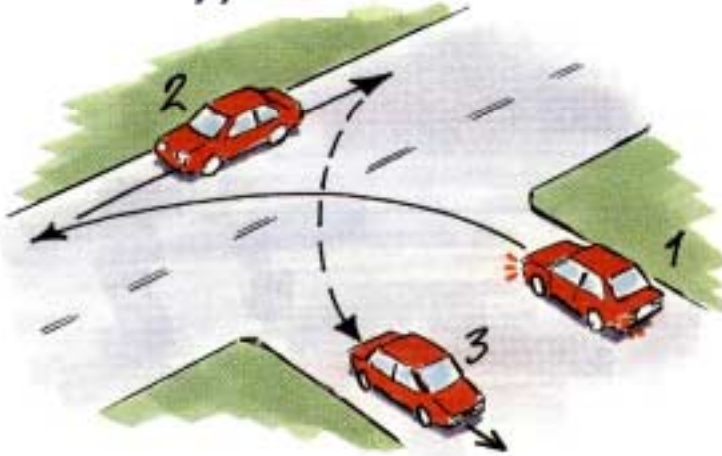
13 b) Parking

The student should learn:

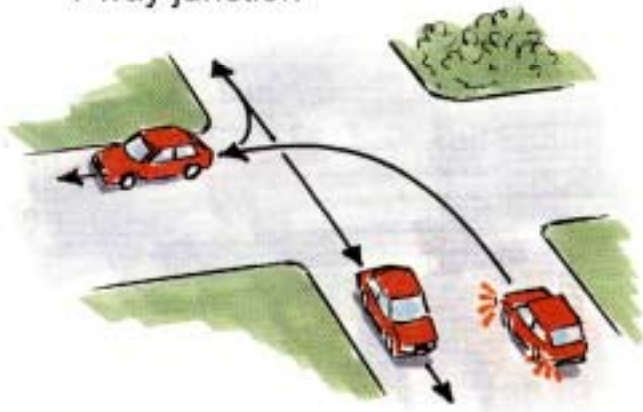
- to park the car front first in the parking bay/space. PIC 13.5
- to reverse into the parking bay/space. PIC 13.6
- to move the car to a parallel parking bay/space. PIC 13.7-13.8
- to use the side mirrors.
- to park the car along the road between two cars, both driving in front first and reversing into the parking bay/space. PIC 13.9
- to use the parking brake correctly.
- to apply the correct rules and road signs when parking.
- the risks when parking too close to junctions and pedestrian crossings. PIC 13.10

PIC 13.1

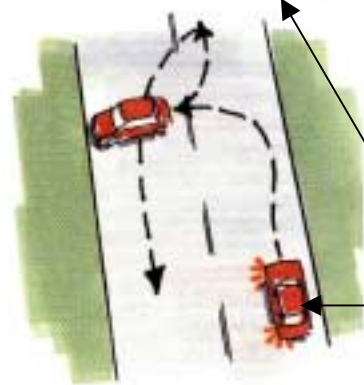
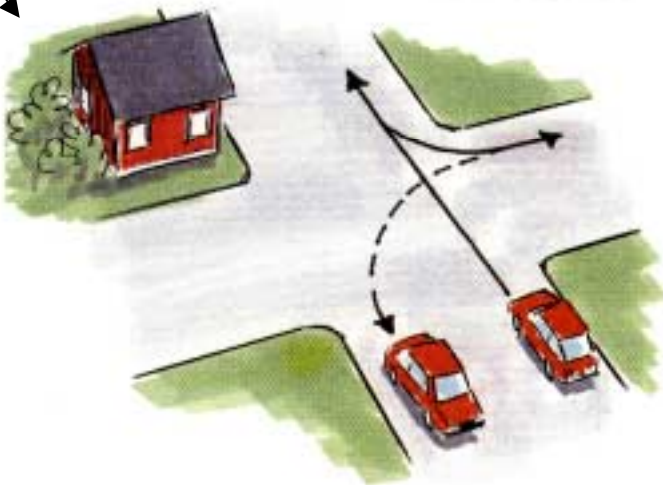
3-way junction



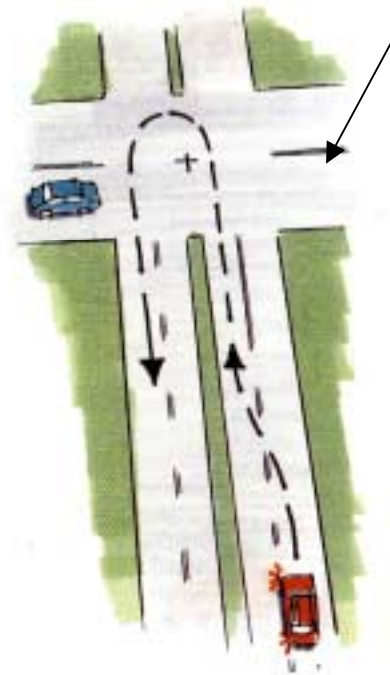
4-way junction



PIC
13.2



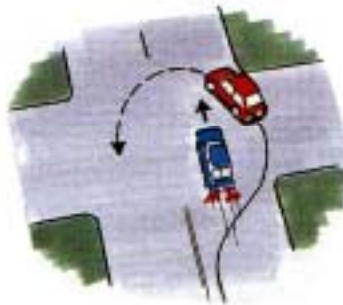
PIC
13.3



Risk 1
Blocked view when reversing



Risk 2
U-turn in junction

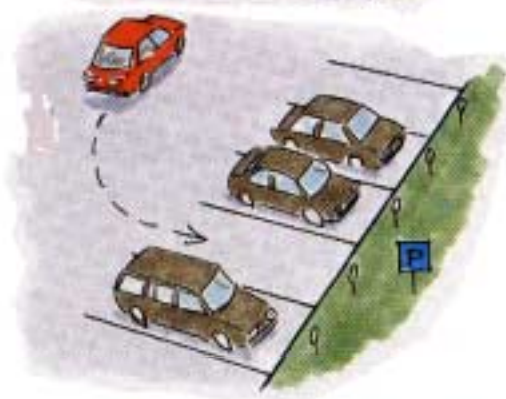


Risk 3
Turning car forgets to
check oncoming traffic and
traffic coming from behind

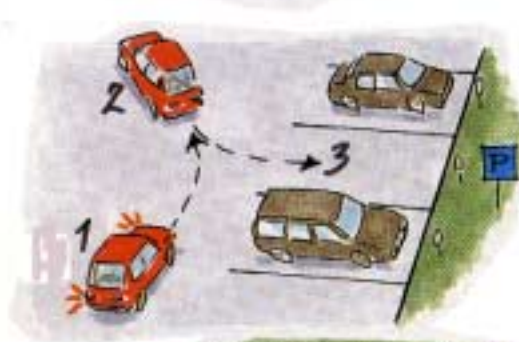




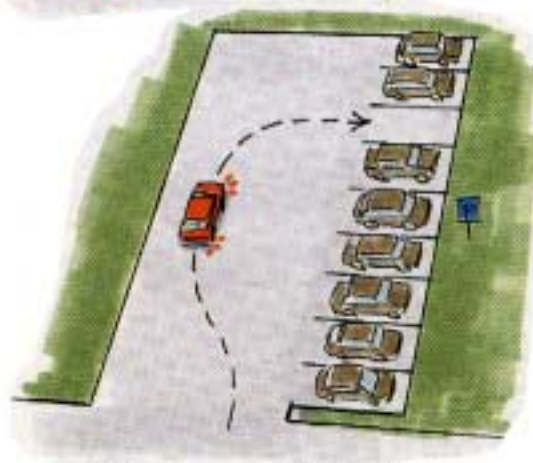
PIC 13.5



PIC 13.6

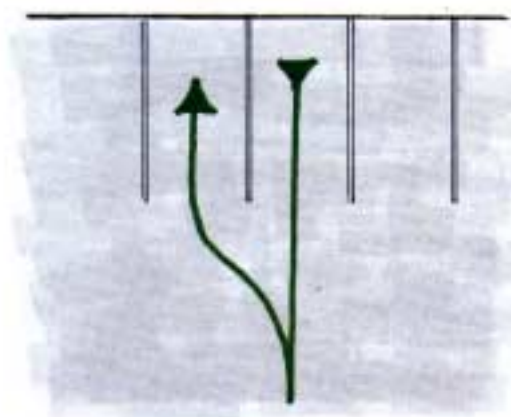
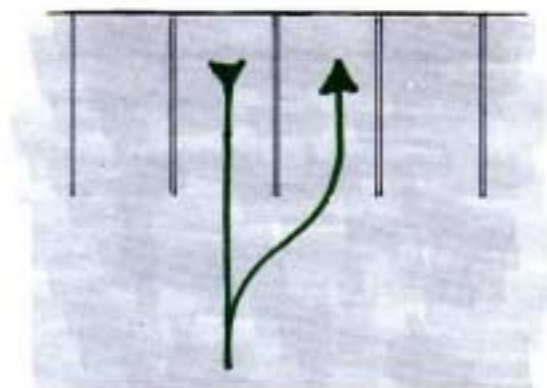


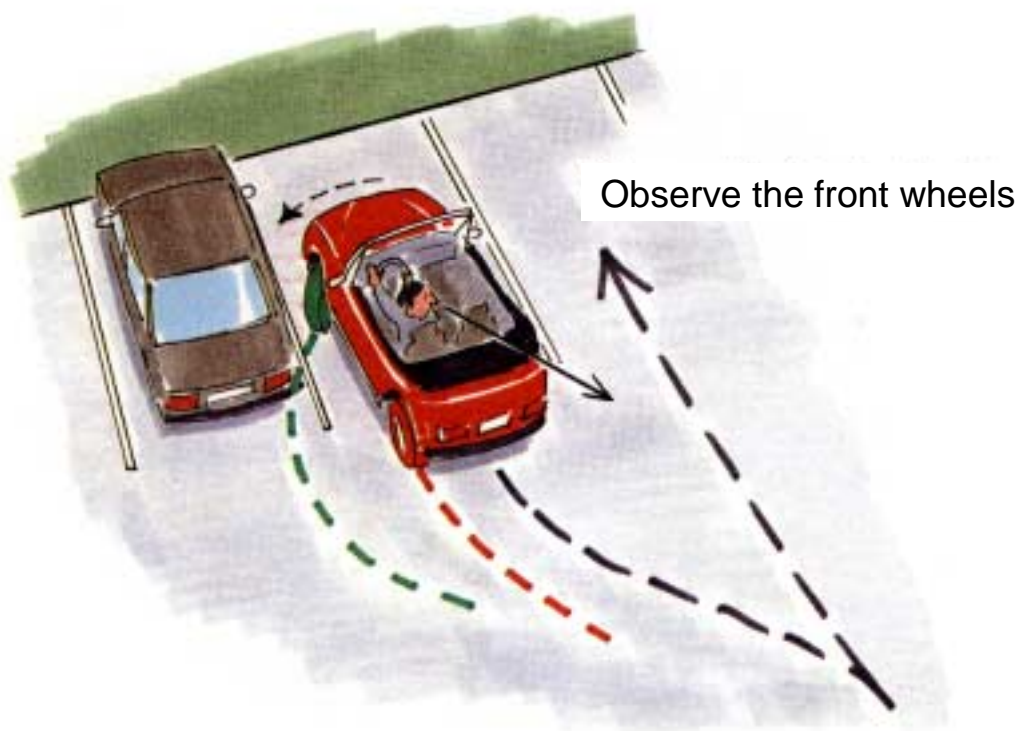
PIC 13.6



PIC 13.5

PIC 13.7





PIC 13.8

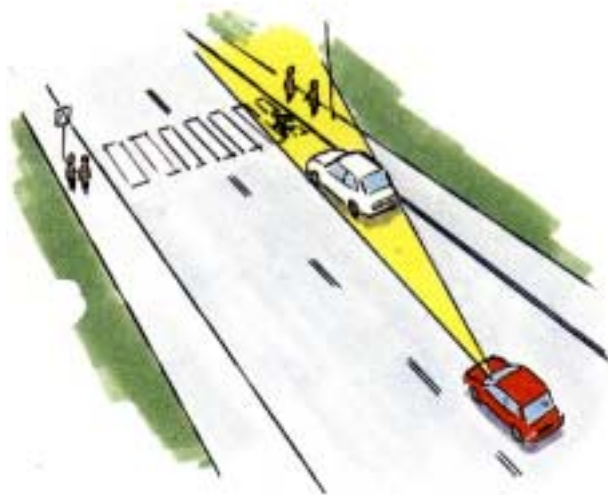


PIC 13.9

Risky parking at a junction



Risky parking at a pedestrian crossing



PIC 13.10

EXERCISE 14

Driving on complex roads with varying traffic in built-up areas (Summary of Exercises 11-13)

Objective: The student should independently be able to practise all previous exercises in frequent and intense traffic. The student should also be able to follow road signs to towns, villages and central districts in towns. The student should be able to solve any problem that arises while driving without assistance from the driving instructor.

Training area: Area with intense traffic and central districts.

