Ecodriving in Learner Driver Education
ECOWILL - Level 1

Handbook for Driving Instructors
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1. Modern Driving

Driving in real world traffic is not an easy-to-do task like switching on the television or moving the eye. Driving is constantly moving in a social system with many emotions and regulations. It can be compared with "social happenings" like a football game, a big street party or even a personal relationship. It is always exciting and you never truly know what will happen next. Driving a car is the art to understand and to smartly participate in this "social happening" skilfully. Young people as new drivers need to persist in this complex system from the beginning their mistakes not being tolerated.

Road traffic is not an inflexible moving system. Driving a car is more than the mere utilization of a car, it is rather moving in a system with social interaction in which every action causes a reaction. The car itself is an emotional object, being a status symbol expressing power or wealth. For some people the car is a beloved partner even given a name, others furnish their cars like their homes giving a lot of space for personal objects.

Young people grow up with the emotionality of road traffic as normal part of driving. More reasonable, clever and social responsible behaviour needs to be learned and more important to be taught. Education of learner drivers has to incorporate the responsibility for other traffic participants, co-drivers but also for the environment, being negatively affected by increasing mobility.

Young drivers need the necessary skills to become self-reliant drivers being capable to take responsibility within traffic. Therefore a solid foundation has to be established during driving school education not easily to be changed by external influences.

Modern driving techniques and driving behaviour have to be taught right from the first driving lesson. Thus, driving competence and driving culture can appropriately adapt to and at the same time positively influence advanced driving style.
2. The World of Young People – A Mobile Life

It is amazing how fast driving style changes after driver test has been passed, how fast some behavioural patterns are unlearned and other behaviour (also unsafe and dangerous) adopted. But if examined in detail this can easily be explained. Young drivers are in a difficult and eventful phase of their life. They are occupied with many aspects of social coexistence searching for their own way, finding out future perspectives, loving and making dramatic experiences within personal relationships also being strongly influenced by friends. From a neurobiological point of view this phase of life is described as follows:

"The brain is a highly dynamic construction area, with scaffolds constantly assembled, new connections made and old ones being terminated."  

Young persons are extremely mobile and spontaneous. They build up their real and virtual social networks having highest priority. Facebook, Skype, YouTube and Xing are only few examples for this mobile way life. The virtual network is used as a second home, chatting on Facebook and at the same time writing an SMS, sometimes while driving. This is why the young generation is also described as "digital natives". In this modern world with high communication speed spontaneous and emotionally motivated rides are quite common.

Depending on country specifics, most novice drivers start driving in traffic with a solid basis enabling them to learn and develop further. However, they only gathered little practical driving experience during their driving school education and testing procedures (800-1000 km driven). After passing the driver test novice drivers encounter many situations which could not be practised nor examined during their education. They need to deal with these situations and accordingly adapt their mobility without having the required support anymore.

1 See also GEO Magazin, edition September 2005, page 134 ff. (ISSN number 0342-8311), www.geo.de.

From a neurological viewpoint this can be described as follows: "Young drivers resemble a full Airbus speeding down the runway with vibrating engines while in the cockpit the navigation and monitoring instruments are still being installed." 

Modern traffic requires that important basics are learned and accepted internalized in a way that novice drivers can be hardly overthrown by external influences having monitoring and navigation instruments already completely installed.

It is important to enable young people to learn and experiment inspiring them to keep this as an accompanying factor throughout their whole development. It has to be assumed that learner drivers already have some experience with mobility and traffic as co-drivers or as users of alternative means of transport (bicycles, skates, etc.) already developing and strengthening attitudes and behavioural patterns.

For the communication of driving behaviour, both in training and testing, the following must be in place:

- It needs to be put in focus that mobility is a service for affecting questions of love and life;
- It needs to be highlighted to young drivers that development of mobility does not exist in a vacuum but rather under attentive and participating supervision of adults;
- Mobility and personal development must be perceived and experienced as exciting process to demonstrate that through observation of regulations and acquisition of different driving styles the whole spectrum of development advances;
- Traffic must be presented as a challenge and not as easily to manage;
- It must be drawn to attention that it is impossible to achieve perfection in traffic and only those achieve mastery who underwent the hard road of apprenticeship before - including all apprehensions and mistakes.

In order to achieve the necessary acceptance for certain driving behaviour in the target group of learner drivers a specific wording needs to be used arousing their interest and presenting the idea of Ecodriving as something worthwhile achieving. "Energy efficient driving" or "environmentally friendly driving" is a wording often associated with "slowing down" or "moseying" not only by young drivers. These associations are more counter-productive rather than supportive for the implementation of this modern driving style.

