Informal document **GRVA-07-70**
7th GRVA, 21-25 September 2020,
Agenda item 7

Proposals from the Informal Working Group on AEBS to amend UN R. No. 152

- Including Car to Bicycle scenario in the regulation
- Amendments of 00 and 01 series

Four working documents (26, 27, 28, 35)
Four informal documents (09, 10, 11, 53)

Discussion point in 7th GRVA

Part I

- Requirement of Car to Bicycle scenario
- Implementation of requirements (Single step or 2 step)

Guidance from GRVA

Part II

- Amendments of existing regulations

(00 series and 01 series)

Deactivation of AEBS, Road test surface,
False reaction scenarios, Clarifications, Corrigendum

Guidance from GRVA

Informal Working Group on AEBS for Light Vehicles

5th GRVA in February 2020:

GRVA agreed to continue the discussions about "Car to Bicycle scenario"

IWG meetings

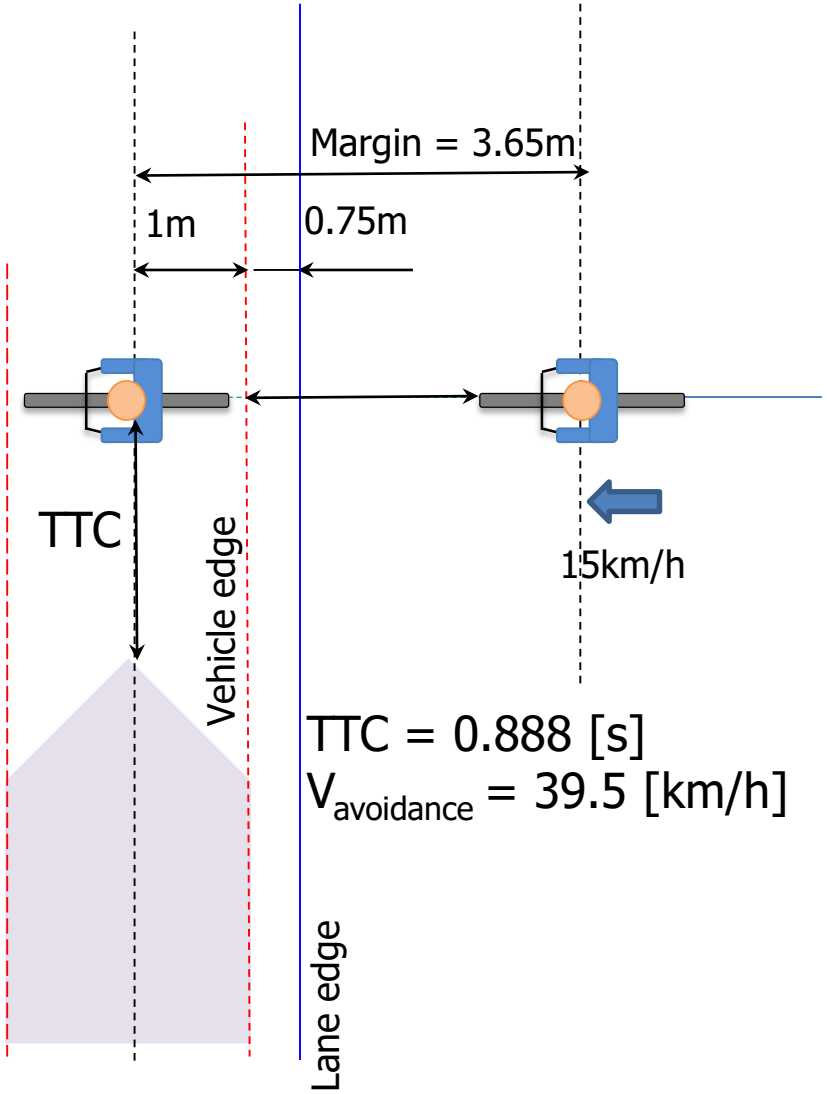
12th meeting in web (14-15 May 2020)
13th meeting in web (25-26 June 2020)
14th meeting in web (4 September 2020)

7th GRVA in September 2020:

Result of 12th and 13th → GRVA-2020-26, 27, 28, 35
Result of 14th → GRVA-07-09, 10, 11, 53