The student should learn:

- to practise previous exercises independently. *Give the student assignments to be carried out independently. The driving instructor should offer constructive criticism after the assignment has been carried out.*
- to follow road signs to towns and villages. *Until now, the driving instructor has told the student where to drive and when to turn etc. Following road signs towards a destination is a new task for the student. Give the student instructions to follow road signs to towns, villages, schools, shopping centres, hospitals etc.*

EXERCISE 15

Driving on highways and main roads

Objective: The student should be able to drive on various types of highways and main roads. The student should be able to enter and exit highways and main roads in a safe way. The student should be able to overtake in a safe way.

Training area: Highways and main roads in rural areas.

15 a) Estimating speed and distances

The student should learn:

- to understand problems of estimating speed of other vehicles. *Stress the problems of estimating speed, especially of oncoming vehicles. A large truck appears to be closer than an ordinary car.*
- to estimate distance other vehicles.
- to look several times for crossing traffic or oncoming traffic before entering a junction.

15 b) Entering junctions on highways and main roads

The student should learn:

- to approach a junction correctly. *The student should approach the junction in such a way that other road users feel confident of his intention. The student should consider the condition of the road surface when braking from high speeds.*
- to estimate the distance to stop signs correctly. *Teach the student hard braking first and gradual braking later.*
- to enter highways and main roads in a safe way. PIC 15.1
- to accelerate rapidly.
- to use the hard shoulder when necessary.

15 c) Exit to the right from highways and main roads

The student should learn:

- to signal correctly. *Explain the risks of signalling too early or too late.* PIC 15.2
- to adjust to correct speed before exit. *Stress the usage of the speedometer in order to reduce the risk of speed blindness.* PIC 15.3
- how to position correctly when turning right. PIC 15.4
- observe other traffic.
- accelerate after the turning.
- to understand the risks when turning right.

15 d) Exit to the left from highways and main roads

The student should learn:

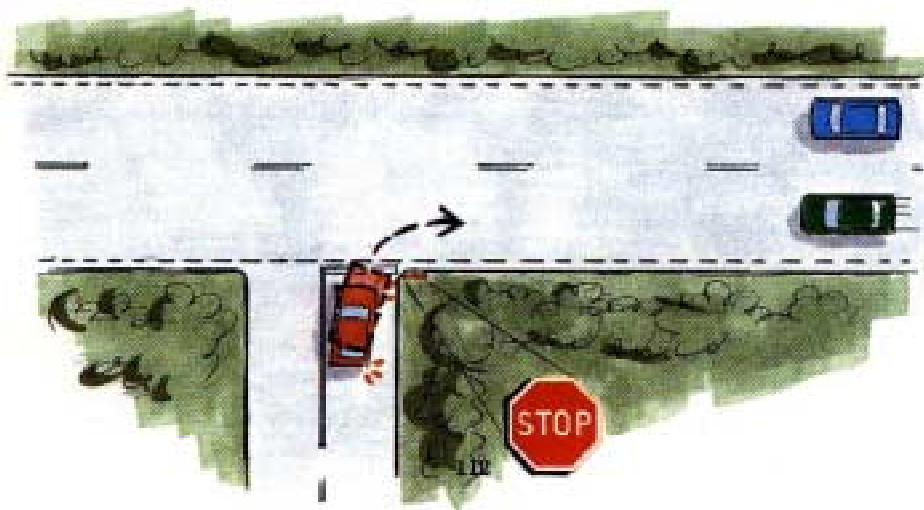
- to turn left from a highway or main road. *Turning left from a highway or main road is one of the most risky traffic situations. Therefore, exercise this phase very carefully.* PIC 15.5
- to signal correctly.
- to choose the correct position or lane. *The risk of being hit from behind will be reduced through correct positioning.* PIC 15.6
- to adjust to the correct speed before turning left.
- to use the hard shoulder when necessary. *Try not to have any cars right behind you just before turning left on a highway or main road. In order to reduce the risk of being hit from behind, use the hard shoulder in advance so that vehicles immediately behind you can pass.* PIC 15.7
- to accelerate after the turning.

15 e) Overtaking

The student should learn:

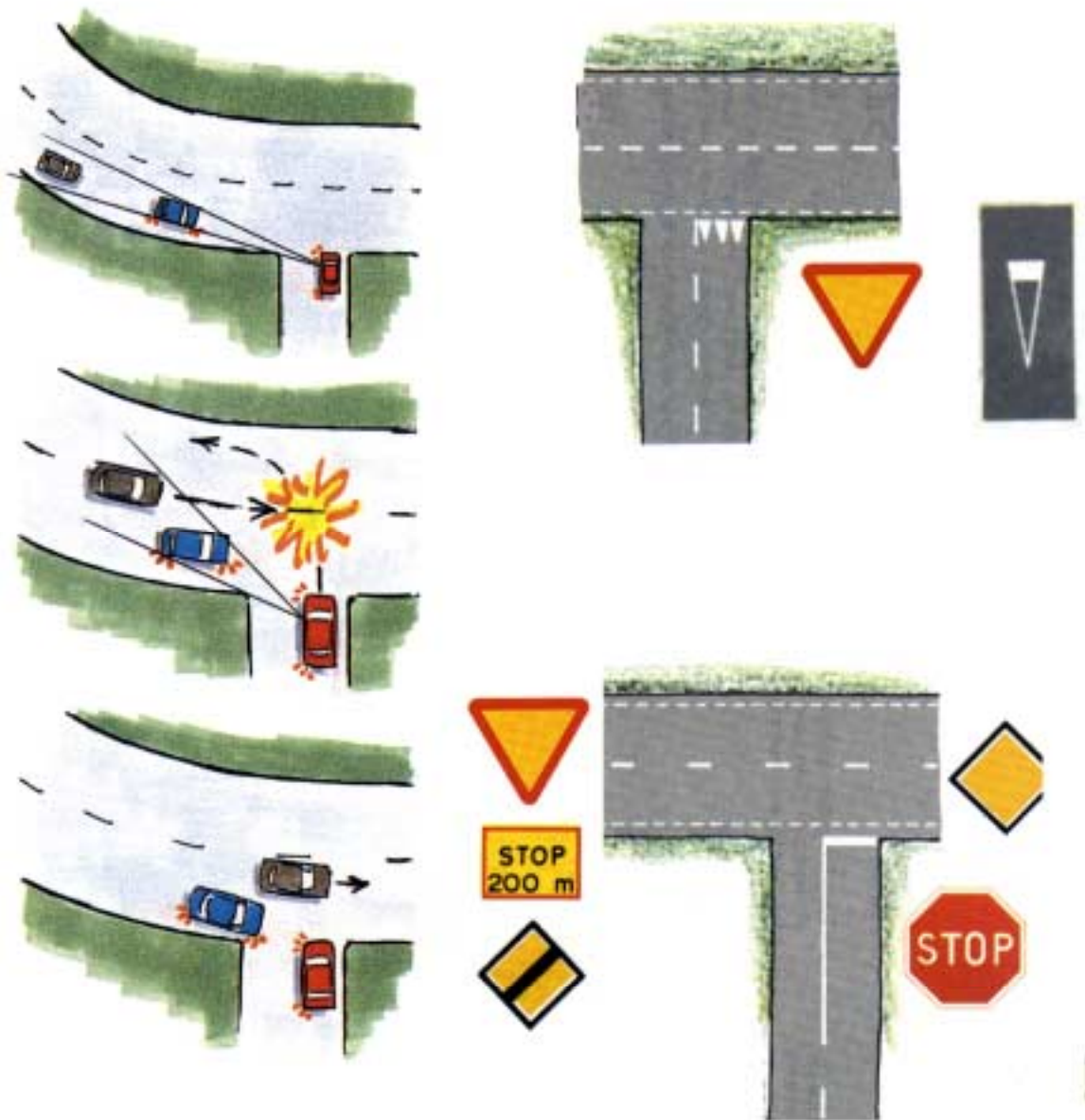
- to estimate the necessary distance for overtaking.
- to overtake in three steps. PIC 15.8
- to be prepared to abandon overtaking.
- to return to the right lane correctly. *Often, the student returns to the right lane much too early. Do not return to the right lane until you can see the car that has been overtaken in the mirror. Use the steering wheel gently.*
- to understand road signs and road markings prohibiting overtaking.
to make it easy for other drivers who want to overtake. The student should use the hard shoulder when necessary, but should be aware of the risks when driving on the hard shoulder, e.g. pedestrians, soft surface, etc.

The obligation to stop is not the only meaning of a stop sign. You must also give way to traffic approaching from both left and right before entering the main road.



PIC 15.1

Entering roads



PIC 15.1

Risk 1
Signal ?



PIC 15.2

Risk 2
Failure to adjust to a slower speed



PIC 15.3

Risk 3
Positioning ?



PIC 15.4

Risks when turning left on rural roads

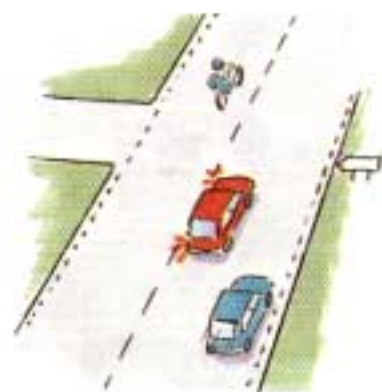
Risk 1
Blocked views



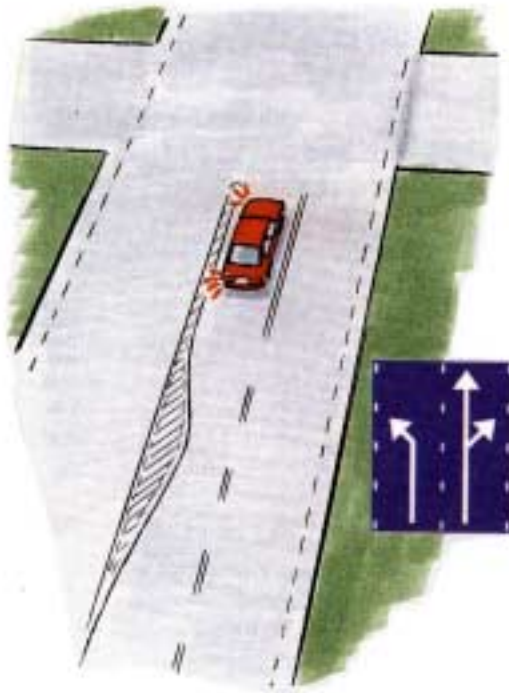
Risk 2
Heavy traffic



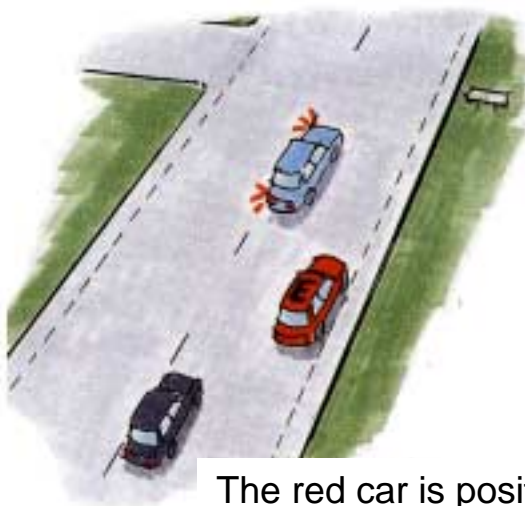
Risk 3
Oncoming traffic



PIC 15.5



PIC 15.6



PIC 15.6

The red car is positioned to the right in order to make the blue car visible as it turns

