



Theory of Up Shifting

Introduction to Basic Shifting Techniques

Why do we shift from one gear to another?

- to control RPM
- to go faster
- to go slower
- to prevent lugging
- to prevent over revving
- to raise RPM
- to lower RPM
- to raise RPM to create louder engine sound**
- to make engine brake more effective
- to maximize fuel economy

Smooth shifting techniques need proper practice in order to achieve desired transmission functions.

Low range: (low to 4th gear)

Purpose of low range: used to just get the vehicle and its load moving.
Examples: heavy load
Starting on an incline.

High Range: **Operational gears** (5th gear to 8th gear)

13 speed transmission: low to 4th gear single speed only = 5 speeds
5th to 8th gear, high & low in each gear = 8 speeds

Total 13 speeds

18 speed transmission: 1st low/1st high, 2nd low/2nd high, 3rd low/3rd high etc.

1st gear to 4th gear Low & High = 8 speeds
5th gear to 8th gear Low & High = 8 speeds
Low/low & High low = 2 speeds

Total 18 speeds

The procedures that follow assume the truck is travelling on a level roadway, for example no upgrades or downgrades.

We will present the different techniques to follow for shifting on Upgrades, Downgrades and Hills.

All low range shifts (1st to 4th) accelerate to 1500 RPM)

Double Clutching

Clutch—Neutral—Pause—Clutch—Gear
(The pause is to allow time for the RPM to drop)

Clutch to floor on only the first shift from a stop.

All high range shifts (5th to 8th) accelerate to 1500 RPM

In order to help our students to learn the shifting techniques we teach we will use the single clutch method as below.

Clutch—Neutral—Pause—Gear
(The pause is to allow time for the RPM to drop)

Manual transmissions in cars are Synchro-Mesh meaning we can usually shift from one gear to another at any speed,

NOT SO . with manual truck transmissions

We need to use a formula of factors **RPM + Road Speed + Gear**

i.e. 1500 rpm @ 60 kmh = 6th high
6th high @ 1500rpm = 60 kmh
60 kmh @ 6th high = 1500 rpm

This is the only combination of all three of the above factors that can produce this result.

A typical **Up shift procedure** from 1st gear to 5th gear

We start in Neutral
Clutch to the floor shift into 1st gear
Let clutch out fully—no accelerator

Raise **RPM** smoothly to **1500**
Clutch **½ way** to the floor and shift to Neutral—**Clutch out**
Hold gear shift in front of 2nd gear, **hold slight pressure**
Raise RPM smoothly and **increase pressure gently** until gear shift moves into 2nd gear

Up shift from 2nd gear to 3rd gear
Raise **RPM** to **1500**
Clutch **½ way** to floor shift to neutral—**Clutch out**
Move gear shift to in front of 3rd gear **hold slight pressure**
Raise RPM smoothly and **increase pressure gently** until gear shift moves into 3rd gear

Up shift from 3rd gear to 4th gear
Raise **RPM** to **1500**
Clutch **½ way** to floor shift to neutral—**Clutch out**
Hold gear shift to in front of 4th gear **hold slight pressure**
Raise RPM smoothly and **increase pressure gently** until gear shift moves into 4th gear

Up shift from 4th gear to 5th gear
Select **High/Low lever UP**
Raise **RPM** to **1500**
Clutch **½ way** to floor, go to neutral—**Clutch out**
Move and hold gear shift to in front of 5th gear **hold slight pressure**
Raise RPM smoothly and **increase pressure gently** until gear shift moves into 5th gear

To shift up through 6th gear to 8th gear, use the same procedure as above

Theory of Down Shifting

A driver will make as many down shifts in a day as up shifts.
Whereas we use **RPM** as our guide to teach **up shifts** we use **Speed** to guide us to teach **down shifts**.

Down shifts occur anytime we are coming to a full stop, climbing steep grades and hills and sometimes just to help us slow down.

You should present many driving scenarios during your teaching that will require proper planning in order for the student to accomplish them safely and efficiently.