Right from the first driving lesson on it is the main task to communicate this modern driving style as normal, exciting, safe and responsible driving worthwhile achieving. Consequently teaching these driving techniques from the first driving lesson on will lead to an earlier and more stable internalisation without causing an additional driving lesson. Conveying it this way, Ecodriving is not recognized as something special or extraordinary to be put additionally on top of driving but just integrated into "normal" driving style.

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2 See also GEO Magazin, edition September 2005, page 134 ff. (ISSN number 0342-8311), www.geo.de.
3 See rheingold, Institut für qualitative Markt- und Medienanalysen GmbH und Co. KG, „Qualitative baseline study of mobility and traffic safety concepts of teenagers and young adults“ 2000, editor German Road Safety Council.
3. The GDE-Matrix (Goals for Driver Education) as Background

The so called "GDE-Matrix" (Goals for Driver Education) deals with all relevant factors and targets that a harmonised European driving school education must comprise according to the GADGET-experts from eight different countries, describing what is characterising a good driver.

The first 4 levels show, that driving consists of technical and social and psychological dimensions with the latter having the bigger impact on driving behaviour. Participating in traffic is not primarily determined by rules or learned behaviour, but underlies psychological and social factors which severely and spontaneously influence and modify driving behaviour. Conveying and reinforcing behavioural patterns accepted as useful help to avoid that external factors can cause such rapid changes.

In 2010, an additional 5th level comprising cultural and work-related influences was introduced. This 5th level is considered as additional influencing variable to the already existing 4 levels.

GDE-Matrix

<table>
<thead>
<tr>
<th>Goals for life, skills for living</th>
<th>Knowledge and skills</th>
<th>Risk-increasing factors</th>
<th>Self assessment, introspection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goals and context of driving</td>
<td>Role of motives, route planning, choice of time</td>
<td>Alcohol, fatigue, purpose of driving</td>
<td>Own motives, self critical thinking</td>
</tr>
<tr>
<td>Traffic situations</td>
<td>Traffic rules, observation, driving path, automatisation</td>
<td>Disobeying rules, information overload</td>
<td>Awareness of personal strengths and weaknesses</td>
</tr>
<tr>
<td>Vehicle control</td>
<td>Control of direction, position, physical laws</td>
<td>Unsuitable speed, difficult conditions</td>
<td>Calibration and awareness of car control skill</td>
</tr>
</tbody>
</table>

5th Level:
Cultural influences; work-related influences
Moreover, the GDE-matrix shows the limitations and difficulties for learning processes aiming to train and change behavioural patterns. Ignoring these aspects, attempts may fail establishing application of contents or change in behaviour.

Conveying driving techniques like early shifting, letting the car roll and enlarging the safety distance are mainly "hard knowledge" how to handle the car and specific driving situations on levels 1 and 2. If those driving techniques shall be accepted by the learner drivers, the corresponding willingness of levels 3 and 4 ("soft knowledge") has to be given. For example, it is hard to teach learners modern driving style, if e.g. their parents constantly drive with medium or even high engine speed / high revolutions (rpm), contradicting and conflicting with the taught driving techniques.

**GDE-Matrix as support**

Taking into account the cultural and work-related influences of level 5, to ignore this dimension may result in complete confusion when communicating with learner drivers. It is crucial to understand why somebody wants to obtain the drivers licence or to drive a car. Knowing the individual wishes, expectations and hopes the learning process can be influenced.

In experiencing novice drivers' driving style significantly distinguish between technical and social components. The technical components are the most important foundation for learner education containing basic knowledge on how to operate a vehicle. The technical components have to be learned and internalised up to a level of automatic reaction.
Social aspects have to be included at a later stage of the education. They serve to smartly master the challenges in daily traffic, and help to actively organise driving in traffic. Overloading the learning process e.g. including social components at a too early stage may prevent significant positive impacts on educational targets.