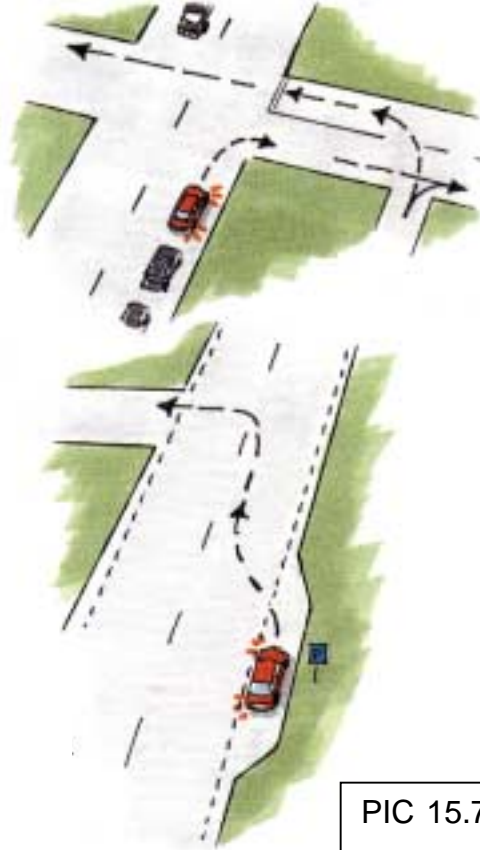
PIC 15.5

Special design to reduce risks when turning left



PIC 15.5

Try to avoid having traffic directly behind you when you turn left

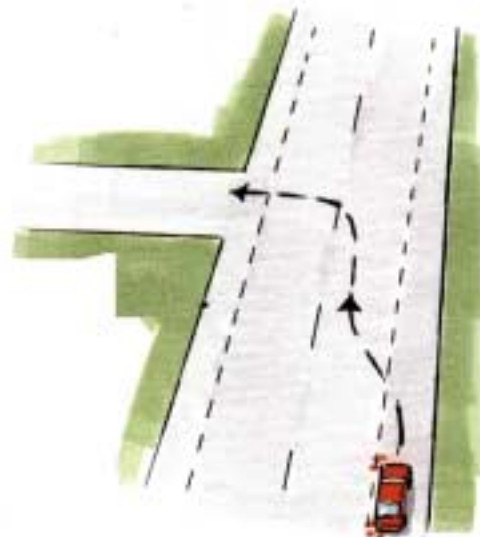


Do not turn left here because of the blocked view



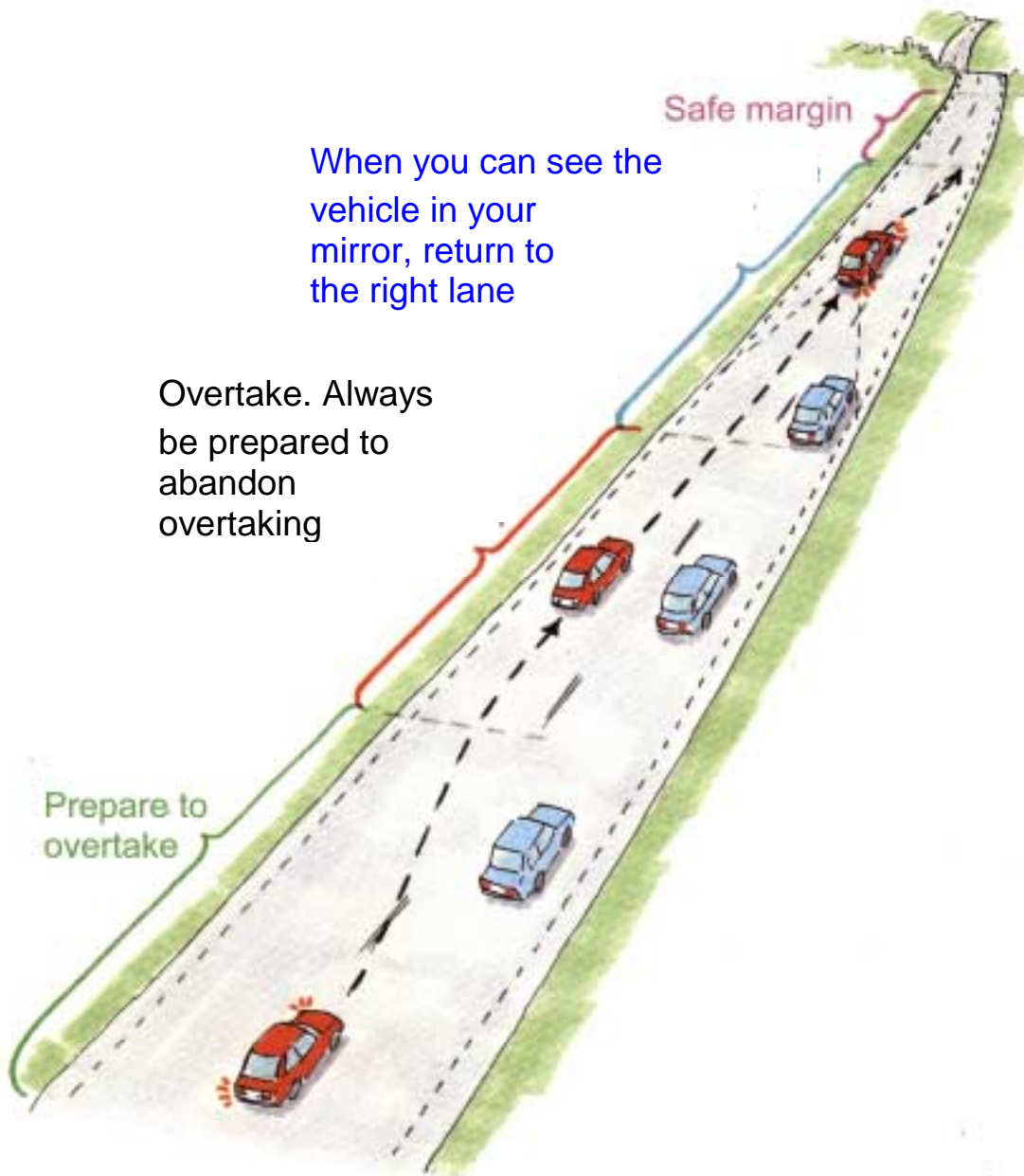
PIC 15.5

PIC 15.7



PIC 15.7

PIC 15.8



EXERCISE 16

Driving on motorways

Objective: The student should be able to enter, exit and drive safely on motorways. The student should also be aware of special rules applying on motorways.

Training area: Motorways

For students with special needs, see Exercise 16, Appendix 1

The student should learn:

- how to enter the motorway. *Explain to the student that other vehicles already on the motorway will more easily detect the vehicle entering the motorway when it signals. Stress speed adjustment, observation of vehicles and blind spots before entering a motorway.* PIC 16.1
- to understand risks when driving on a motorway. *Tiredness due to a relatively inactive way of driving and also the risk of aquaplaning.* PIC 16.2
- to keep the correct distance to the vehicle in front. *Multiple collisions are often related to high speeds and incorrect distance to the vehicle in front. The 3-second rule is useful also on motorways.* PIC 16.3
- to overtake on motorways. *Correct observation before changing lanes and also attention to blind spots.* PIC 16.4
- how to exit motorways. *Explain the exit signs and the risk of speed blindness. In many cases, an off ramp ends in a sharp curve.* PIC 16.5
- how to turn on a motorway. *Use the on and off ramps for safe turning.*
- how to follow route signs. *Instruct the student to follow signs to a destination.*
- the highway code, i.e. prohibition of stopping, parking, etc.



RISKS:



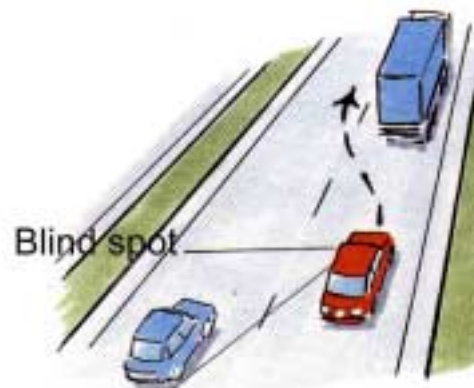
PIC 16.2

Watch out for aquaplaning



Keep a safe distance

PIC 16.3



Blind spot

PIC 16.4

Watch out for sharp curves when you leave the motorway



PIC 16.5

EXERCISE 17

Driving on roads with complex and varying traffic in rural areas (Summary of 15-16)

Objective: The student should independently be able to drive safely on all types of road in rural areas. The student should independently be able to follow route signs to destinations.

Training area: All types of road in rural areas.

The student should learn:

- to drive independently. *The driving instructor should not interfere in the event of minor errors. Offer constructive criticism or comment when the car is parked or when instruction is finished.*
- to drive towards destinations. *Use a road map to show the student the destination.*
- to follow route signs. *Explain the different route signs or road number signs for finding the way to the correct destination.*
- to drive with the correct speed in different situations. *Emphasise how visibility, state of the road and traffic flow influence the judgement of speed.*

EXERCISE 18

Dark driving

Objective: The student should be aware of the special risks involved when driving in the dark. The student should be able to use the headlights correctly in different situations. The student should also be able to park and stop the car safely on a road without street lighting.

Training area: For the demonstration, a long and dark road. Ordinary roads for traffic exercise.

For students with special needs, see Exercise 18, Appendix 1

The student should learn:

- to estimate distances, including stopping distances. PIC 18.1
- the correct use of the headlights when approaching a vehicle in front or when, meeting and overtaking other vehicles. PIC 18.2
- the correct step in an emergency, engine breakdown etc. PIC 18.3
- all about the lighting on the car.

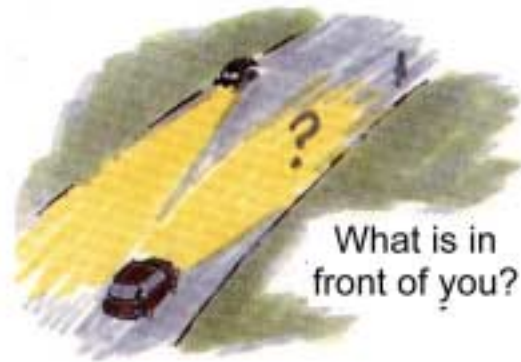
Note: A demonstration is a good method for giving the student an understanding of the distance at which a driver can expect to see a pedestrian with dark clothing, reflectors, etc.

The demonstration should also include:

- the difference between using full beam and dipped beam when meeting other vehicles and when overtaking or being overtaken.
- when to use warning signals.

After the demonstration, practise the above in traffic.