Car to Bicycle scenario

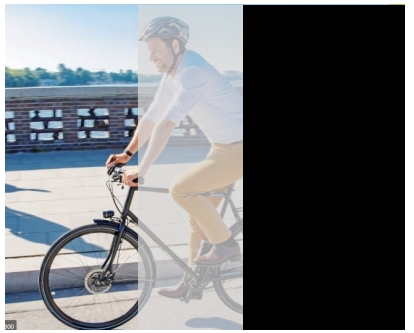
Informal Working Group on AEBS for Light Vehicles
Specifications - Car to Bicycle scenario



- Scenario of C2B
  - Inserting a new paragraph 5.2.3. and 6.7.
  - Crossing collision same as Car to Pedestrian scenario
- What is different between C2B and C2P?
  - Speed (including tolerance in test) of target
    C2B: 10 to 15 km/h in Para. 5.2.3.4.
    C2P: Not more than 5 km/h in Para. 5.2.2.4.
  - Robustness system in Para. 6.10.1
    C2B: 20 % and C2P: 10 %
  - Lower speed of ego vehicle in Para. 5.2.3.3.
    Single step or 2 step

Informal Working Group on AEBS for Light Vehicles
Robustness system in Para. 6.10.1 The reason for 20% - Car to Bicycle

- **<u>At the lower speed limit:</u> Stable detection of a bicycle is far more difficult than that of a pedestrian.**
  - The limiting factor of performance is the field of view of the sensing system.
  - In order to make a robust decision for intervention, the objects need to be detected and classified consistently over a period of time.



- **<u>At the upper speed limit:</u> The emergency braking timing calculation used in system design is more complex than the basic assumptions used to calculate the maximum speed reduction.**
  - Car2Pedestrian = intervention starts, when the pedestrian is only 30cm away from the path of the vehicle.
  - Car2Bicycle = intervention starts, when the bicycle is several meters away.
  - Therefor the risk of false activations is increased.

Informal Working Group on AEBS for Light Vehicles
Final Specifications in GRVA-2020-27 or 28 - Car to Bicycle – Speed reduction

Maximum Impact Speed (km/h) for M_1

Subject vehicle speed (km/h)	*Maximum mass*	*Mass in running order*
20	0.00	0.00
25	0.00	0.00
30	0.00	0.00
35	0.00	0.00
38	0.00	0.00
40	10.00	0.00
45	25.00	25.00
50	30.00	30.00
55	35.00	35.00
60	40.00	40.00

Maximum Impact Speed (km/h) for N_1

Subject vehicle speed (km/h)	*Maximum mass*	*Mass in running order*
20	0.00	0.00
25	0.00	0.00
30	0.00	0.00
35	0.00	0.00
36	0.00	0.00
38	15.00	0.00
40	25.00	0.00
45	30.00	25.00
50	35.00	30.00
55	40.00	35.00
60	45.00	40.00

IWG proposed two options for existing vehicles.

Single step: full collision avoidance from 20km/h from 5/2026

2 step: full collision avoidance from 30km/h from 5/2026

20 km/h from 9/2028

Informal Working Group on AEBS for Light Vehicles
Difference between single step and 2 step: Summary

Approaches	Suppl. or Series	New Type Approvals	Existing Type Approvals
Single step approach	Car-to-bicycle (as a Suppl. 2 to the 01 series)	May 2024	Can be mandated as from May 2026
2 step approach	Car-to-bicycle – Step 1 (as a Suppl. 2 to the 01 series)	Date of Entry Into Force and before May 2024	Shall be accepted until September 2028
	Car-to-bicycle – Step 2 (as a new 02 series)	May 2024	Can be mandated as from September 2028

Informal Working Group on AEBS for Light Vehicles
Guidance from GRVA about Car to Bicycle scenario

Guidance from GRVA related Car to Bicycle scenario

- Requirement of Car to Bicycle scenario
- Implementation of requirements (Single step or 2 step)

Documents

- Single step
  - GRVA-2020-27 (Supplement amendment of 01 series)

- 2 step
  - GRVA-2020-35 (Supplement amendment of 01 series)
  - GRVA-2020-28 (New 02 series)
  - GRVA-07-12 (OICA/CLEPA)

Part II

- Amendments of existing regulations
  (00 series and 01 series)

Deactivation of AEBS, Road test surface,
False reaction scenarios, Clarifications, Corrigendum

Informal Working Group on AEBS for Light Vehicles

Working Documents

- Reflecting the result of IWG in June 2020
- **GRVA-2020-26** (Supplement 3 amendment of 00 series)
- **GRVA-2020-27, 28 and 35** were reflected same amendments of GRVA-2020-26.

