Terms and Conditions *(Rev.03)*
AUTOTRAC 2020 – DG JRC, EC

1.   Introduction

Connectivity and automation are expected to bring a deep transformation in the automotive industry and the transportation networks. The European Commission took a prominent role in the deployment of connected driving, by setting up a C-ITS Deployment Platform on 2014 (European Commission, 2014). In the final report of the C-ITS Platform (European Commission, 2017) it is mentioned that for cities across the EU, the potential arrival of automation raises the prospect of safety issues, increased traffic and consequently worsened pollution and congestion, if not tailored and shaped towards the needs of local authorities. A main report conclusion is the need for orchestration of services, that is, to put in place, when appropriate, the traffic management measures by the means of the different stakeholders, public and private, that are required to come together and act accordingly to pre-established agreements. However, the impact is still vague as current Automated Vehicles (AV) products do not focus on vehicles' cooperation (System-centric approach) but rather on individual performances (User-centric approach). Transport engineers agree that better ways of traffic management need to be investigated and JRC conducts already research towards this direction through the C2ART project[1].

The organization of a small-scale AUTOnomous vehicle TRAffic Challenge (AUTOTRAC) is funded by the JRC Exploratory Research Programme (ER activity). It aims to raising awareness on the potential impact of automated vehicles' cooperation in future transport networks. Are CAVs capable to do a better utilization of the network? Can they deliver the anticipated promises for less congestion, safer and greener mobility? **Promotion of the cooperation between AVs, more efficient energy consumption and the reasonable utilization of the transport network are the main pillars of the AUTOTRAC initiative.** AUTOTRAC is a competition of small-scale AVs asking the participation of students, universities, research centers and the makers' community. Each team participates with multiple AV robots that should demonstrate a) efficiency in automated driving and b) communication with the other AVs of the fleet for better network utilization. So, in contrast to currently running small-scale AV competitions, AUTOTRAC promotes the conceptualization and implementation of collaborative behaviours between robot vehicles.

2.   General information

The competition is organized by the Joint Research Center (JRC) of the European Commission and it will take place in Ispra (VA) from 5 to 7 October 2020.

Six teams have already confirmed their participation. By confirming their participation, the teams agree with the terms and conditions of the competition.

For other teams, the application is extended until 30 April 2020.

Each team selected for participation in the JRC AUTOTRAC should provide (only if not already done) specific documentation by 30 April 2020 (see qualification section).

The technical specifications will freeze one month before the competition. From the moment that the list of participant is fixed, any updates will be communicated via email and not via the website. **For further questions regarding the JRC AUTOTRAC please contact JRC-AUTOTRAC@ec.europa.eu**

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[1] https://trimis.ec.europa.eu/project/towards-connected-coordinated-and-automated-road-transport-c2art-system

3.   Participation

Admission to the AUTOTRAC competition is subject to the following conditions:

- **Up to 4 members of each team are allowed** to attend the competition in the Ispra premises of the JRC. However, there is no restriction the individuals that contribute in the preparation of the team. Each team should participate with exactly 4 vehicles (the vehicles can be different).
- **All teams will receive a compensation of approximately 2.000€. The compensation will be in the form of a European Commission expert contract to the team leader. The expert contract will be paid upon receipt of the technical description of the solution that should be delivered by 30 June 2020 (afterwards you will be of course allowed to further improve the performances of your fleet until the date of the competition).**
- **Furthermore, for the winning team of the challenge there will be the possibility to develop a demonstrator in the Ispra site of the JRC with a contract of around 15.000€.**
- **Finally, the winning team will have the opportunity to demonstrate their performance during a high-level scientific event organized in 2021. More information about the specific event will be provided following the end of the competition.**
- **The JRC will provide financial support for travel and accommodation for all the teams. The financial support will be provided according to the rules of the European Commission. More details will be communicated at a later stage.**
- JRC will offer to all participants snacks, coffee and lunch, while the first day there will be a dinner in the JRC premises.
- Customized "JRC AUTOTRAC 2020" T-shirts will be provided to all teams.
- **There is no admission fee for the competition**
- Participants must be over 14 years old at the start of the competition. At least one of the team members shall be at least 18 years old and take responsibility of those under 18.
- Each team will have to indicate a contact person who will interact with the organizers of the competition.
- Visitors accompanying the team are exceptionally allowed upon approval by the organizers. In any case they are excluded from participation and reimbursement schemes.
- A technical area will be available to the teams near the competition area with 220V electric power supply and work tools.
- By registering, every team and every participant declare their agreement with the publication of image, video and audio recordings. This also includes the recording of team presentations.
- The participants accept a JRC referee team that will decide the final ranking and will be responsible to solve any objections or problems that may arise.