Visibility with dipped beam



Visibility with
main beam



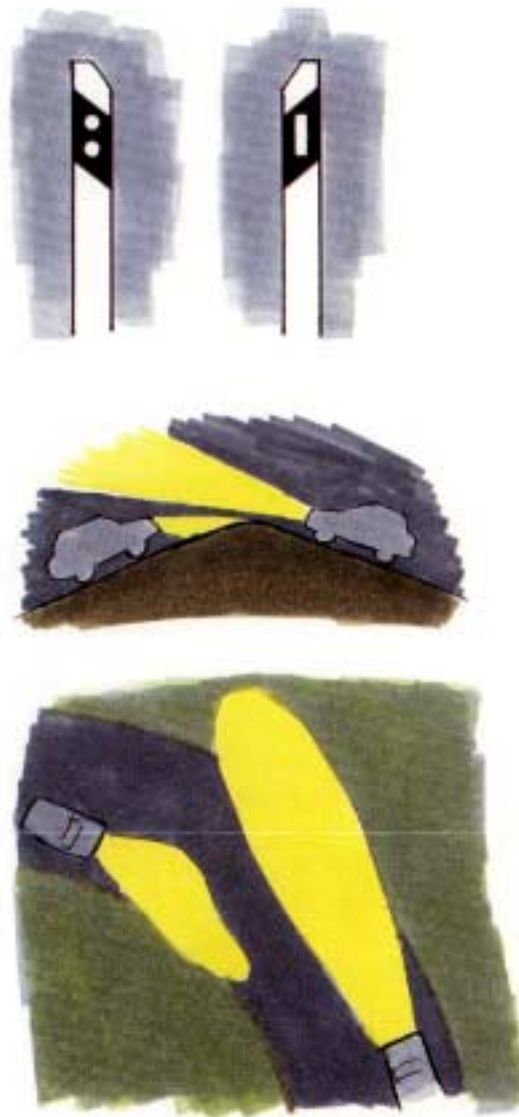
dark
clothing
150m

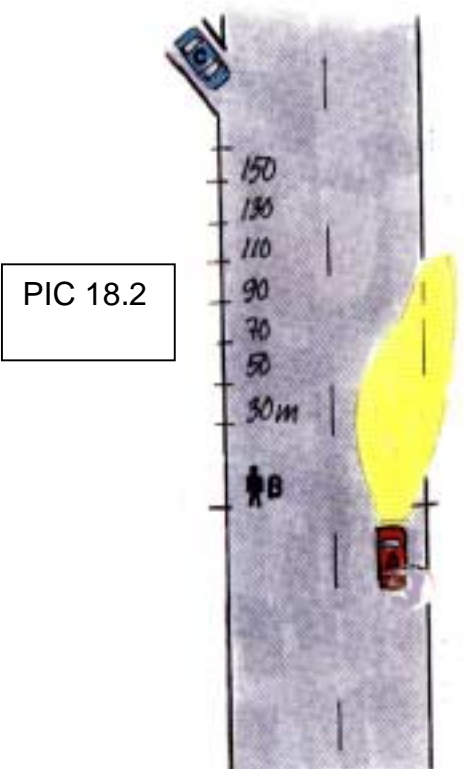
light
clothing
300m

reflector tag
450m

PIC 18.1

PIC 18.2

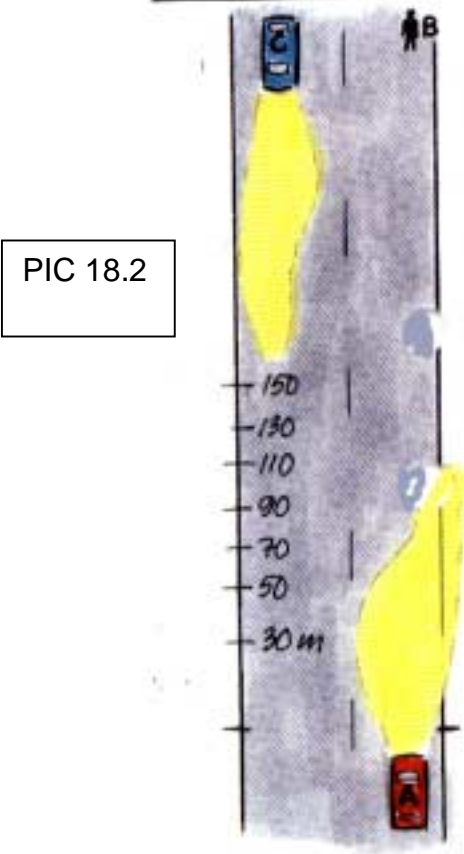




PIC 18.2



PIC 18.2



PIC 18.2



PIC 18.3

EXERCISE 1, Appendix 1, for students with special needs

- The student should learn:
- Seating adjustments:
 - about hazards when opening the door. The student with special needs may require a wider entrance door than normal. This implies making a special check in the rear view mirror before opening the door. PIC 1.1
 - how to find the correct sitting position in the seat and carry out simple routine checks before starting from the kerb. The student who requires a special sitting position should preferably use an electrically powered and widely adjustable seat. The reason for this is to avoid non-crashworthy solutions using extra cushions or other seat modifications with loosely attached devices. However, if medically trained personnel find the use of cushions and other modifications necessary, cushions and other modifications should be firmly attached to the seat. The sitting position should allow comfortable and safe use of the accelerator and brake pedals. In the case of manual gear shifting, this also applies to use of the clutch. The sitting position should also allow comfortable and secure use of the steering wheel. Further details of adapted steering devices are given in Exercise 2, Appendix 1. PIC 1.2
 - the position and correct use of control switches. For the student with special needs, the control switches may have to be relocated in order to be accessible. The use of an IR link system may also fulfil this requirement. The controls should be adapted in collaboration with a medically trained person having adequate knowledge of the student's special needs. *The student should be able to find the control switches without looking at them.*
 - how to use the safety belt correctly. For the student with special needs, the use of the safety belt is crucial. Thus, exemptions from using a safety belt on medical grounds should be avoided. Furthermore, it is necessary to adapt the training car in order to fulfil this requirement, i.e. the student should find the safety belt comfortable when seated. *Explain to the student why the safety belt must be used. The safety belt should not be twisted or damaged. Explain why loose objects can be a hazard when braking.* PIC 1.3
 - how to adjust the rear view mirrors correctly for an optimum view. The student with special needs should preferably be able to adjust the mirrors, either manually or with electrically powered mirrors. If this is not possible, the driving instructor should assist the student. PIC 1.4 Sometimes, the student will need a panorama rear view mirror due to restricted head movements.
 - that even with the rear view mirrors correctly adjusted, there will be blind spots that must be checked before starting from the kerb or changing lanes, etc. Sometimes, the student will need wide angle door mirrors, due to restricted head movements, in order to eliminate blind spots. PIC 1.5

EXERCISE 2, Appendix 1, for students with special needs

- The student should learn:
- how to get ready before starting from the kerb. For the student with special needs, the most commonly used system is the automatic gearbox. The student may need assistance to set the gear lever in the right position. However, it is important for the student to be able to handle this procedure independently. One solution could be an extended lever connected to the security pushbutton in order to facilitate its use. If this is not possible, due to a lack of motor abilities, an electrically powered gearshift might be used. *The correct sequence before starting from the kerb.*
- how to place the hands on the steering wheel and how to steer correctly. The basic requirement for steering is the same for the student with special needs as for any other student. Methods of fulfilling this requirement may vary considerably. For the student who is able to use a steering knob or a specially designed grip, it is important to make sure that this provides control equivalent to full 360-degree movement of the steering wheel. The position of the knob or special grip should be set to minimise the static load on the student's muscular system. This may be done in collaboration with a medically trained person having knowledge of the student's situation. Special attention should be paid to the student's ability to handle the steering wheel when the steering knob or special grip is at its lowest position (i.e. close to the lap). Power assisted steering should be adapted to the student's ability to turn the steering wheel. For a student who is unable to use the described systems, there are more advanced technical solutions for steering (e.g. high power miniature steering wheels, foot steering systems, full hydraulic steering systems and joystick steering systems). Almost any person with a lack of muscular strength can handle steering if the right equipment is available.
- how to observe traffic before starting from the kerb. The student with special needs should preferably be able to adjust the rear view mirrors, either manually or with electrically powered mirrors. If this is not possible, the driving instructor should assist the student. PIC 1.4 Sometimes, the student is in need of a panoramic rear view mirror, due to restricted head movements. PIC 1.5 *Stress the blind spots.*
- how to start smoothly. For the student with special needs, correct adjustment of the seating position is essential. The reason is that when starting from the kerb, the student's body will be pushed backwards, which may interfere with his ability to handle the accelerator, brake, steering or other controls (e.g. indicators). Special attention should be paid to this if the student is using hand controls for these functions and/or foot controls for steering.
- how to drive straight ahead very slowly. For the student with special needs, the steering and accelerator/brake system should be ergonomically designed for comfortable and safe driving. The systems should be evaluated for long periods of driving. Thus, it is essential to verify that the student has the same ability to handle the vehicle at the beginning of the lesson as at the end. *Edging along.*

- how to drive very slowly and steer at the same time. For the student with special needs, see above *Edging along and steering*.
- how to bring the car to a complete stop correctly. *The correct sequence before stopping. Explain precautions to be taken before leaving the car (parking brake).* For the student with special needs who uses an automatic gearbox, use of the parking brake is not necessary since the parking mode of the gearshift has the same function. The student should be able to brake smoothly and apply maximum braking. Furthermore, the instructor should focus on the student's ability to use the braking system throughout the lesson. The instructor should pay attention to the student's ability to use the rear view mirrors and to check blind spots PIC 1.5.

Note: "Edging" describes a driving technique in which the driver controls the speed with the clutch, i.e. drives very slowly. This is very important when the student later practises parking and reversing. For a student driving a car with an automatic gearbox, it is also important to control the car at very slow speeds. PIC 2.1

EXERCISE 3, Appendix 1, for students with special needs

- Changing gear and braking gently

Note: For students with special needs who drive a car with an automatic gearbox, part of the training in gear-changing is of course unnecessary.

- The student should learn:
- the correct sequence when stopping. *Checking the rear view mirrors before braking. Initially, the student should be taught to stop smoothly and later to stop at a given point, such as a road sign. The student should be able to stop smoothly and exactly at the point. This should be practised starting at different speeds.* PIC 3.2. For the student with special needs who uses an automatic gearbox, this picture applies with the exception of use of the clutch. The general instruction in PIC 3.2 is applicable to all types of adapted vehicle manoeuvring system.
- to adjust speed when approaching a junction and accelerate after the junction. *Start practising right-hand turns. After a while, the student can practise turning left and driving straight ahead. A common error is that the student approaches the junction too fast.* PIC 3.3. For students with special needs, PIC 3.3 is applicable with the exception of the text in the yellow boxes.
- To scan correctly when approaching junctions. *Give the student hints where and how to look when approaching the junction, driving through the junction and leaving the junction.* For students with special needs who experience problems with head movements, it is essential for the instructor to be aware of these problems. They can be compensated for in many ways, for example by adding extra mirrors. However, the basic scanning procedure must be clearly defined and practised in this exercise.

EXERCISE 4, Appendix 1, for students with special needs

Starting from the kerb using the brake pedal. For students with special needs who use an automatic gearshift, the technique is described below.

The student should learn:

- to shift gear mode from park to drive while keeping the car in a fixed position.
- how to quickly reduce brake pedal pressure and adjust the accelerator in order to keep the car still.
- to observe other traffic before starting from the kerb.

EXERCISE 5, Appendix 1, for students with special needs

Reversing.

The student should learn:

- to sit correctly while reversing. For students with special needs, aids to compensate for limitations of head and abdomen movement are available. Extra rear view mirrors and panorama mirrors can help in obtaining the best possible rear view.
- how to reverse in a straight line. *Explain the problems in detecting small objects behind the car.* PIC 5.1 For students with special needs, reversing aids such as warning signals and TV monitors are useful.
- how to control steering and reversing at the same time. *Explain turning point.* PIC 5.2 For students with special needs, the steering device should be easy to handle and comfortable to use even when driving for long periods. The steering device should allow the user to remain seated in an optimal position even during this exercise.
- reversing in a straight line after turning.

This exercise may set extreme demands on the skeletal/muscular system of the student with special needs. Thus, it should not be carried out if the student feels uncomfortable. It may be beneficial to practise this exercise in several relatively short sessions.

EXERCISE 7, Appendix 1, for students with special needs

For students with special needs, accelerating and braking should be performed independently of the sitting position. Subsequently, the sitting position should not be affected by accelerating and braking.

The student should learn:

- how to use the power of the engine when accelerating
- how to brake hard from different speeds e.g. 50 km/h, 70 km/h, 90 km/h. *Simulate a situation in which the student has to brake very hard. Practise on different road surfaces and, if the car is equipped with ABS, remove the fuse to disconnect the ABS system. Measure the stopping distance with “foot/hand on brake” and without “foot/hand on brake”. PIC 7.1.*

For the student with special needs, it is essential that the force required for hard braking (e.g. with the brake pedal or a manual braking system) does not exceed the maximum physical strength of the student.

- The “thinking distance” (shown in PIC 7.1) may be prolonged due to sub-optimal solutions for the student in changing from acceleration to braking. If the student finds it difficult to transfer his foot from the accelerator to the brake pedal or to change the hand control from the accelerating position to the braking position due to inadequate technical solutions, this may be revealed within the “thinking distance” of this exercise. The driving instructor should be aware of this type of problem in the case of students with special needs.
- The braking system should not be designed so that the student has to use his maximum reach to perform hard braking. If the student experiences problems due to poor design of the braking system, this may be revealed within the “braking distance” (PIC 7.1). The driving instructor should be aware of this type of problem in the case of students with special needs.

EXERCISE 8, Appendix 1, for students with special needs

- For the student with special needs, this is the first main exercise in which he has to handle the vehicle in more demanding traffic situations. If problems are experienced in driving straight ahead or turning at junctions, this may be due to a non-optimal solution of the steering system for the particular student. The restraint within the powered assisted steering system could be either too hard or too soft. Both problems will be indicated by difficulties in keeping the vehicle within the lane.
- If the student cannot maintain his sitting position during this exercise, the instructor should be observant and suggest use of a postural support or supplementary seat belt system. However, such a solution should be tested and used in collaboration with medically trained personnel having knowledge of the particular student's situation.

EXERCISE 9, Appendix 1, for students with special needs

Students with special needs who are unable to perform the simple routine checks mentioned in this exercise should have adequate knowledge of these activities on a theoretical level. Once the student becomes a licensed driver, he will be responsible for making such checks. The instructor should make this clear for the student with special needs.

The student with special needs should be able to handle the control functions and switches required for safe driving without help from the driving instructor.

EXERCISE 10, Appendix 1, for students with special needs

Since this exercise is conducted at high speeds, relatively pronounced g-forces will be experienced by the student with special needs. Therefore, the following will be highlighted even further than in Exercise 8.

- For the student with special needs, this is the first main exercise in which he has to handle the vehicle in more demanding traffic situations. If problems are experienced in driving straight ahead or turning at junctions, this may be due to a non-optimal solution of the steering system for the particular student. The restraint within the powered assisted steering system could be either too hard or too soft. Both problems will be exposed by difficulties in keeping the vehicle within the lane.
- If the student cannot maintain his sitting position during this exercise, the instructor should be observant and suggest the use of a postural support or supplementary seat belt system. However, such a solution should be tested and used in collaboration with medically trained personnel having knowledge of the particular student's situation.

EXERCISE 13, Appendix 1, for students with special needs

For students with special needs, turning and parking in traffic may be further complicated if head and upper torso movements are restricted. Sometimes, the driving instructor will need to recommend a student with special needs to use rear view mirrors, although direct viewing is preferable. The driving instructor must make the student aware that there should be no blind spots before performing turning and parking manoeuvres.

Certain students with special needs require extra large parking bays, which are indicated by special signs that the student should learn to recognise. Special permits are required in order to use these bays. The driving instructor should inform the student about the procedure for obtaining a permit.

EXERCISE 16, Appendix 1, for students with special needs

For students with special needs, emergency telephones are usually not accessible under normal conditions. Furthermore, it is not advisable for safety reasons that persons with special needs should leave their vehicles in an emergency in order to find a telephone. A better solution is to use a mobile telephone or special designed sign to attract the attention of other road users.

EXERCISE 18, Appendix 1, for students with special needs

Students with special needs must be able to operate headlight and dipped beam switches simple, comfortably and with no effect on driving.

Introduction to Appendix 1

Common and general aspects: attitudes to and treatment of the learner driver with physical disabilities

The target group of interest in this text consists of learner drivers with physical disabilities but no additional disabilities. The text is aimed at driving instructors who will be working with the specified target group. This introduction deals with common and general aspects of training and education of learner drivers with disabilities.