For this reason, education needs to be organised in different well-matched and connected stages building on each other. It is advised to subdivide the education into the following five stages: Basic Stage, Structural Stage, Performance Stage, Special Trips and Final Stage (approaching the driver test). Especially the basic and structural stages contain and train technical dimensions, while the performance stage the special trips and the final stage focus on social dimensions.
The GDE-Matrix 2010

Proposal was based on a five-level GDE5-SOC matrix (Keskinen, Peräaho & Laapotti, 2010)

5 Social environment
e.g. culture, legislation, enforcement, subculture, social groups, group values and norms

4 Personal goals for life, skills for living
e.g. lifestyle, motives, values, self-control, habits, health

3 Goals and context of driving
e.g. trip related choices, goals, driving environment, company

2 Mastery of traffic situations
e.g. rules, observation, driving path, interaction

1 Vehicle handling and manoeuvring
e.g. gears, controls, direction, tyre grip, speed adjustment

Influencing, shaping
Seeking, selecting

PERÄAHO, KESKINEN, LAAPOTTI, KATILA, HERNETKOSKI 2010
## Trend in driver training contents

<table>
<thead>
<tr>
<th>Hierarchical levels of behaviour</th>
<th>Essential curriculum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goals for life and skills for living (general)</td>
<td>Knowledge and skills</td>
</tr>
<tr>
<td>Driving goals and context (journey-related)</td>
<td></td>
</tr>
<tr>
<td>Mastery of traffic situations</td>
<td></td>
</tr>
<tr>
<td>Vehicle manoeuvring</td>
<td></td>
</tr>
</tbody>
</table>

Mika Hatakka
The driver education under supervision ADAC/DVR Symposium
(by Keskinen and Hatakka, 1997)
4. Coaching as Method in Driving School Education

Coaching is the professional counselling and attendance of a person (the coachee) by a coach, while the person is exercising complex actions. Aim is to enable the coachee to achieve his personal optimum result.

The term "coach" means a horse-drawn carriage getting people from one point to another. In this respect, on the meta-level, coaching can be seen as a "development tool". The target is defined by the coachee who is accompanied by the coach on a specific journey, for example sensitively approaching a road crossing.

The term "coach" in this meaning was initially used in sports, where the coach is not only a trainer of skills but also partner and motivator. In the first place, a coach is the trainer of the mental strength of sportsmen. As neutral partner in communication and interaction, the coach shall enable, accompany and facilitate the coachee´s individual development process.

Increasingly, coaching is practiced in management and marketing, but also in personal context. Triggered by an expert suggestions, specific actions are assessed under real-world conditions and better alternatives jointly revealed. Coaching is the most effective way to lead the coachee to his personal optimum, maybe even a top performance.

Regarding road traffic and especially car-driving, coaching requires the consideration of the full context of driving from the coachee´s real-life point of view. Driving a car is not isolated, but strongly correlated to contextual conditions (see GDE-matrix). Here, the task of the coach is to support the learner driver in achieving an excellent performance in safe, economical and environmentally friendly driving.

Coaching is characterised either by intensive evaluation of experiences made using specific key questions or slowly acquainting the coachee to new behaviour by asking for ideas or first impressions/experiences. In this sense, especially in further education of drivers, situations can be customised, activating the participant, allowing important first impressions and triggering further-leading interactive involvement. The role of the coach is not to represent a "knowledge pool" but to incorporate an interested companion, allowing the coachee to find his own way by the help of sophisticated questioning. The key principle of coaching is partnership.
Coaching urgently requires that learner and "teacher" are introduced in the subject of learning. The targets need to be defined beforehand so the learner knows in which direction the common work is pointed.

Driving is more than just moving from point A to point B. It is a quite complex task in a social context. Driving and the related risks are strongly determined by driving motives and purposes as well as by lifestyle and attitudes towards road traffic. Only few drivers ever reflected this keeping these nexuses unconscious. The earlier and more intense drivers learn to confront themselves with these factors and learn to question them, the bigger their competence will be in assessing certain driving situations, avoiding or dealing with them in a risk decreasing way.

As stated earlier, it is important to get to know the related wishes, expectations and hopes of the learner in context of driving school education (see chapter GDE-Matrix). Therefore it is useful to skilfully ask the learner about his motives and expectations right from his first lesson. The following key questions could be used to start a conversation:

- Could you please describe shortly why you want to obtain a drivers licence?
- Why do you want to obtain a drivers licence?
- What expectations do you have regarding the driver license?
- What wishes and expectations do you associate with the driver license?
- What are the first things coming to your mind thinking of the drivers licence?
- What do you want to do when you have obtained the drivers licence?

Getting to know the details behind those questions a personalised education plan can be established, helping to get the optimum access to the learner.
5. The "Golden Rules" of Ecodriving as defined in the ECOWILL project

Ecodriving is the modern and smart way of to save fuel and reach your destination swiftly and – most important – safely.