Informal Documents

- Reflecting the result of IWG in September 2020
- GRVA-2020-26 was amended by **GRVA-07-09** (00 series)
- GRVA-2020-27 was amended by **GRVA-07-10** (01 series as single step)
- GRVA-2020-28 was amended by **GRVA-07-11** (02 series as 2 step)
- GRVA-2020-35 was amended by **GRVA-07-53** (01 series as 2 step)

Informal Working Group on AEBS for Light Vehicles
Amendment of existing regulations

Items

- **Deactivation of AEBS (Para. 5.4.2.3)**
- **Road test surface (Para. 6.1.1.1)**
- **False reaction scenarios (Appendix 2 in Annex 3)**
- **Response to failures (Para. 5.1.4.1.3)**
- **False reaction avoidance (Para. 5.1.6)**
- **Speed reduction by demand (Para. 5.2.1.4, 5.2.2.4, 5.2.3.4)**
- **Sensor misalignment (Para. 5.4.2)**
- **Relationship between AEBS and other ADAS (Para. 5.4.4)**
- **Yellow color for signaling AEBS temporary deactivation (Para. 5.5.7)**
- **Permitting deviating test conditions (Para. 6.1.6)**
- **Test target of Car to Car scenario (Para. 6.3.1)**
- **Subject vehicle test speed in test procedures (Para. 6.4, 6.5, 6.6, 6.7)**

Proposed by (1) Working document, (2) Working and Informal document, (3) Informal document.

Informal Working Group on AEBS for Light Vehicles
Amendment of existing regulations

- **Deactivation of AEBS (Para. 5.4.2)**

Working document (26, 27, 35)

5.4.2. When the vehicle is equipped with a means to automatically deactivate the AEBS function, for instance in situations such as off-road use, being towed, being operated on a dynamometer, being operated in a washing plant, in case of a non-detectable misalignment of sensors, **[or when the Electronic Stability Control is switched off,]** the following conditions shall apply as appropriate:

- **OICA propose this issue as GRVA-2020-25.**
- **IWG could agree the below requirement in last Sep. IWG.**
- **New proposal in informal documents (9, 10, 11)**

5.4.2.3. Where automatic deactivation of the AEBS function is a consequence of the driver manually switching off the ESC function of the vehicle, this deactivation of the AEBS shall require at least two deliberate actions by the driver.

Informal Working Group on AEBS for Light Vehicles
Amendment of existing regulations

- **Road test surface (Para. 6.1.1.1)**

Working document (26, 27, 35)

6.1.1.1. The road test surface shall have a nominal peak braking coefficient (PBC) of **at least** 0.9. unless otherwise specified. when measured using either:
In footnote 3: The "nominal" value is understood as being the **minimum** theoretical target value."

- **IWG agreed the below requirement in last Sep. IWG.**

- **New proposal in informal documents (9, 10, 53)**

6.1.1.1. The road test surface shall have a nominal peak braking coefficient (PBC) of ~~**at least**~~ 0.9. unless otherwise specified. when measured using either:

In footnote 3: The "nominal" value is understood as being the ~~**minimum**~~ theoretical target value."

Since it is the provisions regarding road to be used in other tests (R140 / R78), PBC value should be in the same sentence as the R140 / R78 in accordance with GTR3 / GTR8.

As a practical issue according to ASTM, there are several test surfaces that do not exceed a PBC value of 0.9 per year check. Taking into account this, the simple wording "nominal" is suitable according to ASTM method.

- **False reaction scenarios (Appendix 2 in Annex 3)**

Working document (26, 27, 35)

Insert a new introductory paragraph, to read:

The following scenarios shall be used to assess the system's strategies implemented in order to minimize the generation of false reactions. For each type of scenario the vehicle manufacturer shall explain the principle strategies implemented to ensure safety.

The manufacturer shall provide evidence (e.g. simulation results, real-world test data, track test data) of the system's behaviour in the described types of scenarios. The parameters described in subparagraph 2 of each scenario shall be used as guidance if the Technical Service deems a demonstration of the scenario necessary.