The following list of recommendations is general in the sense that it applies to all exercises and at all times during the driving education process. It does not specifically apply to any special type of adaptation of the car. *Rather, it is an attempt to visualise the tacit knowledge created through long experience of learner drivers with various disabilities, or in other words to render implicit knowledge explicit.* Thus, most of the text in this section of the manual is formulated in more general terms using generic concepts. The reader is expected to use this material as a framework for all driving education with disabled learner drivers. Expert knowledge is often associated with tacit or silent knowledge. Tacit knowledge is by nature imprecise. Consequently, it is often very difficult to give exact answers to potential problems. One method of developing expertise is to solve a large number of problems, although this may take a very long time. Theory learning does not really offer an acceptable alternative to “hands on” experience. Two alternative methods of obtaining expertise can be applied; one consists of providing numerous examples and the other of providing effective tools that facilitate the process of building up expertise. Here, the latter approach has been chosen. Such tools should support the driving instructor not only in gaining expertise but also in providing a platform for developing a specific education profile taking into account the national context, available educational resources (staff, vehicles and training premises), personal knowledge, and preferences. It should also conform with the specific educational situation of the individual learner driver. This means that there are numerous additional aspects that have to be considered apart from those mentioned here. Specific medical, ergonomic, technical, legal and financial conditions should also be considered.

Skill/Insight. A useful pedagogical approach might be to make a distinction between *skill* and *insight*. *Skill* is achieved by the driver while learning how to handle and control the vehicle in every situation specified by the exercises. The aim is to make the learner driver confident with the vehicle, its possibilities and limitations. *Insight* means that the learner driver can intellectually understand and apply the knowledge that he/she is part of a social interaction requiring compliance with certain rules and regulations, in other words, knowledge of how to interact with other road users. Skill achievements should contribute to insight and vice versa. Skill and insight interact in a loop (see). Normally, the process starts with utilising insight before a skill training segment is executed. After an exercise, the learner driver should have gained insight into what has been achieved. The interaction between skill and insight should be considered for all driver education, especially in the case of learner drivers with disabilities.



Figure 1 Interaction between skill and insight

Learner drivers with physical disabilities may differ from other learner drivers in the sense that they may occasionally need more education devoted to skill training. However, this does not mean that insight becomes less important. Educational efforts designed to improve insight may also be different for those with disabilities, who may have to accept a different, more cautious driving style. However, the concepts of skill and insight should be considered as two important tools for the driving instructor in planning and evaluating education efforts.

Driving education activities. Driving education can be said to consist of four equally important and complementary *activities*: providing theoretical rationale, demonstration, practical training with instructions and feedback, and independent training (see Figure 2). Together, they constitute what is understood as education. Providing a theoretical rationale means that the instructor states a reason for the exercise. Demonstration implies that the instructor shows how to perform a task before the learner driver is given the chance to perform it. The next step is for the instructor to actively control and supervise how the learner driver executes the task. Finally, the learner driver performs the task independently in order to gain experience. All four activities should be used in compiling individual exercises and aim at providing the learner driver with both skill and insight. This is also reflected in the driving education logbook that will be described later on. The allocation of educational efforts over the four activities described above is likely to be different when working with people with physical disabilities. It is important to cover every activity and in particular to provide a theoretical rationale for the exercise. In order for the instructor to be able to use the proposed activities, he must be able to drive the adapted car himself (more about this later). However, using the distinction between the described activities provides the driving instructor with excellent tools for planning and evaluating education with respect to the goal of providing both insight and skill.

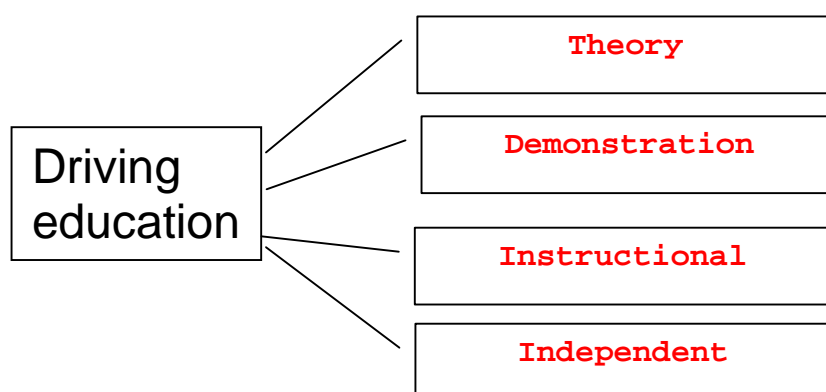


Figure 2 Activities used to provide driving education

Driving education pedagogics. Since the pupils are grown-up, usually over 18 years of age, the driving instructor will be working with adults and appropriate pedagogics should be adopted. The learner driver will possess prior experience that can be utilised by the instructor. To some extent, the instructor and his/her pupil can be said to be on the same level, not of course with respect to driving, but intellectually and with respect to life experience. This means that driving education can be performed more in the form of a dialogue and that insight can provide a starting point for achieving skill. In contrast, the education of children is often performed in the reverse order, with skill providing the key to insight. However, for all learner categories, it is important to utilise as many human skills/abilities as possible for effective education. The more the senses that are involved in the learning process, the more sustainable will be the knowledge. Since driving education is given to adult learners, work can be made more problem-oriented. This in turn creates better opportunities for giving the pupil greater influence over his education. Such an approach could also be applied in order to assign more responsibility to the learner driver himself, which could be of great importance for those with disabilities. Many such drivers have suffered very negative experiences in life, which could have had a devastating influence on their self-confidence. Problem-oriented learning may provide a way of re-establishing the pupil's confidence and could also be important for traffic safety as it would contribute to better insight. A specific pedagogic method has been developed called *problem-based learning* (PBL). PBL has gained considerable interest and has proved effective in several contexts. It is rapidly becoming more and more widespread, especially in higher education. This approach basically means that the pupil learns from solving a specific (explicit) problem and takes an active part in the learning process. Using PBL would provide a way of implementing the above suggestions.

What, Why, How? One way of planning the education and exercises, and of choosing the methodology to apply, is to introduce the questions **What, Why** and **How?**

What? – What is the planned content of the exercise? This planning should be done in collaboration with the individual learner driver.

Why? – Why should this exercise be conducted? What is the goal? Both the learner driver and the instructor should be clear about this.

How? – How should the exercise be performed? What method should a driving instructor use in order to best help the learner driver achieve the insight and skill agreed upon.

It is important for the exercises to be well planned and introduced with the structure proposed above. The reason is that otherwise it is very easy for the exercises to be planned only on the basis of **How?** while leaving out **Why?** This will have implications regarding the motivation of both the learner and the instructor.

Approve/disapprove. Before the education begins, the instructor should consider two concepts: *approve* and *disapprove*, which will have a significant influence on execution of the education. We would like to advocate what is known as the Nordic approach to disabled persons' right to mobility. In simple terms, this could be formulated as "every citizen's equal right to mobility". This has been transformed into a social responsibility to provide resources (e.g. financial) for ensuring the mobility of disabled persons. In Sweden, the approach has been implemented as an appointed overall responsibility for the Swedish National Road Administration (SNRA) to ensure that elderly and disabled persons have access to every mode of transport. However, a clear decision must be made in driving instruction as to whether the *primary goal is mobility or traffic safety – under the assumption that the goals may be incompatible*. Before the education starts, the instructor should come to a common agreement with the appropriate medical, ergonomic, technical, psychological, legal and financial personnel concerning the goal for the specific learner driver. Naturally, the overall goal should be to improve his mobility, hopefully through an approved driving license test. However, mobility can also be achieved by other means, such as alternative modes of transportation. These may have to be considered if the learner driver is unsuccessful in the driving test. As mentioned above, mobility goals could endanger/compromise traffic safety goals, both for the disabled person and also for other road users. What is meant here is that sooner or later the driving instructor will have to face a situation in which he has to make a decision on whether a specific learner driver has the capability to drive safely or if the education should be aborted. The problem can be visualised as in Table 1. The aim should of course be a perfect selection procedure with no drivers being missed out or incorrectly licensed.

Table 1 Possible outcome of driver licensing procedure

	Licensed	Not licensed
<i>Capability of safe driving performance</i>	Correctly licensed drivers	Missed but capable drivers
<i>No capability of safe driving performance</i>	Incorrectly licensed drivers	Correctly rejected incapable drivers

The above table could also be discussed using the two terms *sensitivity* and *specificity*. *High sensitivity* implies that we have a test or selection instrument that will license as many as possible who may be able to drive safely. This has the advantage that the risk of missing a capable driver is low, but on the other hand the risk of letting non-capable drivers pass the test and obtain a license is increased. *High specificity* means that we can effectively distinguish those not capable of driving from the risk of increasing the number of missed but capable drivers. A perfect selection would mean no missed or incorrectly licensed drivers. One major problem here is that we have

never been able to specify more precisely what safe driving performance is. In the case of drivers with disabilities, there may very well be a difference compared to other drivers, possibly because a driver with disabilities would use more of his resources in order to achieve the safety goals, even if the car is adapted. Such drivers are more often closer to their limit of their resources. Even if it is not possible to achieve a perfect selection tool, the aim should be to simultaneously have a high sensitivity and specificity. This discussion was aimed at making this selection mechanism visible and explicit so that the individual driving instructor can formulate his opinion on how to assign priority. Also, it could form a basis for a discussion at the Institute on how to formulate a common position in this question. It might very well be that the national goals do not coincide with the individual instructor or institute; if so, it should be considered.

If the driving instructor is able to distinguish correctly those who should be rejected, he should nevertheless consider his responsibility to inform the learner driver of his rights and possibilities to achieve mobility by other means. This should be done in co-operation with medical staff.

Personal integrity. Driving instructors for learner drivers with disabilities are likely to find themselves in situations where they have to face intimate and perhaps unfamiliar and embarrassing situations requiring physical contact with their pupils. There are situations where the instructor will have to help the learner driver, for example to adjust the seating position, put on the safety belt, or lean over the driver's seat to make various adjustments. In other words, the instructor will have to assist the disabled pupil through instructions on how to adjust his position in the in-car environment. It is very important that the driving instructor always lets the learner driver have the initiative. The learner driver must always give his consent before the instructor provides any assistance. There is a need for mutual understanding of the assistance needed. It may be necessary for the instructor to lift the bottom of the pupil in order to correct the seating position or to come into contact with the pupil's breasts while adjusting the safety belt. This can be embarrassing for both.

In summary, the instructor should make it clear that he is always available for help/assistance but should leave the initiative to the learner driver. Make an agreement on what assistance is needed – remember **What?, Why?, How?** to help. **If the instructor is unsure, he should ask before doing anything!** The instructor should establish clear communication and an open atmosphere in order to avoid problems.

Method in driving education

Entry/Exit. In the early phases of the education, it is preferable to get into the car as soon as possible. Do not spend too much effort initially on entering and exiting the car. It is better to spend the available resources and attention on driving. Getting in and out of the car is a problem that can be solved later on, if such a problem exists. Help the learner driver to get in and out if necessary, even if the ultimate goal is that he should be able to do this independently. If too much effort is spent on entering the car, the learner driver may associate driving with manual transfer problems. This is not good practice.

Safety margin. Driving education for disabled persons is basically the same as for the rest of the population, regardless of the adaptations made in the car. What may be different is that a person with disabilities has to be educated (in terms of insight and skill) in handling specific adaptations connected with his abilities/disabilities e.g. mainly technical handling skill and insight. This training will eventually lead to a insight into what are appropriate safety margins, taking into account the performance resources of the learner driver and interaction with other road users and the environment. This training is not concentrated to the initial phases of driving education but should be distributed over the entire programme and associated with the different exercises. When sufficient skill in handling the adaptation has been acquired, education should proceed as for other drivers without disabilities. The goal is to achieve what could be perceived as adaptation transparency. Information about this can be found in Appendix 1. References to specific sections of Appendix 1 can be found in the basic exercise instructions in the driving instructor's manual.

Repetition/Variation. If the learner driver requires a large amount of repetition for a specific exercise, it is important to introduce some kind of variation with respect to execution and the traffic environment. This could be done for example by selecting a different context for the same exercise. Problems of this type are likely to occur more frequently among persons with disabilities. As an alternative, it might be possible to change exercise, but the driving instructor should give a reason for the change. Further information about this can be found in the accompanying educational logbook. It is often good practice to change between different exercises, preferably exercises that have some common feature. It may be so that both the instructor and the pupil feel they have come to a dead end, but hopefully this will turn out to be only a temporary obstacle. The cause may be temporary poor health, which is likely to occur among this category of learner drivers. It is an expert skill to know how to apply the "right" mix of repetition and variation in the education. The way this is done will vary between different categories of learner drivers with disabilities. However, the instructor should not be afraid to try out different mixes in order to develop this educational skill.