Consuming energy/fuel costs money and causes CO₂ emissions with negative environmental impact. Especially driving with high engine revolutions (high RPM) raises the fuel consumption significantly. Also avoidable sequences of acceleration and braking as well as inappropriate use of air conditioning and electronic equipment will lower fuel efficiency.

Following the guideline “Safety First”, the application of Ecodriving tips listed enables a highly fuel-efficient, smart and relaxed driving style with best environmental effect.

1. Anticipate Traffic Flow
   - Read the road as far ahead as possible and anticipate the flow of traffic.
   - Act instead of react – increase your scope of action with an appropriate distance to use momentum.
   - Make maximum use of the vehicle's momentum.

5 An increased safety distance equivalent of about 3 seconds to the car in front optimises the options to balance speed fluctuations in traffic flow, enabling steady driving with constant speed (see also additional explanation #1).

6 Three different techniques are applicable (within 2 categories: (a) with traction; (b) without traction) – consider details of the car’s manual (see also additional explanation #2).

2. Maintain a steady speed at low RPM
   - Drive smoothly, using the highest possible gear at low RPM.
   - Remember driving at high speeds or with high RPM significantly increases fuel consumption.

3. Shift up early
   - Shift to higher gear at approximately 2,000 RPM.
   - Consider traffic situation, safety needs and vehicles specifics.

7 See also additional explanation #3.1.

8 See also additional explanation #3.2.

9 See also additional explanation #4.
4. Check tyre pressures frequently, at least once a month and before driving at high speed
   - Keep tyres properly inflated as low tyre pressure is a safety risk and wastes fuel\(^\text{10}\).

5. Consider any extra energy required costs fuel and money
   - Use air conditioning and electrical equipment wisely and switch it off if not needed\(^\text{11}\).
   - Avoid dead weight and aerodynamic drag.

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\(^{10}\) For correct tyre pressure (acc. to loading and speed driven), check with car’s manual.

\(^{11}\) Electrical energy is converted from extra fuel burned in a combustion engine, so electrical consumers don’t work “for free” – it always extra energy and money.
Golden Rules of Ecodriving (version: April, 28th 2011)

Ecodriving is the modern and smart way of saving fuel and reaching your destination swiftly and – most important – safely. Consuming energy/fuel costs money and causes CO₂ emissions with negative environmental impact. Especially driving with high engine revolutions (high RPM) raises the fuel consumption significantly. Also avoidable sequences of acceleration and braking as well as inappropriate use of air conditioning and electronic equipment will lower fuel efficiency. Following the guideline “Safety First”, the application of Ecodriving tips listed enables a highly fuel-efficient, smart and relaxed driving style with best environmental effect.

Anticipate Traffic Flow

Maintain a steady speed at low RPM

Consider that any use of energy costs fuel and money

Shift up early

Check tyre pressures frequently at least once a month and before driving at high speed
Additional Explanation #1:

Systematically increasing vehicle-to-vehicle distance within traffic flow significantly improves overall road safety. Increased safety distance equivalent of around 3 seconds to a vehicle driving ahead optimises options to act instead of only react and reduces risky situations.

Key action: Step off the accelerator if traffic flow is slowing down to keep safety distance. With this simple action speed fluctuations in traffic can often be equalised and gently managed. As a result (strong) braking – while wasting built-up kinetic energy – can be often avoided as well as the need to accelerate after too hard deceleration.

Additional Explanation #2:

Making use of vehicles' momentum means to use built-up kinetic energy of the car most efficiently. The overall goal is letting the car roll and driving steady speed whenever possible instead of braking and subsequently accelerate.

Using vehicles momentum three different techniques are applicable – classified in two categories. It is important to consider specific advices of the individual car's manual as well as strictly follow national legal requirements.

Using momentum can be realised within two different categories of driving techniques:

(i) in gear,

(ii) in neutral – resulting into three specific advices.

Category #1 “using momentum in gear”

Driving advice technique #1: Let the car roll in gear

The speed of the vehicle will reduce due to the engine's braking effect via mechanical friction (as gear engaged). Using the right gear unintended acceleration (e.g. while driving downhill) can be avoided. This technique is beneficial to saving fuel if the respective engine has a fuel cut-off mode and also while driving at higher speeds (consider advice for engine's fuel cut-off).
Category #2 "using momentum in neutral"

Driving technique #2: Let the car roll in neutral (no gear engaged with idling engine)

The technique rolling in neutral with no gear engaged (with idling engine) makes better use of a vehicle's kinetic energy because there is no engine braking effect. This is beneficial for situations like approaching an obstacle or an identified stop (red traffic lights; Stop-sign). Thus, a relative long distance can be driven at quite constant speed without additional acceleration. While rolling in neutral the fuel consumption is defined by the idling engine alone. Especially for cars without engine fuel cut-off mode this is a good technique to use vehicle’s kinetic energy. But also for cars with fuel cut-off the option to letting the car roll without gear engaged can save fuel at typical low speed driving in cities (esp. when "stop-and-go" or only little faster). Engine’s fuel cut-off does not work at low RPM (check with the car's manual for details), and is activated beyond a specific engine speed for the individual car. For safety reasons while driving downhill it is important to always stay in the right gear to avoid unintended acceleration.