New scenario for false reaction of AEBS

Scenario 1: Left turn or Right turn at the intersection
Scenario 2: Right turn or Left turn of a forward vehicle
Scenario 3: Curved road with guard pipes and a stationary object
Scenario 4: Lane change due to road construction

These scenarios were proposed by Japan (AEBS-13-07)

- **False reaction scenarios (Appendix 2 in Annex 3)**
  Informal document (9, 10, 53)

1. Move definitions as a new introduction paragraph.

- **Overlap ratio**
  (The name change from the wrap ratio to the overlap ratio)
- **Offset ratio**

2. Amendment of corrigendum
in Figure 1 (left turn) and Figure 2 (right turn).

Informal Working Group on AEBS for Light Vehicles
Amendment of existing regulations

- **Response to failures (Para. 5.1.4.1.3)**
  Informal documents (9, 10, 53)

Insert a new paragraph 5.1.4.1.3., to read:

"**5.1.4.1.3.** **Upon detection of any non-electrical failure condition (e.g. sensor blindness or sensor misalignment), the warning signal as defined in paragraph 5.1.4.1. shall be illuminated.**"

Paragraph 5.1.4.3., delete.

Proposal to move the current paragraph 5.1.4.3. up as a 3rd subparagraph of 5.1.4.1.

The latter states that any failure that leads the system to no longer meet the requirements, shall be indicated to the driver. The following sub-paragraphs address the individual failure response to an electrical failure (5.1.4.1.1.) to a delayed initialization (5.1.4.1.2.) and the third sub-paragraph should be non-electrical failure conditions (which is currently a separate paragraph).

- **False reaction avoidance (Para. 5.1.6)**
  Informal documents (9, 10, 53)

5.1.6. False reaction avoidance

The system shall be designed to minimise the generation of collision warning signals and to avoid advanced emergency braking in situations where **there is no risk of an imminent collision** ~~the driver would not recognise an impending collision~~. This shall be demonstrated in the assessment carried out under Annex 3, and this assessment shall include in particular scenarios listed in Appendix 2 of Annex 3.

This amendment aims to clarify that warning or emergency brakings shall not be given in situations where the driver would not assess the situation to be critical. With the original wording "where the driver would not recognise an impending collision" it could be misunderstood that interventions were only justified where the criticality of a situation was obvious to the driver, which is not always the case.

Informal Working Group on AEBS for Light Vehicles
Amendment of existing regulations

- **Speed reduction by demand (Para. 5.2.1.4 and Para. 5.2.2.4)**
  Working document (26, 27, 35)

5.2.1.4. Speed reduction by braking demand

(e) In ambient illumination conditions of at least 1000 Lux without ~~direct~~ blinding **of the sensors (e.g. direct blinding** sunlight**)**;

(f) In absence of weather conditions affecting the dynamic performance of the vehicle (e.g. no storm, not below 0° C); ~~and in absence of extreme driving conditions (e.g. harsh cornering).~~

(g) When driving straight with no curve, and not turning at an intersection.

Paragraph 5.2.1.4.(e): refining the wording since the light affecting the sensor can be indirect; the direct sunlight is only an example

Paragraph 5.2.1.4.(f): attempts to further discriminate the relevant affecting parameters in order to avoid large exemptions. Technically, two effects are simultaneously at stake:

(a) The yaw movement of the sensor attached to the vehicle can create a "ghost" movement in the perception of a stationary (or slow moving) obstacle

(b) In the case of a turning event (e.g. at a junction or in a parking) an obstacle can remain out of the field of detection until the very end of the manoeuvre.

- **Sensor misalignment (Para. 5.4.2)**
  Informal documents (9, 10, 53)

5.4.2. When the vehicle is equipped with a means to automatically deactivate the AEBS function, for instance in situations such as off-road use, being towed, being operated on a dynamometer, being operated in a washing plant, ~~in case of a non-detectable misalignment of sensors,~~ the following conditions shall apply as appropriate:

This provision is already covered by the new paragraph 5.1.4.1.3.: need to avoid confusion with the warning.

- **Speed reduction by demand (Para. 5.2.2.4)**

Working document (26, 27, 35)

5.2.2.4. Speed reduction by braking demand

(a) With unobstructed **perpendicularly** crossing pedestrians with a lateral speed component of not more than 5 km/h;

Paragraph 5.2.2.4 (a): clarifies that the pedestrian's path is assumed to be broadly perpendicular to the ego vehicle's path for avoiding the effect of an unexpected component of movement.