It was presented in the Theory of Up Shifting that there are three factors that need to be considered in order to make smooth shifts, either up or down shifts.

RPM + Road Speed + Gear.

Present several situations of **down shift** and the group of factors to consider:

Shifting from 7th gear to 6th gear

Slow to **50 kmh** (gravity and/or brake)

½ clutch -- shift to neutral **Clutch Out**

Move shifter to the front of 6th gear position, **hold slight pressure**

Raise **RPM** gently and **increase pressure gently** to allow **RPM** to match road speed and the shift into 6th gear is accomplished.

Shifting from 6th gear to 5th gear

Slow to **40 kmh** (gravity and/or brake)

½ clutch -- shift to neutral **Clutch Out**

Move shifter to the front of 5th gear position, **hold slight pressure**

Raise **RPM** gently and **increase pressure gently** to allow **RPM** to match road speed and the shift into 5th gear is accomplished.

Shifting from 5th gear to 4th gear

Select low range (lever down)

Slow to **30 kmh** (gravity and/or brake)

½ clutch -- shift to neutral **Clutch Out**

Move shifter to the front of 4th gear position, **hold slight pressure**

Raise **RPM** gently and **increase pressure gently** to allow **RPM** to match road speed and the shift into 4th gear is accomplished.

What is happening in these above scenarios is that we are raising the RPM to the level it would show on the tachometer if we were **already** in the new gear at the speed we are travelling at.

Most speedometers are not very useful for down shifting from 4th gear down so we use vision to relate road speed to the selected gear. Students soon learn to recognize the speeds for the lower gears.

You also want the students vision concentrated on the road ahead in the restricted situations encountered when coming to a stop.

The remaining down shifts (4th to 3rd, 3rd to 2nd, 2nd to 1st.)

Is brake, clutch, gear, brake, clutch, gear, brake, clutch, gear etc.

To down shift going up hills, different technique.

Because gravity is slowing us down we do not need to use the brake,

Instead we watch the RPM, and when we can no longer maintain 1500 RPM, we shift. If we have no accelerator left and we are approaching 1500 we also shift. Usually we will shift to the high in a gear when we shift to the lower gear, this allows us to button shift to the low in the new gear if necessary.

To shift smoothly requires practicing techniques that work.

As in all learning, some parts of learning will be more instinctive than others.

Some common difficulties that students face are:

- (1.) Pushing the clutch too far in or down after the first shift from a stop. This activates the clutch brake and disturbs the rotation of the gears in the transmission.
- (2.) Stabbing the accelerator pedal when raising the rpm whether in an up shift or down shift situation.
- (3.) Forgetting to move the High/Low range lever when shifting from 4th to 5th and from 5th to 4th.
- (4.) Not planning the down shift soon enough, thus running out of the space ahead.

The good news is that all students do learn to shift smoothly.

Remember learning is progressive.



LEVEL ROAD

Progressive Shifting GEAR	RPM
1	1000
2	1100
3	1200
4	1300
5	1400
6	1500
7	1600
8	1700

GEAR UP

Maintain R.P.M. = 1700
 No Gas
 One clutch & shift to neutral
 Two clutch & shift to up gear

GEAR DOWN

Maintain R.P.M. = 1700
 No Gas
 One clutch & shift to neutral
 Two clutch & shift to up gear

GEAR UP

Maintain R.P.M with Brake = 1200
 Shift Quick & No Gas
 One clutch & shift to neutral
 Two clutch & shift to up gear

GEAR DOWN

Maintain R.P.M with Brake = 1000
 One clutch & shift to neutral
 Maintain R.P.M = 1400
 Two clutch & shift quick to down gear



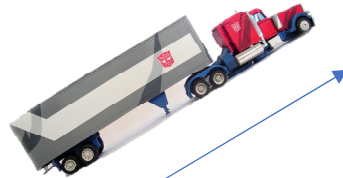
DOWNHILL

GEAR UP

Give gas & maintain R.P.M = 2000
 One clutch & shift to neutral
 Pause for a little bit
 Two clutch & shift to next gear