Driving technique #3: Letting the car roll in gear, but with clutch disengaged

This technique is advisable in situations when it can be assumed that the ride can be continued soon in the same gear, and the use of the engine's fuel cut-off and engine braking effect is not useful for good fuel efficiency.

Consider: Make use of the engines fuel cut-off whenever useful

It is important to know that inner mechanical friction (of engine/ transmission) wastes more kinetic energy than letting the car roll without traction (no gear engaged or clutch disengaged). Engine fuel cut-off (if available for a specific car) operates only at certain speed range and revs area which differs from car to car. It is useful to know the car’s specifics as from the owner’s manual. At low RPM and low speeds (below 50 kph) – as typical for driving in cities – the use of the engine's fuel cut-off is not always possible and useful. Especially for city driving it can be extremely difficult and distracting – safety risk! – to identify the right gear for making best use of the engine's fuel cut-off. Relevant for safe driving is the fact that some modern cars accelerate automatically if the car falls below a specifically defined (engine) speed. This effect – if unintended – should be avoided because it raises fuel consumption and may lead to driver's irritation (road safety issue). Older cars mostly have no engine fuel cut-off mode.

Note: All three techniques are to be applied strictly following the guideline "Safety First".
Additional Explanation #3:

3.1. Smooth driving with steady speed saves a lot of fuel compared to the same average speed, but with sequences of acceleration and braking.

Unnecessary speed peaks and abrupt braking do not only waste fuel, but also raise the stress level while driving and causing additional safety risks. Ecodriving strives for a smooth driving style allowing undisturbed, easy floating within traffic.

Using a cruise control can be advisable to support a smooth ride, especially for extra-urban driving (rural roads or highways), but also some traffic situations in city driving.

3.2. High speed driving leads to a drastically increased fuel consumption

Especially for city driving there is nearly no chance to increase average speed or gaining time advantage with strong acceleration and speed peaks. The time you need for a ride is dominated by external factors (like traffic density, traffic lights, etc.). Even on highways the time saving potential is quite low and has to be (over-)paid with drastically increased fuel consumption. Even getting a little bit faster means higher RPM plus aerodynamic drag, even within speed limits (e.g. 110 to 120 kph), and more fuel has to be burned and money wasted (see on-board vehicle computer).

Additional Explanations #4:

1. Driving with high or even medium engine RPM always consumes more fuel than driving at low RPM at whatever speed. Therefore, early shifting is highly recommended. However, vehicle specifics and also given traffic situation has to be taken in account.

Rough guidance for shifting and steady speed driving (on the flat, not uphill):

<table>
<thead>
<tr>
<th>Gear</th>
<th>Speed</th>
<th>Fuel consumption at 50 kph</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>Driving-off only (one vehicle length)</td>
<td>7.0 l</td>
</tr>
<tr>
<td>2nd</td>
<td>20 kph</td>
<td>4.6 l</td>
</tr>
<tr>
<td>3rd</td>
<td>30 kph</td>
<td>3.8 l</td>
</tr>
<tr>
<td>4th</td>
<td>40 kph</td>
<td>3.4 l</td>
</tr>
<tr>
<td>5th</td>
<td>50 kph</td>
<td></td>
</tr>
<tr>
<td>6th</td>
<td>60+ kph</td>
<td></td>
</tr>
</tbody>
</table>

Based on the rough guidance for steady speed driving (on the flat, not uphill) the optimum gear shifting for each car has to be identified individually.
Full throttle acceleration should be avoided if the acceleration can be chosen individually. When driving uphill choose a gear which does not require fully pushing down the accelerator to keep an acceleration reserve (safety issue). As appropriate accelerator pedal position 2/3 or 3/4 should be chosen.

**Note:** "Safety First" guideline also applies for acceleration! For strong acceleration required (e.g. overtaking, lane changing, driving onto a highway) use intentionally full throttle acceleration "pedal to the metal" to quickly achieve the speed envisaged and safely manage the specific situation.