- **Relationship between AEBS and other ADAS (Para. 5.4.4)**
  Working document (26, 27, 35)

Insert a new paragraph 5.4.4., to read

5.4.4. While automated driving functions are in longitudinal control of the vehicle (e.g. ALKS is active) the AEBS function may be suspended or its control strategies (i.e. braking demand, warning timing) adapted without indication to the driver, as long as it remains ensured that the vehicle provides at least the same collision avoidance capabilities as the AEBS function during manual operation.

This proposal to clarify the understanding of the AEBS functioning when assistance systems are in operation: "when a longitudinal control system is active, the vehicle deceleration may be smooth enough not to reach the requested 5 m/s² (paragraph 5.2.2.2.) hence making the AEBS superfluous. Of course, AEBS remains in veil and intervenes in case of sudden unexpected event".

- **Yellow color for signaling AEBS temporary deactivation (Para. 5.5.7)**
  Informal documents (9, 10, 53)

5.5.7. When the driver is provided with an optical warning signal to indicate that the AEBS is temporarily not available, for example due to inclement weather conditions, the signal shall be **constant** ~~**and yellow in colour**~~. The failure warning signal specified in paragraph 5.5.4. above may be used for this purpose.

Proposal to avoid a confusion by the driver of the conditions of paragraph 5.4.3. (AEBS deactivation) and of paragraph 5.5.7. (function not available).

Informal Working Group on AEBS for Light Vehicles
Amendment of existing regulations

- **Permitting deviating test conditions (Para. 6.1.6)**
  Informal documents (9, 10, 53)

Insert a new paragraph 6.1.6., to read

6.1.6. At the request of the manufacturer and with the agreement of the Technical Service tests may be conducted under deviating test conditions (suboptimal conditions, e.g. on a not dry surface; below the specified minimum ambient temperature), whilst the performance requirements are still to be met.

This amendment aims to carry over the amendment to UN-R79 ACSF B1 already adopted by GRVA-04 to the AEBS Regulation as well.
In order to ensure type approval testing also during the winter months it should be possible to test vehicles also on wet surfaces or at lower temperatures. Since both influences tend to result in lower adhesion, this results in a more challenging situation to the system than the standard test conditions defined by the Regulation, and additional demonstration of system behavior within the specified range is not necessary because it would already be covered by the performed tests.

- **Test target of car to car scenario (Para. 6.3.1)**
  Working document (26, 27, 35)
- 6.3.1. The target used for the vehicle detection tests shall be a regular high-volume series production passenger car of Category M1 AA saloon. or alternatively a "soft target" representative of such a vehicle in terms of its identification characteristics applicable to the sensor system of the AEBS under test according to ~~ISO 19206-1:2018~~ **ISO 19206-3:2020**. The reference point for the location of the vehicle shall be the most rearward point on the centreline of the vehicle.

Informal Working Group on AEBS for Light Vehicles
Amendment of existing regulations

- **Subject vehicle test speed in test procedures (Para. 6.4, 6.5, 6.6, 6.7)**
  Working document (26, 27, 28, 35)
  Informal documents (9, 10, 11, 53)

Maximum mass	Mass in running order	**Tolerance**
20	20	**+2/-0**
40	42	**+0/-2**
60	60	**+0/-2**

All values in km/h ~~**with a tolerance of +0/-2 km/h**~~

At low test speeds, the current tolerance would force testing at e.g. 18 km/h, i.e. at speeds beyond the operating design domain of the system or of the frame of testing conditions. The tolerance must hence be shifted into the domain of operation and/or the defined test conditions.

TOR (GRRF-84-03)

The informal group shall address the following issues:

a. Define AEBS requirements adapted to moving and stationary obstacles. Priority will be given to rear end collision with M/N vehicles.

b. Define AEBS requirements adapted to pedestrians.

c. Define AEBS requirements adapted to cyclists

d. Shall provide a technical review for the extension of technical requirements to include motorcyclists and large animals.

Thank you for your attention

Appendix

4th GRVA (September 2019)
GRVA agreed two proposal in 4th session.