Documentation – driving education logbook. An unconditional requirement for successful driving education is that the instructor keeps a record of how the education is progressing. The instructor should do this by using a well-structured logbook. A suggestion for the layout of such a logbook is enclosed in Appendix 2 The logbook should contain personal information about the learner driver: date of birth, a description of the disability, date of assessment, assessment outcome, type of adaptation needed in the car. The instructor will keep a record of what activities (e.g. theory, demonstration, instruction, independent training) were performed during the

exercises, the outcome and any problems encountered. It is very important for the instructor to be careful in logging accurate data for the education as it may be necessary to change instructor in an unforeseen situation. Also, the logbook records may be of vital importance if the education has to be aborted. In such a case, the logbook can be used to support a decision that a learner driver will not be able to achieve the required driving performance. Yet another important use of the logbook will be to evaluate and further develop the educational methods. Finally, the logbook could be used as a source for applied research into various disabilities and their relation to length of education, allocation of exercises, types of problems encountered, vehicle adaptations, etc. Thus, the message is that a well-kept logbook is a powerful and essential tool for the instructor.

Human machine interaction (HMI) problems – adaptation

Driver/Adaptation deficiencies. It is important for the driving instructor to be able to identify precisely the sources of insufficient driving performance. These may be the result of a lack of training (skill and/or insight), or a lack of human abilities due to the learner driver's impairment, or inappropriate/insufficient adaptation. The instructor in collaboration with colleagues as well as medical and technical expertise will perform this type of analysis. The following scheme could be used.

Table 2 Scheme for specifying who to consult to discover sources of insufficient performance.

Type of problem	Consult with
Insufficient performance due to educational problems	Colleagues (internal and/or external)
Insufficient performance due to impairment or disability	Medical expertise (external)
Insufficient performance due to shortcomings in adaptation	Technical expertise (external)

Here, too, it is obvious that a well kept (complete and extensive) logbook can be a key source for accurate identification of the true sources of performance deficiencies. One reason is that external experts depend on the logbook to analyse the problem and propose solutions.

Adaptation knowledge. The driving instructor should possess sufficiently deep knowledge (insight and skill) of how various adaptations work. He should be able to drive the car with the aid of the adaptation. The reason is that it may be necessary for the instructor to give a practical demonstration of how the adaptation works. Situations may also occur where the instructor has to explain driving performance deficiencies as a result of inappropriate handling of the adaptation. Furthermore, in depth knowledge can be a good help when the instructor has to distinguish between technical and medical sources of impaired driving performance. This has to be considered when compiling an educational time schedule for an individual learner driver.

Health and disabilities

Three different approaches are used in Appendix 1 regarding the issue of disabilities/diagnoses and vehicle adaptations. The approaches can be described as follows:

Table 3 Approaches to vehicle adaptations using either diagnosis or disability specification as a starting point

Starting point	Related to	With reference to
Function/dysfunction of trunk and extremities	Diagnosis/sub- diagnosis	Vehicle adaptations in a general approach
Function/dysfunction of trunk and extremities	Vehicle adaptation that may be necessary or helpful for the driver with disabilities	
A selection of frequent diagnoses	Important issues for assessment of educational needs and needs for adaptation	Vehicle adaptation that may be necessary or helpful for the driver with disabilities

In the latter part of Appendix 1 (Disabilities and Vehicle adaptation) the disability classification “No function/Reduced function” is used. This terminology is used intentionally to limit the content and complexity of the tables. However, a disability can usually be described in much more precise terms. Thus, the following additional information may be useful when working as a driving instructor for persons with disabilities:

Involuntary movements – Due to impairments of the central nervous system (i.e. not the muscular system) the learner driver with disabilities may execute unintentional and uncontrollable movements. These movements may be of a more constant recurring vermicular type (athetosis) or of a fragmented or incomplete type (ataxia). The involuntary movements may be triggered by tactile sensations, audio sensations (fluctuating or unexpected sudden noises) or even visual sensations. It is important for the instructor to be aware of these types of problem. The instructor should consult medically trained personnel who are familiar with the learner driver in order to extend his knowledge both generally and in the individual case.

Spasticity – hypertonus of the muscular system. The reason for this is that the agonist/flexor (i.e. the muscle that bends the joint) and the antagonist/tensor (i.e. the muscle that stretches the joint) do not collaborate. Instead, they both function with hypertonus (i.e. using full strength more or less all the time). This means that most of the joints in the body will be permanently bent since the flexor muscles are in general more powerful than the tensors. The spasticity is caused by a malfunction in the central nervous system and not within the muscular system. If you intend to help a learner driver who suffers from spasticity to stretch a joint you can – in collaboration with the learner driver – assist the stretching process by *very slowly* and carefully adding sufficient force to the muscles that stretch the joint. If you do not do this slowly and carefully enough, there is a possibility that the assistance will trigger the bending musculature to become even tenser. The instructor should address medically trained

personnel familiar with the learner driver in order to extend his knowledge both in general and in the specific case.

Tremor - involuntary trembling or quivering. Tremor usually does not limit the mobility of the body. However, problems may occur when precise movements are required. The instructor should consult medically trained personnel familiar with the learner driver to extend his knowledge both in general and in the individual case.

Progressive conditions – Some of the disabilities described in the latter part of Appendix 1 (Disabilities and Vehicle adaptation) are progressive. The progression may be of a constant but slowly degenerating type (as is the case of muscular dystrophy). The progression may also occur as a sharp decline over a short period of time, after which it may be fairly stable. It may then be followed by another sharp deterioration (as in the case of rheumatism and MS). It is important to be aware of this when assessing the learner driver's performance in the short term as well as the long term. Questions to be answered in the short-term perspective might include the following: What was today's performance like compared with yesterday's? Does the progression in the disability explain why the learner driver did better yesterday than today? Questions to be answered in the long-term perspective might include the following: Why can't the learner driver perform as well as he used to during the first exercises in the programme? Will the person with a disability still be able to drive the vehicle in a year's time with the adaptations he uses at present? Will the progression in the disease call for a completely new steering system in two years time? The instructor should consult medically trained staff familiar with the learner driver in order to extend his knowledge both in general and in the individual case.

Stress – Stress always affects the general condition of a person. Usually, this is reflected in the tonus of the muscular system. If the disability of a person is related to the muscular system (e.g. muscular dystrophy) then stress will amplify the outcome of the disability. Spasticity and involuntary movements will be triggered and become more frequent. Nothing will be gained by trying to speed up activities for persons with such disabilities. On the contrary, stress will make it more difficult or even impossible to execute movements that can be performed otherwise. The instructor should address medically trained personnel familiar with the learner driver in order to extend his knowledge both generally and in the individual case.

Comfort/Discomfort – Every type of long-term exposure to a certain activity generates some form of discomfort. One example is the sitting posture of the learner driver with disabilities. If he does not have the possibility to adjust his sitting posture regularly, due to the disability or to insufficient adaptation, the driving instructor should offer assistance to resolve the problem or limit the duration of the exposure, preferably both. Rescheduling the lesson could provide a way of addressing the latter problem. Comfort/discomfort aspects relate not only to performance problems but also to health status. Health may be at risk unless problems of extended discomfort are taken seriously. For example, a person who is lacking tactile sensations in the lower parts of the abdomen may be exposed to sufficient focal pressures to cause sores without being aware of this. Another example of a comfort/discomfort related problem is found when the driver experiences an excessive level of discomfort which may cause him to limit his driving and avoid long-distance journeys. There are guidelines for acceptable levels of required forces on primary controls that could be

applied in order to satisfy comfort/discomfort requirements. Yet another problem can be related to loading/unloading of wheelchairs. For instance, a paraplegic driver will be able to get in and out of the car, moving to and from the wheelchair. The driver has to load the wheelchair while seated in the car. This is often done by disassembling the wheelchair, after which the driver lifts the parts over to the passenger seat. This can be very laborious and result in upper limb problems. The instructor should also consult medical experts in order to find a solution that provides the driver with an acceptable level of comfort/discomfort. Physiotherapists should be able to provide substantial help in these matters.

Termination of the programme

If you find that the learner driver is not making sufficient progress in driving education, regardless of your efforts as a driving instructor, sooner or later you will face the prospect of terminating the programme. One way of reasoning in this respect and deciding the methodology to apply is to introduce the questions **What?**, **Why?**, and **How?**

What? - Before reaching a point when a decision on termination has to be taken, the driving instructor should have considered the previous sections of this chapter (1-4, “Common and general aspects: attitudes to and treatment of the learner driver with physical disabilities, Method of driving education, Human machine interaction (HMI) problems – adaptation, and Health and disabilities”). The educational logbook is then of major importance for being able to make a decision on whether to terminate the programme or not.

Why? - As a driving instructor, you find that the learner driver is not making any progress. He has reached a plateau, although the problems have been analysed using the schedule in Table 2.

Table 2 Scheme for specifying who to consult in order to discover the source of insufficient performance.

Type of problem	Consult with
Insufficient performance due to educational problems	Colleagues (internal and/or external)
Insufficient performance due to impairment or disability	Medical expertise (external)
Insufficient performance due to shortcomings in adaptation	Technical expertise (external)

Termination may be necessary due to the progression of the disability affecting the learner driver. Furthermore, the technical solutions are not insufficient to compensate for the disability, due to non-availability, or legal or financial restrictions. However, it is equally important to stress that educational problems should not be the reason for termination unless alternative driving pedagogics, methods or driving instructors have been tried.

How? – A decision on termination should not be made by a single driving instructor. The decision should be made in collaboration with the learner driver, colleagues and medically trained personnel. The learner driver should be aware of the circumstances

under which he has been advised to terminate the programme. These circumstances should be noted in the logbook and signed by the learner driver as well as the driving instructor. This means that the learner driver whose education has been terminated has full insight into the reasons for this decision. However, using the logbook for this purpose does not mean that the learner driver has to agree with these reasons. He is signing simply to document the fact that he has been informed of the arguments and has understood them.

As previously stressed, the driving instructor has an obligation to inform the learner driver on how to find an optimal solution to his transport needs. This implies that the driving instructor should have knowledge of different types of useful and accessible transport systems within the community. The instructor should also consult medical experts familiar with the learner driver to help find the most appropriate solution for the particular individual.

Disabilities and Vehicle adaptation.

Three different approaches are used in Appendix 1 concerning the issue of disabilities/diagnoses and vehicle adaptations. The approaches are described below:

Approaches to vehicle adaptations using either a diagnosis or disability specification as a starting point

Starting point	Related to	With reference to
Function/dysfunction of trunk and extremities	Diagnosis/sub-diagnosis	Vehicle adaptations using a general approach
Function/dysfunction of trunk and extremities	Vehicle adaptation that may be necessary or helpful for the driver with disabilities	
A selection of frequent diagnoses	Important issues for assessment of educational and adaptation needs	Vehicle adaptation that may be necessary or helpful for the driver with disabilities

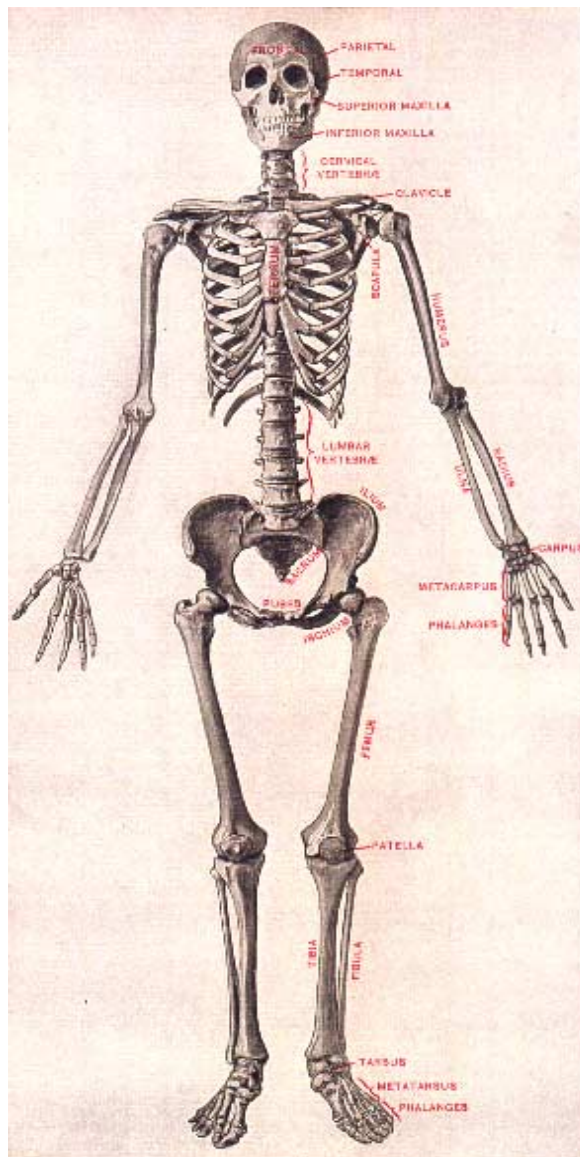
The impairment causing the disability may vary. The impairment may consist of any form of malfunction of the brain and the central nervous system, the peripheral nervous system, the muscular system and the skeletal system.