When accelerating stronger skipping gears can help to save fuel. Skipping gears is meaningful and fuel-efficient to reach faster a targeted final (steady) speed and keeping it for a longer time.

Engine torque curves of diesel and petrol cars differ strongly, also when comparing older and advanced engines in general (irrespective of fuel sort). Cars with diesel powered engines or advanced direct injection gasoline engines can be shifted up at even lower RPM than (older) petrol powered cars.

**Specific advises for automatic transmission:**

To drive fuel-efficient avoid kick-down to accelerate excepted when it is required for safety reasons (see above).

To intentionally shift up and ride with lower RPM with automatic transmission simply step-off the accelerator shortly.

Shifting and driving at low RPM is harmless to any engine or car! Overloaded/blocked particulate filter of diesel cars do not result from driving with low RPM, but relate to low engine temperature at too many short trips (also to be avoided due to high fuel consumption). If necessary a 10 minute lasting highway ride can prevent blocking the particulate filter. Please also see details and practical instructions in the car’s manual or from car manufacturer directly. In general it is advised to select and buy a car that fits to the use pattern and trip structure.
"Silver Rules" of Ecodriving:

1. Avoid short trips! Cold engines need much more fuel compared to warmed-up engines and causing equivalently more CO₂. On short trips the engine does not reach its optimum operating temperature, engine increasing wear and reducing durability.

2. Drive-off immediately after starting the engine; do not warm up the engine by idling.

3. Do not push the throttle while starting the engine.

4. Switch off the engine at longer stops (or use the automatic “start/stop”) – when expected to last longer than 20 seconds (ignition on).

5. Close windows while driving at higher speeds, as open windows increase aerodynamic drag and consume extra fuel.

6. Use low friction oils and low energy tyres (EU labelling).

7. Check your car regularly and have it serviced to keep it "eco-fit" and also "safety-fit".

8. Fuel-saving starts with choosing a low emission car.


11. Around 25% of all car trips cover less than two kilometres and 50% of car trips less than five kilometres. Cycling and walking do not only have positive effects on the environment but also on your health and budget. The use of public transport also helps saving money as well as avoiding stress and emissions. Consider setting up a car pool with friends/colleagues or use car sharing to save fuel and reduce costs.
6. Structure of a Level of Proficiency-based Driving School Education

6.1 Basic Stage

Aim of the basic stage is to gain the fundamental psycho-motor abilities in choosing right gears especially in terms of the modern driving style. Training a safe and modern shifting process using all possible gears as well as familiarise with basics of using momentum depending on the type of vehicle are the major targets for the education in this stage.

Fuel consumption and emissions of an engine strongly depend on the engine speed (revs/rpm). In general, higher rpm cause higher fuel consumption. Advanced engines enable and are specially designed to foster driving at low rpm with shifting and driving at around 2,000 rpm. In doing so, the engine reaches its optimum operating temperature much faster than driving in lower gears with higher rpm. A bucking engine indicates that the engine is leaving the optimum rpm range – even below idling speed – having chosen a gear to low. Mastering the use of all gears including idle gear without looking at the gear lever is a necessary requirement to drive a vehicle safely. It should be trained to quickly accelerate and shift up early. The rpm shifting point slightly lower for diesel cars compared to petrol driven cars. (For more details: see "Golden Rules" Chapter 5).

As a rough guidance for shifting and driving steady speed (on the flat, not uphill) can be helpful:

<table>
<thead>
<tr>
<th>Gear</th>
<th>Speed (kph)</th>
<th>Fuel Consumption (l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; Gear</td>
<td>Driving-off only (one vehicle length)</td>
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<tr>
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</tr>
<tr>
<td>3&lt;sup&gt;rd&lt;/sup&gt; Gear</td>
<td>30 kph</td>
<td>3.8 l</td>
</tr>
<tr>
<td>4&lt;sup&gt;th&lt;/sup&gt; Gear</td>
<td>40 kph</td>
<td>3.4 l</td>
</tr>
<tr>
<td>5&lt;sup&gt;th&lt;/sup&gt; Gear</td>
<td>50 kph</td>
<td>3.4 l</td>
</tr>
<tr>
<td>6&lt;sup&gt;th&lt;/sup&gt; Gear</td>
<td>60+ kph</td>
<td>3.4 l</td>
</tr>
</tbody>
</table>

At the same time it should be trained to let the car roll in a clever way. This can be done without traction (letting the car roll in neutral, or in gear with the clutch disengaged) or with traction making use of engine's fuel cut of (if applicable). The right use of gears fitting to the speed driven has to be trained to practice it without looking at the gear lever. Cars with automatic gearboxes always have to stay in "D" mode.
6.2 Structural Stage

Within the structural stage the driving techniques trained should be combined and be more elaborated. Therefore, specific exercises are needed to support young learners in getting a good comprehension on and to better train vehicle handling.