GEAR DOWN

Give gas & maintain R.P.M = 1500
 One clutch & shift to neutral
 Maintain R.P.M = 2000
 Two clutch & shift to down gear



UPHILL

Basic Shifting Guide for Manual Transmission

13 & 18 speed Progressive Shifting Guide Overview
(RPMs & speeds will vary within trucks, transmissions, differentials, tire size)

Shift up:

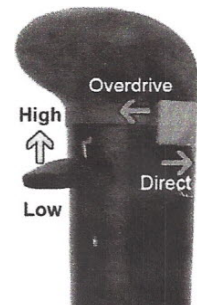
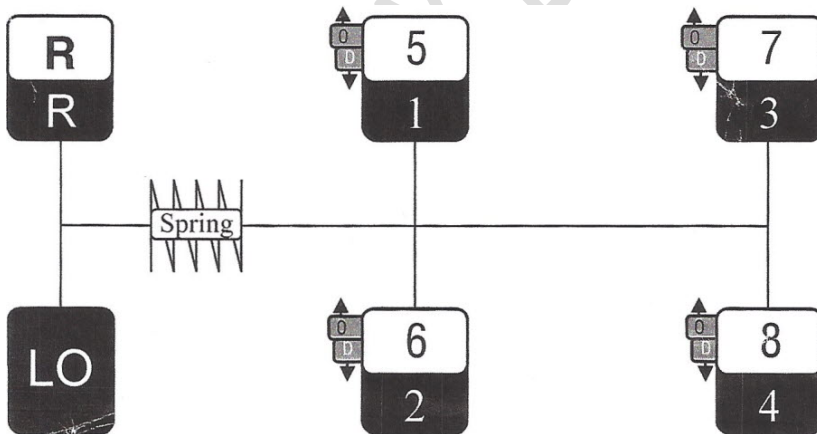
GEAR	RPM	SPEED km/h
1	1,200	5
2	1,300	10
3	1,400	15
4	1,500	20
5	1,700 -1,800	
6		
7		
8		

Low Range 1,2,3,4

High Range 5,6,7,8

Direct

Overdrive



- Below 1,200 RPM shift **DOWN**, above 1,700 RPM shift **UP**
- 500 RPM drop per shift in high range (average)
- 250 RPM drop when splitting gears (Direct •• Overdrive)
- Cruise 1,450 - 1,500 RPM (most engines)

Shifting using the Splitter on a Pre-Select system. Known as shifting 1/2 Gears.

Up Shifting:

From Direct to Overdrive in the same gear:

- Raise the RPM to desired RPM
- Switch splitter forward to overdrive
- Immediately release throttle

From Overdrive to Direct of the next higher gear:

- With positive throttle pressure switch selector back from overdrive to direct
- Immediately make a shift to the next higher gear as normally done
- Shift timing will be twice as fast because engine is only dropping 250-RPM - (500 RPM for a full shift)

Down Shifting:

From Overdrive to Direct in the same gear:

- Drop RPM to desired RPM
- Switch splitter back to direct
- Immediately & slowly raise RPM until gear catches

Down Shifting from Direct to Overdrive of the next lower gear

- Drop RPM to desired RPM
- Release throttle pressure & switch selector from direct to overdrive
- Immediately shift to the next lower gear as normally done
- Raise RPM approximately 250-RPM (not 500 as in a full gearshift)

Turns & Cornering

Instructor demonstration of various turns

Planning:

The planning for a turn at an intersection begins the moment we recognize that a turn will be necessary. As we approach the turn area, we begin to assess what we see. Everything associated with the turn must be assessed.