- 01 supplement amendment of existing regulation (GRVA-04-51 → WP29-2020-09)
- 01 series amendment for C2P and deletion of N1 full cab (GRVA-04-52 → WP29-2020-10)

Result of 180th WP29 in March 2020

- **WP29-2020-09 and WP29-2020-10 were adopted at WP29 in March.**
  - 01 supplement amendment of the original series (Revision of requirements etc.)
  - 01 series amendment (Remove N1 full cab vehicle etc.)

5th GRVA (February 2020)
GRVA agreed the proposal for "Robustness of system" in 5th session.

- GRVA adopted the proposal of the original and 01 series amendment in 5th session. (GRVA-2020-17 amended by GRVA-05-60 → WP29-2020-98)

181th WP29 in June 2020

- **WP29-2020-98 (original series) was adopted at WP29 in June.**
  - 02 supplement amendment of the original series (Robustness system)
  - 01 supplement amendment of 01 series (Robustness system) (Confirmation: 182th WP29 in November 2020)

- **Single step (Details in GRVA-2020-27)**
  - Below requirements apply as **Supplement 02 of the 01 series**.
  - Lower speed range of subject vehicle is from **20 km/h**

Maximum Impact Speed (km/h) for M_1

Subject vehicle speed (km/h)	*Maximum mass*	*Mass in running order*
20	0.00	0.00
25	0.00	0.00
30	0.00	0.00
35	0.00	0.00
38	0.00	0.00
40	10.00	0.00
45	25.00	25.00
50	30.00	30.00
55	35.00	35.00
60	40.00	40.00

Maximum Impact Speed (km/h) for N_1

Subject vehicle speed (km/h)	*Maximum mass*	*Mass in running order*
20	0.00	0.00
25	0.00	0.00
30	0.00	0.00
35	0.00	0.00
36	0.00	0.00
38	15.00	0.00
40	25.00	0.00
45	30.00	25.00
50	35.00	30.00
55	40.00	35.00
60	45.00	40.00

- **2 step**
  - Combination of **Supplement amendment** and **Series amendment**.
  - Below table show the transitional provision for the series amendment.

	New Type Approvals	**Existing Type Approvals**
Car-to-bicycle – Step 1 (as a Suppl. 2 to the 01 series)	Date of Entry Into Force	Shall be accepted until September 2028
Car-to-bicycle – Step 2 (as a new 02 series)	May 2024	Can be mandated as from September 2028

- **2 step (Details in GRVA-2020-35)-Step1**
  - Below requirements apply as **Supplement 02 of the 01 series**.
  - Lower speed of subject vehicle is from **30 km/h**

Maximum Impact Speed (km/h) for M_1

Subject vehicle speed (km/h)	*Maximum mass*	*Mass in running order*
30	0.00	0.00
35	0.00	0.00
38	0.00	0.00
40	10.00	**0.00** ~~10.00~~
45	25.00	25.00
50	30.00	30.00
55	35.00	35.00
60	40.00	40.00

Maximum Impact Speed (km/h) for N_1

Subject vehicle speed (km/h)	*Maximum mass*	*Mass in running order*
30	0.00	0.00
35	0.00	0.00
38	15.00	0.00
40	25.00	10.00
45	30.00	25.00
50	35.00	30.00
55	40.00	35.00
60	45.00	40.00

IWG agreed the collision avoidance at 40 km/h.
GRVA-07-11 Para. 5.2.3.4.

- **2 step (Details in GRVA-2020-28)-Step2**
  - Below requirements apply as **the new 02 series**.
  - Lower speed of subject vehicle is from **20 km/h**

Maximum Impact Speed (km/h) for M_1

Subject vehicle speed (km/h)	*Maximum mass*	*Mass in running order*
20	0.00	0.00
25	0.00	0.00
30	0.00	0.00
35	0.00	0.00
38	0.00	0.00
40	10.00	0.00
45	25.00	25.00
50	30.00	30.00
55	35.00	35.00
60	40.00	40.00

Maximum Impact Speed (km/h) for N_1

Subject vehicle speed (km/h)	*Maximum mass*	*Mass in running order*
20	0.00	0.00
25	0.00	0.00
30	0.00	0.00
35	0.00	0.00
36	0.00	0.00
38	15.00	0.00
40	25.00	0.00
45	30.00	25.00
50	35.00	30.00
55	40.00	35.00
60	45.00	40.00