Many learner drivers (and also more experienced drivers) cannot imagine how far a car can go when rolling in neutral or with clutch disengaged. It can be a good exercise to put the car in neutral or engage the clutch after driving in a higher gear.

Another apprehension is that the engine will go out approaching idling speed while in gear. To convey more experience it can be practised to step off the accelerator at 40 kph with 4th gear engaged and let the car roll until it begins bucking. It should be stated that on a flat the car would drive on idling with gear engaged until it runs out of fuel.

Using momentum is never to be practised while driving downhill. The right selection of gears at downhill driving has to be trained separately. As a general rule it can be stated to prevent a further acceleration of the vehicle a lower gear has to be chosen if the car speeds up automatically while coasting (with or without fuel cut-off) or while running in neutral.

6.3 Performance Stage

Especially the performance stage as well as the special trips stage, approaches the social components of the driving school education founded on solid competences in the technical dimensions. It is advised approaching this stage not too early to avoid overstraining the learner driver. The challenge at this stage is to transfer the driving techniques into specific traffic situations. It is important to acknowledge/confirm the young learner drivers in using the modern driving techniques. But it is also important to train situations which require for safety reasons stronger acceleration and higher rpm for a short period of time. These situations are described as follows:

- Approaching the autobahn/ highway,
- While overtaking,
- Shifting while driving uphill.

In these situations the right gear must be engaged allowing the necessary acceleration to safely operate the envisaged driving manoeuvre. As already indicated, making use of the car's momentum has to be transferred into more complex traffic situations giving the learner the opportunity to train the respective appropriate behaviour. Additionally the right use of gears should be trained further if not already mastered by the learner. The following examples describe traffic situations in which using momentum should be trained:

- Approaching a red traffic light or a traffic light which will shortly change to red;
- Approaching a "Stop" or a "Give Way / Yield" sign;
- Approaching a road crossing or a junction where to turn;
- Approaching an obstacle;
- Approaching speed limiting traffic signs;
- Use momentum in stop-and-go traffic situations.

Keeping an enlarged safety distance ("buffer distance") helps young drivers to recognise how their scope of action is broadened. This allows acting instead of only reacting in traffic. Training to enlarge safety distance is extremely relevant during this education stage. Young drivers see it as gain of social competence to have sufficient space and time to react on traffic situations. The enlarged safety distance has many benefits especially allowing maximum use of vehicle's momentum:

Stopping at an obstacle can be avoided by early changing the lane. The danger that a tailgating car crashes into the own car's back is reduced due to less hard breaking actions needed. Fluctuations in traffic can be equalised gently without losing too much momentum.

In this phase besides training choosing the right safety distance should be evaluated as well as highlighting the related benefits.

6.4. Special Trips Stage

During this stage the learner's acquired abilities in making use of the modern driving techniques should be transferred into further specific traffic situations/trips. In this stage special trips on the autobahn/motorway, night time driving or rural road driving should be trained.

6.5 Final Stage

The final stage (shortly before the driver test) is completing the driving school education. Special contents of autonomous driving can be trained and deepened while applying the "Golden Rules" of Ecodriving.
7. Targets for Driving Instructor Education and Further Education on Ecodriving – Level 1

Targets for the Level 1 seminars within at least 2 days:

1. Driving instructors / national Master-Trainees qualified within the European project "ECOWILL" have a common understanding of the "Golden Rules".

2. Driving instructors / national Master-Trainees get to know the basic facts and background of the ECOWILL project.

3. Driving instructors / national Master-Trainees will be enabled to understand and implement the objectives of the GDE-Matrix.

4. Driving instructors / national Master-Trainer will become acquainted with basic background information, facts and data on Ecodriving and integrate the "Golden Rules" into their education process of learner drivers.

5. Driving instructors / national Master-Trainees are capable to convey the "Golden Rules" of Ecodriving in theoretical lessons.

6. Driving instructors / national Master-Trainees are capable to practically convey the "Golden Rules" of Ecodriving in a level of proficiency-based driving school education.

7. Driving instructors / national Master-Trainees will be able to apply themselves and educate techniques / behaviour of Ecodriving in real world traffic / on public roads.