In this presentation, the motor functions of the described limbs are classified as either reduced (reduced function) or non-existent (no function). However, in most cases, the demands on vehicle adaptation will be the same for the same kind of disability, disregarding the level of function.

Disabilities in the lower extremities: the lower extremities consist of six joints. The joints are sturdier the more proximally they are located, i.e. the more peripheral the joints, the finer they are. Three major bones and the complex skeletal structure of the foot form the basic structure of the lower extremities. The structure is shown in PIC, App 1.

The function of the extremities is dependent on the muscular system. The operation of the muscular system is dependent on a fully functioning nervous system, both for activation of the muscles and for sensation (feedback) by the muscular system.

This means that reduced function or a total loss of function in one or both of the lower extremities may be caused by an impairment in the nervous system, the muscular system or the skeletal system.

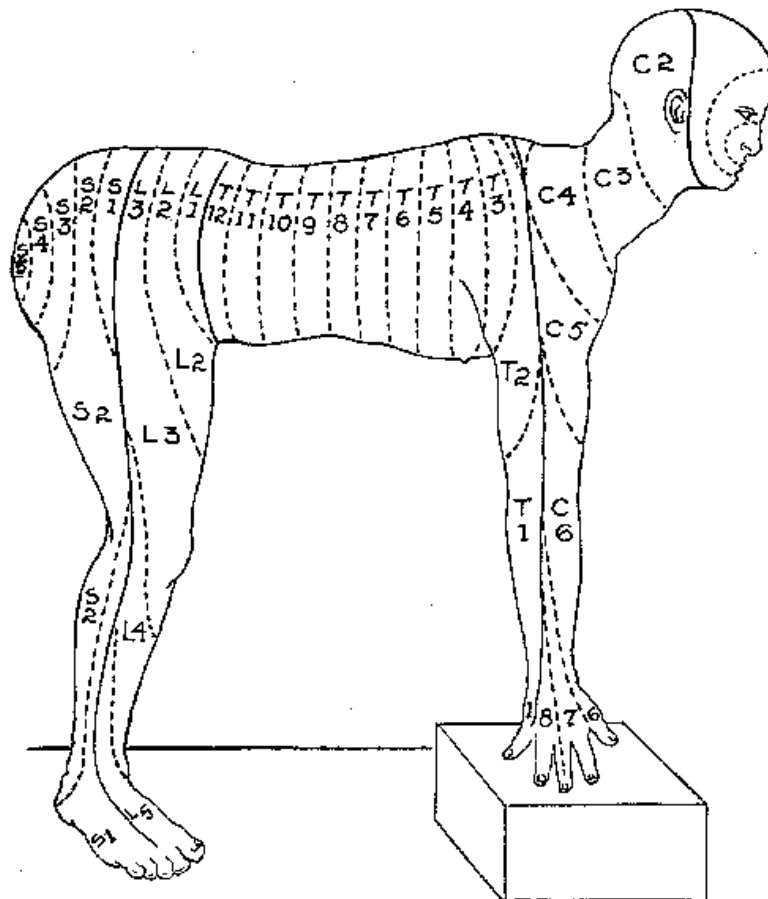


PIC App 1. The human skeletal system.

The most common impairments of the nervous system for the lower extremities are the following: (Note that these are only examples)

- Cerebral palsy (CP). The impairment is situated in the brain. The nervous system operates either abnormally or not at all. When the legs are affected by CP, the terminology used is diplegia (when both legs are affected), hemiplegia (when one leg and one arm, i.e. one side of the body, is affected) and tetraplegia (when all four extremities are affected). Postural dysfunction is common.
- Myelomeningocele (MMC) or Spina bifida. The nervous system is interrupted partly or wholly by a hernia as it passes through the spinal cord. The lower the hernia is situated on the spinal cord, the better is the function of the lower extremities. A total interruption affects the functions more severely than a partial interruption. The correlation between the different segments of the spinal cord and

the function of the motor system is shown in *PIC App 2*. MMC is usually located where the thoracic and lumbar parts of the spine meet. Postural dysfunction is common.



PIC App 2: Dermatomal map (Derma = skin, tom = cut) showing the distribution of sensor-motor nerves (S = sacral, L = lumbar, T = thoracic, C = cervical)

- Traumatic spinal cord injuries (SCI). What applies to MMC also applies to SCI. Two groups of SCI can be distinguished: paraplegia (lower limb paresis) and quadriplegia (upper and lower limb paresis). If a lesion is located below the fourth cervical vertebra (C4), there are good prospects of the SCI patient being able to drive a car with suitable adaptation. Postural dysfunction is common.
- Multiple Sclerosis (MS) – sclerosis occurring in sporadic patches throughout the brain and the spinal cord. The nerve impulses are disturbed. Postural dysfunction is common.
- Polyneuropathy. Primarily affects the peripheral parts of the nervous system, e.g. the feet.

- Poliomyelitis (polio). The nerves emerging from the spinal cord to transmit signals to the muscles do not function. The reason is a viral inflammation of the grey substance of the spinal cord. The virus may attack the spinal cord at any point, but most commonly in the cervical or lumbar region. *PIC App 2*. Postural dysfunction is common.
- Spinal muscular atrophy (SMA). The nerves emerging from the spinal cord to transmit signals to the muscles do not function. This is due to hereditary causes. Postural dysfunction is common.

The most common impairments of the muscular and skeletal systems of the lower extremities are the following: (Note that these are only examples)

- Muscular dystrophy (several types exist, all characterised by muscular atrophy). Some are more severe than others, i.e. some patients suffering from muscle dystrophy can walk, while others cannot. Postural dysfunction is common.
- Myasthenia gravis. Malfunction in the transmission of signals from the nerves to the muscles. The muscles are prevented from performing repeated actions.
- Arthritis. The joints are inflamed and thereby malfunction.
- Arthrosis. The joints malfunction due to other changes in the cartilage in the joints.
- Chondromalasy. Shortness of stature due to congenital disease.
- Osteogenesis imperfecta – extreme fragility of the bones. Congenital disease. The person is always short in stature.
- Anomalies such as missing part of the limb or the whole limb.
- Amputation of part of the limb or the whole limb.

Disabilities in the upper extremities: the upper extremities consist of six joints. The joints are more sturdy the more proximal they are located, i.e. the more peripheral the more fine joints are found. Three major bones and the complex skeletal structure of the hand forms the basic structure of the upper extremities. The structure is shown in *PIC, App 1*.

The most common impairments of the nervous system for the upper extremities are (please note that these are just examples)

- Cerebral palsy (CP). The impairment is situated in the brain. The nervous system operates either abnormally or not at all. When the arms are affected by CP, the terminology used is hemiplegia (affecting one leg and one arm, i.e. one side of the body) and tetraplegia (affecting all four extremities). Postural dysfunction is common.

- Traumatic spinal cord injuries (SCI). Quadriplegia (upper and lower limb paresis). If a lesion is located below the fourth cervical vertebra (C4), there are good prospects of the SCI patient being able to drive a car with suitable adaptation. Postural dysfunction is common.
- Multiple Sclerosis (MS) – sclerosis occurring in sporadic patches throughout the brain and the spinal cord. The nerve impulses are disturbed. Postural dysfunction is common.
- Polyneuropathy. Primarily affects the peripheral parts of the nervous system, e.g. the hands.
- Poliomyelitis (polio). The nerves emerging from the spinal cord to transmit signals to the muscles do not function. The cause is a viral inflammation of the grey substance of the spinal cord. The virus may attack the spinal cord at any point, but most commonly in the cervical or lumbar region *PIC App 2*. Postural dysfunction is common.
- Spinal muscle atrophy (SMA). The nerves emerging from the spinal cord to transmit signals to the muscles do not function. This is due to hereditary causes. Postural dysfunction is common.

The most common impairments of the muscular and skeletal systems of the upper extremities are the following: (Note that these are only examples)

- Muscular dystrophy (several types exist, all of which are characterised by muscular atrophy). Some are more severe than others, i.e. some patients suffering from muscle dystrophy can walk, while others cannot. Postural dysfunction is common.
- Myasthenia gravis. Malfunction in the transmission of signals from the nerves to the muscles. The muscles are prevented from performing repeated actions.
- Arthritis. The joints are inflamed and thereby malfunctioning.
- Arthrosis. Malfunction of the joints due to other changes in the cartilage in the joints.
- Chondromalasy. Shortness of stature due to congenital disease.
- Osteogenesis imperfecta (OI) – extreme fragility of the bones. Congenital disease. The person is always short in stature.
- Anomalies such as missing part of the limb or the whole limb.
- Amputation of part of the limb or the whole limb.

Vehicle adaptations:

The following schema can be used for a general description of suggestions for vehicle adaptation according to the disability. The disability is classified by the motor functions of the described limbs as either being reduced (reduced function) or non-existent (no function). However, it must be borne in mind that reduced function may also be due to involuntary movements. There are two types of involuntary movement:

Large

- chorea - involuntary and irregular jerking movements
- athetosis - a derangement marked by constant, recurring series of slow vermicular movements of the hands and feet, due principally to a brain lesion)

Small

- tremor – involuntary fine wave trembling or quivering

The sensory function of the limbs is as important as the motor function. The only way to compensate for a loss of sensation (i.e. reduced feedback) is for the driver to pay visual attention to the motor function that is performed. This is not recommended in driving. Also, a loss of sensation connected to a limb may alter the requirements on vehicle adaptation. Loss of sensation or reduced sensation is also included in the term “reduced function”.

Note that the suggestions on the next page are only examples.

The need for technical aid systems by category

Equipment • = needed * = may be needed o = helpful	Right leg, no function	Right arm, no function	Right arm & right leg, no function	Right arm, both legs, no function	Both legs, reduced function
hand operated accelerator				•	*
hand operated brakes				•	•
automatic gearshift	•	•	•	•	•
servo steering/power steering		o	*	•	o
augmented servo steering			o	•	
left pedal accelerator	•		•		*
electrically controlled seat	o		o	•	
electrically heated seat	o		o	o	
electrically controlled side window		o	o	o	
electrically adjustable mirrors				o	
adjustable steering wheel					
cruise control			o	o	
electronic gear selector			*	*	
steering knob on the steering wheel		*	•	o	*
steering knob with controls		o	o	o	
gear lever			*	*	
electrically controlled brakes					
swivel seat					
extended seat rails			*		
anatomically shaped seat			*	•	
extra equipment			*	•	
elevator					*
adjustable pedals for very short drivers with special needs					
foot controlled steering					
steering by electro-hydraulic control stick				*	
Electro-hydraulic accelerator/brakes				*	
augmented electrically powered miniature steering wheel					
joystick steering				*	
wheelchair lift				*	
complete adaptation of mini-van				*	*

The need for technical aid systems by category, continued.

Equipment • = needed *= may be needed o= helpful	Both legs, no function	Both arms & both legs, reduced function	Both arms, reduced function & both legs no function	Both arms, no function
hand operated accelerator	•	*	•	
hand operated brakes	•	*	•	
automatic gear change	•	•	•	•
servo steering/power steering	*	•	•	•
augmented servo steering	*	*	*	*
left pedal accelerator		*		
electrically controlled seat	*	o	o	•
electrically heated seat	o	o	o	
electrically controlled side window	o	o	o	•
electrically adjustable mirrors	o	o	o	•
adjustable steering wheel				
cruise control	o	o	o	
electronic gear selector		*	*	*
steering knob on the steering wheel	*	*	*	
steering knob with controls	o	*	*	
gear lever		*	*	*
electrically controlled brakes		*	*	*
swivel seat	*	*	o	
extended seat rails	*	*	*	
anatomically shaped seat	*	*	*	
extra equipment	*	*	*	*
elevator		*		
adjustable pedals for very short drivers with special needs				
foot controlled steering				•
steering by electro-hydraulic control stick		*	*	
electro-hydraulic accelerator/brakes		*	*	
augmented electrically powered miniature steering wheel		*	*	
joystick steering		*	*	
wheelchair lift	*	*	*	
complete adaptation of mini-van	*	*	*	

It is very important for the driving instructor for persons with special needs to have sufficient medical information in order to guarantee the student safe and secure training.

One way of organising this is to locate the driving school facilities close to the rehabilitation clinic. However, this is not possible in every case and medical information may therefore have to be communicated on paper or by telephone from the medical staff to the driving instructor.

To enhance the work of the driving instructor in such cases, a very basic schema can be developed. The following schema is not complete (several diagnoses are missing) but it is added to the manual in order to provide an example of what can be done.

Spinal Injuries	
Problems:	Muscular weakness/paralysis
	Loss of sensation/risk of pressure sores
	Incontinence
	Spasms
	Pain
Consider:	Is the person the driver or a passenger?
	Level of lesion
	Sitting balance
	Degree of muscular weakness
	Increased/reduced tonus
	Sensory loss and any history of skin breakdown
	Wheelchair used and ability to self propel
	Transfer method for the person with special needs and the wheelchair
	Size, age and ability of the carer
Probable solutions:	
Paraplegic Drivers:	
	Access and seating as above
	two-door car for wheelchair loading
	Major controls usually automatic transmission
	hand controls (pedal guards?)
	light steering
Tetraplegic Drivers:	
C6-7 and below	As for paraplegics, but:
	may need mechanised wheelchair loading device
	may need tailor-made power assisted steering

C5-6	Likely to be wheelchair drivers, therefore:
	Vans
	Tail lifts
	Wheelchair tie-down system
	Tailor-made power assisted steering
	Possibly power braking
	Modified parking brakes and other secondary controls
C4	As for 5-6, but likely to need:
	Joystick, electric parking brakes, etc.