4.   Vehicle requirements

This section describes the regulations related to the vehicle requirements. Violation of these requirements can lead to exclusion of the competition.

For each vehicle the following should apply:

- The vehicle must be registered before the competition. The registration process includes technical inspection of the vehicle and testing of the remote start and stop function.
- To facilitate the recognition of the 4 vehicles by the judges and the camera, 4 stickers (will be provided by the organization) with a different colour (red, green, blue and yellow) will be positioned at the 4 corners of each vehicle. The vehicle must provide an adequate flat space (white to avoid interference with the detection system) on top to position these stickers.
- The stickers will have a white background with a size of 4x4cm with inside the colored sticker with a diameter of 3cm.
- Technical inspection must be completed by the time specified by the organizers.
- The vehicle must not damage the field or endanger the spectators in any way.

- The vehicle must be completely automated. Any kind of interaction with the team members or any other remote entity during the runs is forbidden with the consequent exclusion from the competition.
- The vehicle must have a remote control which should be used for start or stop. The remote control can also give commands before the start of the run about choice of the scenario (J or #) or assignment of the colour.
- The vehicle should be equipped with electric motors.
- Energy must be supplied with batteries. Max Voltage battery 24V or LiPo 6S (22,2V).
- Changing and charging batteries is allowed.
- The vehicles must be based on a chassis with maximum dimensions 250x250x250mm (width, length, height); only sensors for external lines/spaces recognition can exceed the dimensions of the vehicle by a maximum of 3 cm on all sides.
- The vehicle's maximum weight should be 3kg.
- The sensor setup can be arbitrarily chosen by the teams. Laser sensors are allowed only up to class 2 devices. Reference standard for laser devices: IEC 60825-1: 2014
- There is no limitation to the use of robotic platforms and sensors.
- Each vehicle must be equipped with at least one camera for environment recognition.
- It is possible to use smartphones or tablets (not PCs) beyond the maximum measurements and weight of the rules.
- 2nd and 3rd day, when the competition begins, the hardware of the vehicle cannot be modified except in case of supervised repair.
- The software can be changed during the competition (2nd and 3rd day), but not during the run.
- Each team is free to apply Vehicle-to-Vehicle (V2V) connectivity between its vehicles. Own private WiFi router/network, Bluetooth, radio transmission, etc... is allowed (including communication between PC and vehicle). However, participants are reminded that remote control of vehicles is prohibited, except for start and stop, choice of the scenario (J or #) or assignment of the colour). No WiFi network for such reason will be provided by the JRC.

5. Tracks

This section describes the specifications of the track where the scenarios will take place. There will be 2 tracks.