The most important part of cornering procedures is the **Pre-corner plan**. It obviously takes skill to maneuver a big truck around a corner safely and efficiently but this will not happen consistently without a proper plan. The plan begins as far back from the corner as possible. The basic elements of the plan to consider:

1. Traffic on the street you are on.
2. Your road speed.
3. Whether you will be stopping or not.
4. Gearing down.
5. Lane choice to facilitate positioning.
6. Conditions through the turn into the new street traffic, islands, pedestrians, width etc.
7. Traffic signals, walk signs, stop signs, yield signs, crosswalks etc.
8. Which lane will you finish the turn in?

Positioning:

There are four basic types of cornering and somewhat different positioning of the truck and trailer is necessary in each case.

(1). RIGHT TURN from a STOP:

It is necessary to make wide right turns with a large truck in order to accomplish the turn without hitting the curb, posts, signs or pedestrians etc. This is due to the fact of **OFF-TRACK**, which means that the trailer does not follow the tractor around the corner on the same line or track.

Position your truck & trailer in the right lane if only one right turn lane exists or in the left hand right turn lane if two right turn lanes exist. It may be necessary to straddle both right hand lanes if only one is for straight through or right turns.

*****MAINTAIN CONSTANT OBSERVATION LEFT & RIGHT*****

Positioning:

The purpose of the straddling is to block traffic on the right side, if enough room is left on the right, be sure that vehicles will move into that position.

If we position our truck into the right lane we stay there until about a half truck and trailer length from the corner and then as traffic on the left allows, turn our tractor on an angle to the left. This action keeps our trailer blocking the right lane and begins our blocking of traffic to our left to allow the swing out we require to facilitate making the wide right turn.

As you start from the stopped position consider the gear you want to use through the turn and shift into that gear as soon as possible, it is poor technique to be shifting and turning at the same time. On a road test you will receive demerits if you turn the steering wheel and shift at the same time.

If crossing the centre line of the road you are on or the road you are turning into, it is usually better to take the room on the road you are turning on to, but not always. Sometimes islands, blind corners and narrow roads will necessitate taking more room on the road you are on.

This is all part of your planning as you approach the beginning of the turn.

You will be taught and will practice a variety of right hand turns from a stop and through practice your planning and execution will improve.

(2). RIGHT HAND TURN without STOPPING:

The set-up is similar to the right hand turn from a stop except of course you are moving. It all happens a bit quicker so plan early.

- (1). Get in your desired gear early, you want to be in the proper gear before you block the traffic. This allows you to make the maneuvers at a constant speed with the traffic slowed down behind you as you begin to set-up your position.
- (2). Set-up your position
- (3). Look into the turn and decide where to take the room you need.

*****MAINTAIN CONSTANT OBSERVATION LEFT & RIGHT*****

- (4). Exaggerate your visual tracking forward, right rear and left

throughout the turn.

(5.) Which lane will you finish the turn in?

(3.) LEFT HAND TURN from a STOP:

If there are two left turn lanes take the one on the right. If only one a slight widening out to the right may be necessary.

There are some main points to consider:

- (1.) Plan the turn as early as possible
- (2.) Get into the proper gear. (Do not shift while turning the wheel)
- (3.) Cross traffic, pedestrians, walk signals, advance lights etc.
- (4.) Looking into the turn determine the obstacles such as islands etc.
How many lanes on the road being turned into?

*****MAINTAIN CONSTANT OBSERVATION LEFT & RIGHT*****

- (5.) Distance the tractor is moved straight ahead before the swing to the left.
- (6.) Which lane will you finish the turn in?

Positioning:

(4.) LEFT TURN without STOPPING:

Similar considerations to the same turn from a stop except again it all happens a little quicker. **Consider:**

- (1.) Plan early
- (2.) Get the right gear
- (3.) Look into the turn, where will the trailer finish the turn?

****MAINTAIN CONSTANT OBSERVATION LEFT & RIGHT****

- (4.) How wide is the road being turned into?

- (5). Parked cars, obstructions, how wide can you swing, traffic on crossroad, pedestrians, lights etc.
- (6). Which lane will you finish the turn in?

Most turns, left and right end in the right lane. There are exceptions that will be pointed out when the need arises.

INTEGRITY DRIVING SCHOOL