Spina Bifida		
Problems:	Muscular weakness/paralysis	
	Loss of sensation/risk of pressure sores	
	Incontinence	
	Learning difficulties	
Consider:	When will they be old enough to drive? (16)	
	Level of lesion ?	
	Spinal deformity and sitting height often insufficient	
	Sitting balance	
	Degree of muscular weakness	
	Sensory loss and history of skin breakdown	
	Wheelchair used and ability to self propel	
	Transfer method for the person with special needs and the wheelchair	
<u>Probable solutions:</u>		
For drivers:	Access as above	
	Wheelchair loading – two-door estate car for loading wheelchair	
	Power winch inside	
	Power winch at rear	
	Rooftop hoist	
	Compatibility/Autobility/Car Chair	
	Protect door sill	
	Major controls:	automatic transmission
		hand controls
		light steering
		pedal guards
	Seating:	may need major modifications
		raise/tilt to drive <u>but</u> wheelchair level for transfer
		impervious seat covering
		side support
	Secondary controls:	indicator switch on hand control
		check other dashboard controls

Arthritis		
Problems:	PAIN	
	Join restrictions	
	Muscular weakness	
	Fatigue and general tiredness	
	Weight	
Consider:	The type of arthritis?	
	Age of person	
	Is the person the driver or a passenger?	
	Does the person have a carer?	
	Does the person use walking aids?	
	Does the person use a wheelchair? If so, which sort?	
	Does the person have to load the chair?	
	Can the person shut the tailgate/boot?	
	Can the person get in and out of the car?	
	Does the seat support the person?	
	If the person is the driver, what controls are needed?	
Probable Solutions:		
Driver:	As above, plus	
	Major controls	automatic transmission
		power assisted steering
		servo braking
	Secondary controls	electric windows
		central and remote locking
		enlarged keys
		modified handles
	Loading	estate car
		ramps
		wheelchair winches
		tailgate closures

<u>Poliomyelitis</u>	
Problems:	Muscular weakness/paralysis
	Joint deformities, especially back
	Fatigue
	Balance
	Worn out joints - pain
	Breathing
	Frustration!
Consider:	Age
	Where is the person affected?
	Can the person walk? If so, how far? (Callipers, walking aids, speed)
	Do the person use a wheelchair? If so, which type?
	How well can the person propel himself?
	How does the person transfer himself and the wheelchair?
	How long has the person driven a car? With which controls?
<u>Probable solutions:</u>	
For drivers:	As above, plus
	Automatic transmission
	Power assisted steering (including tailor-made)
	Central locking; electric windows
	Servo or power braking
	Foot supports/armrests
	Light hand controls for some people

<u>Muscular Dystrophy</u>	
Problems:	Muscular weakness
	Permanent deformities
	Lack of balance
	Weight of person and "floppiness" for transfer
	Fatigue
Consider:	How far can the person walk?
	Rate of progress
	How many in the family?
	Other family needs
	Ability of carer
	Age in relation to weight
	Wheelchair used now and in future
	Other equipment (frames, braces, callipers)
	Does the person drive? Will the person drive?
<u>Probable solutions:</u>	
For drivers:	As above, plus
	Automatic transmission
	Tailor-made power assisted steering
	Power braking
	"Everything" electric
	Remote infra-red secondaries
	Joysticks and drive from wheelchair
	Frequent reassessment of needs, depending on type of dystrophy

Multiple Sclerosis	
Problems:	Unpredictable pattern of the disease
	Muscular weakness
	Incoordination
	Spasms
	Poor balance
	Altered sensation
	Fatigue and general tiredness
	Brain dysfunction in some instances
	Bladder problems
Consider:	Driver or passenger
	Ability of carer
	How long has the person had MS?
	Rate of progress, will vehicle be suitable throughout contract?
	Walking ability, aids used, speed, distance
	Wheelchair: Which type? How often used? Ability?
<u>Probable solutions:</u>	
Driver:	Automatic transmission
	Power assisted steering - tailor-made if necessary
	Servo brakes, powered?
	Hand controls
	Pedal guards frequently essential
	Frequent reassessment of needs

<u>Cerebral Palsy</u>	
Problems:	Spasticity/stiffness
	Permanent deformities
	Incoordination
	Posture and balance
	Learning difficulties
Consider:	Driver or passenger
	Age, weight and growth of children
	Ability of carer
	Can the person walk at all? Callipers, aids
	If the person uses a wheelchair, what type is it?
	How far and fast can the person propel a wheelchair (if at all)?
	Is it likely that the person will want to drive at the age of 16?
<u>Probable solutions:</u>	
For drivers:	Automatic
	Light steering
	Carefully placed foot pedals
	Hand controls (pedal guards probably necessary)

<u>Stroke</u>	
Problems:	Weakness/paralysis on one side
	Sensory impairment
	Joint pain
	Concentration - perception - learning
	Increased/decreased muscle tonus
	General tiredness
	Poor balance
	Reduced field of vision
Consider:	Is the person the driver or a passenger?
	How old is the person and how old is his carer?
	Does the person suffer from any other impairments?
	Can the person walk at all?
	If the person uses a wheelchair, what type is it?
	Do the person need to take the wheelchair in the car?
	If driving, what controls does the person need?
<u>Probable solutions:</u>	
For passengers:	Easy access:
	high seat
	wide door
	low sill
	long seat runners
	Wheelchair loading for carer:
	hatchback
	estate
For drivers:	Automatic car
	Light steering for one-hand operation
	Infra-red secondary controls on steering aid
	Left foot accelerator for right-sided hemiplegia

Family name	Christian name	Address	Photo
Date of birth		Phone	
Date of test (test result is presented on another page) _ _ _ _	Test location (e.g. hospital, clinic, institution etc.) including addresses and phone numbers.	Type of disability - indicate in the figure on the next page which parts have no function or have reduced function or are missing. Done: <input type="checkbox"/> yes <input type="checkbox"/> no	Diagnosis (and additional subdiagnosis)
Test protocol enclosed with this logbook: <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> _____ _____	Persons in charge of the test , names, positions, etc.	Type of disability - comments	Diagnosis - comments
Driving instructor	Date of starting education	Vehicle adaptations necessary for driving - comments	Vehicle adaptations -classification code # (according to the enclosed information)
Driving school			

Logbook introduction page

Date	Lesson number	Lesson time in minutes	Exercise number	Why should this exercise be carried out? (i. e. the purpose of the exercise)	Theoretical rationale	Exercise demonstrated	Exercise instructed	Exercise practised	Exercise approved	Sign Instructor	Sign learner driver	Notes / comments

Learner driver: _____ Instructor: _____

Logbook sheet example

Disability description chart

Thorax <ul style="list-style-type: none"> <input type="checkbox"/> no function <input type="checkbox"/> reduced function <input type="checkbox"/> other: _____ 		Neck <ul style="list-style-type: none"> <input type="checkbox"/> no function <input type="checkbox"/> reduced function <input type="checkbox"/> other: _____
Right upper arm <ul style="list-style-type: none"> <input type="checkbox"/> no function <input type="checkbox"/> reduced function <input type="checkbox"/> missing <input type="checkbox"/> other: _____ 		Left upper arm <ul style="list-style-type: none"> <input type="checkbox"/> no function <input type="checkbox"/> reduced function <input type="checkbox"/> missing <input type="checkbox"/> other: _____
Right lower arm and hand <ul style="list-style-type: none"> <input type="checkbox"/> no function <input type="checkbox"/> reduced function <input type="checkbox"/> missing 		Left lower arm and hand <ul style="list-style-type: none"> <input type="checkbox"/> no function <input type="checkbox"/> reduced function <input type="checkbox"/> missing
Right upper leg <ul style="list-style-type: none"> <input type="checkbox"/> no function <input type="checkbox"/> reduced function <input type="checkbox"/> missing <input type="checkbox"/> other: _____ 		Left upper leg <ul style="list-style-type: none"> <input type="checkbox"/> no function <input type="checkbox"/> reduced function <input type="checkbox"/> missing <input type="checkbox"/> other: _____
Right lower leg and foot <ul style="list-style-type: none"> <input type="checkbox"/> no function <input type="checkbox"/> reduced function <input type="checkbox"/> missing <input type="checkbox"/> other: _____ 		Left lower leg and foot <ul style="list-style-type: none"> <input type="checkbox"/> no function <input type="checkbox"/> reduced function <input type="checkbox"/> missing <input type="checkbox"/> other: _____

Vehicle adaptation classification

01 Adapted Clutch

Hand controlled clutch	(01 a,)
Automatic clutch, vacuum controlled	(01 b,)
Automatic clutch, centrifugally controlled	(01 c,)
Adaptation of the automatic gear selector	(01 d,)
Adaptation of the automatic gear selector for short DSN	(01 e,)
Foot controlled gear selector	(01 f,)
Motor assisted gear selector	(01 g,)
Other	(01 h,)

02 Adapted Braking Mechanism

Hand push lever brakes under steering wheel for right arm	(02 a,)
Hand push lever brakes under steering wheel for left arm	(02 b,)
Hand controlled brakes placed on the floor	(02 c,)
Braking ring on the steering wheel	(02 d,)
Lower arm controlled brakes	(02 e,)
Servo assisted brakes	(02 f,)
Joystick controlled brakes	(02 g,)
Reversal of parking brake position	(02 h,)
Adapted parking brake placed under dashboard	(02 i,)
Foot controlled parking brake	(02 j,)
Motor driven parking brake	(02 k,)
Brakes for the driving instructor	(02 l,)
Specially designed brakes for the driving instructor	(02 m,)
Other	(02 n,)

03 Adapted Acceleration Mechanism

Left foot accelerator	(03 a,)
Adaptations for short legged DSN	(03 b,)
Hand push lever accelerator	(03 c,)
Hand push lever accelerator, under steering wheel	(03 d,)
Hand controlled accelerator, radial control	(03 e,)
Motorcycle accelerator	(03 f,)
Twist controlled accelerator on the hand-controlled brake	(03 g,)
Accelerator ring on the steering wheel	(03 h,)
Lower arm controlled accelerator	(03 i,)
Servo assisted accelerator	(03 j,)
Joystick controlled accelerator	(03 k,)
Cruise control	(03 l,)
Other	(03 m,)

04 Adapted Steering

Steering-knobs and other specially designed grips	(04 a,)
Special steering wheels, thin or thick	(04 b,)
Extended steering column	(04 c,)
Tiltable steering wheel	(04 d,)
Adapted servo assisted steering	(04 e,)

Vertical steering	(04 f,)
Horizontal steering	(04 g,)
Rotatable plate foot controlled steering system	(04 h,)
Pedal controlled steering	(04 i,)
Knee steering	(04 j,)
Control stick steering	(04 k,)
Joystick steering	(04 l,)
4-way systems	(04 m,)
Other	(04 n,)

05 Adapted Secondary Control Devices

Extended switches on the steering column	(05 a,)
Extensions of toggle switches	(05 b,)
Extensions of pushbuttons	(05 c,)
Adjustments of rotary switches	(05 d,)
Switches placed on hand control	(05 e,)
Switches placed on steering wheel	(05 f,)
Switches placed on neck rest	(05 g,)
Foot controlled switches	(05 h,)
Specially made switch consoles	(05 i,)
Air controlled (blowing sucking) switches	(05 j,)
Voice controlled switches	(05 k,)
Menu driven switches	(05 l,)
Other	(05 m,)

06 Ignition key and heater control

Adaptation of ignition key	(06 a,)
Adaptation of ignition key switch	(06 b,)
Ignition control without key	(06 c,)
Adaptation of sliding controls for heater regulation	(06 d,)
Adaptation of rotary controls for heater regulation	(06 e,)
Alternative controls for heater regulation	(06 f,)
Other	(06 g,)

07 Vision enhancement: windows, mirrors etc.

Adaptations of wipers (windscreen)	(07 a,)
Adaptations of wipers (rear window)	(07 b,)
Electrically operated side windows	(07 c,)
Special windows (glare reduction)	(07 d,)
Headlight wipers	(07 e,)
Adaptation of mirror placed on the windscreen	(07 f,)
Exterior wide angle mirrors	(07 g,)
Mirrors for side observation	(07 h,)
Electrically controlled mirrors	(07 i,)
Wide angle lens placed on the rear window	(07 j,)
Motor controlled sun visors	(07 k,)
Extra external sun visors	(07 l,)
Reverse warning	(07 m,)
Rear anti-collision warning systems	(07 n,)
Rear view monitor	(07 o,)
Other	(07 p,)