8. Driving instructors / national Master-Trainer will get to know and to apply the coaching method in driving school education.

9. Driving instructors / national Master-Trainer will be able to structure and operate a Train-The-Trainer Seminar (Level 1) for other driving instructors.
8. Prototypical Structure of Driving Instructor Education on Ecodriving

Organisational structure: Day #1

<table>
<thead>
<tr>
<th>Time</th>
<th>Content</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 min.</td>
<td>Introduction</td>
<td></td>
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<td></td>
<td>Organisational issues</td>
<td></td>
</tr>
<tr>
<td></td>
<td>History of ECOWILL</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Expectations</td>
<td></td>
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<tr>
<td></td>
<td>Experiences</td>
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<tr>
<td>90 min.</td>
<td>Techniques / Behaviour of Ecodriving</td>
<td>&quot;Golden Rules&quot;</td>
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<tr>
<td></td>
<td>Shifting</td>
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<td></td>
<td>Safety distance</td>
<td></td>
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<td></td>
<td>Using momentum</td>
<td></td>
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<tr>
<td></td>
<td>Low engine speed/rpm</td>
<td></td>
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<td></td>
<td>Correct tyre pressure</td>
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<td></td>
<td>etc.</td>
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<tr>
<td>120 min.</td>
<td>Driving Exercises</td>
<td>6 x 15 min. Driving and Coaching by experienced Master-Trainers as well as Driving and Coaching in small groups</td>
</tr>
<tr>
<td></td>
<td>Applying tasks for observation and using feedback rules</td>
<td>Additional 6 x 5 min. break / buffer time</td>
</tr>
<tr>
<td>60 min.</td>
<td>Evaluation of Observation</td>
<td></td>
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<tr>
<td></td>
<td>Evaluation of Feedback</td>
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<td></td>
<td>Conclusions for driver education</td>
<td></td>
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<td></td>
<td>Personal consequences</td>
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</tbody>
</table>
Organisational structure: Day #2

<table>
<thead>
<tr>
<th>Time</th>
<th>Content</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 min.</td>
<td>The GDE-Matrix as foundation for Ecodriving in driver education</td>
<td><strong>Technical components:</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>GDE-Level 1: How is a target-oriented driver education organised?</td>
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<tr>
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<td>GDE-Level 2: How are situations prepared, accompanied and evaluated?</td>
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<td><strong>Social components:</strong></td>
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<td></td>
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<td>GDE-Level 3: How do driving motives and driving purposes influence Ecodriving? How to deal with it in driver education?</td>
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<td>GDE-Level 4: How do attitudes affect Ecodriving? How to deal with it in driver education?</td>
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<td></td>
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<td>Comment: Levels 3 + 4 are more theoretical. GDE-Level 5 is integrated into the seminars e.g. in countries without theoretical education there will be special theoretical in-car-teaching module. There is already an existing approach from the &quot;Hermes&quot; project. It is necessary to be more flexible in the sense of GDE-Level 5 and look for a country-specific approach.</td>
</tr>
<tr>
<td>60 min.</td>
<td>Practical training dealing with car handling issues (GDE-Level 1)</td>
<td>3 x 20 min.</td>
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<tr>
<td>15 min.</td>
<td></td>
<td>3 x 5 min. buffer time</td>
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<tr>
<td>60 min.</td>
<td>Practical training dealing with traffic situations (GDE-Level 2)</td>
<td>3 x 20 min.</td>
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<tr>
<td>15 min.</td>
<td></td>
<td>3 x 5 min. buffer time</td>
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<tr>
<td>30 min.</td>
<td>Ecodriving in theory (group) and respectively one-on-one conversation in car (GDE-Level 3 and 4)</td>
<td></td>
</tr>
<tr>
<td>90 min.</td>
<td>Conclusions / Consequences how to operate own Train-the-Trainer Seminars</td>
<td></td>
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</tbody>
</table>

End of seminar:

1. Standardised qualification test.
2. Presentation of certificates.
3. Final wrap-up and goodbye to certified driving instructors / Master-Trainers.
9. Annex ECOWILL

The **two main objectives** of the EU-project ECOWILL are:

(i) Integration of Ecodriving into learner driver education (Level 1)  
(ii) Further education of licensed drivers on Ecodriving (Level 2)

More information: [www.ecodrive.org](http://www.ecodrive.org)

10. References:


2. To the point 3, Studies on "Drive like a pro – safe driving, both in a professional and a private context", Editor DVR, 2009.