Highway Scenario (J-shape track)   Urban Scenario (#-shape track)
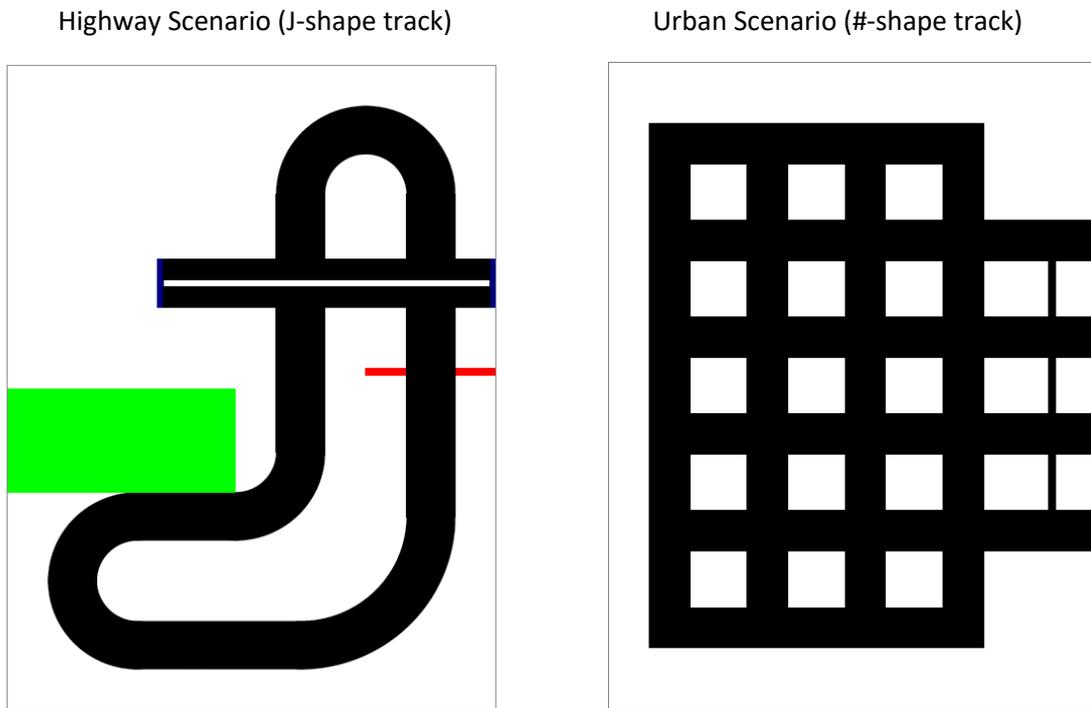
Fig. 1 - Networks layouts for the AUTOTRAC Competition. On the left the J-shape track corresponding to highway conditions. On the right the #-shape track corresponding to urban conditions.

J-shape track: The J-shape track resembles highway traffic conditions. It is a one-lane track with the shape of the letter 'J'. Regarding its dimensions, the track will be enclosed in a rectangle of 4x3 meters (4 panels 2x1.5 meters joined together with insulating tape). The width of the lane is 300mm. An illustrative representation of the track is depicted in Fig. 1 (left).

The minimum turning radius of the line is 400mm (in the middle of the lane).

The track will be crossed by a vehicle (obstacle) that will move forward and back along a white line (like a tram). If the vehicle touches the obstacle, it will be penalized.

The size of the mobile obstacle (tram) is approximately 150x150x150mm with a (almost) constant speed of about 0.1m/s.

To improve the recognition of the tram by vehicles, two stickers (diameter 3mm) of different colours will be positioned on the right (red) and left (green) side, approximately 10 cm above the ground. The red sticker will be positioned in the direction of the starting line.

The 'tram' is not responsible to recognize approaching vehicles. On the contrary, the competing vehicles should be able to predict the movement of the 'tram' and regulate their movement accordingly.

There is no restriction on whether all vehicles should wait for the 'tram' or the car-platoon should be split. If this happens then the remaining vehicles should be able to catch up the car-platoon.

On one sides of the path, there is the parking area, printed in green ink. In this parking area, there will be no line markings. The challenge is to park all vehicles (whole vehicle body) inside the green area without touching each other.

#-shape track: The #-shape represents urban traffic conditions. It is a one-lane track with 12 intersections. Regarding its dimensions, the track will be enclosed in a rectangle of 4x3 meters (4 panels 2x1.5 meters joined together with insulating tape). The width of the lane will be 250mm. An illustrative representation of the track is depicted in Fig. 1 (right).

The black lane is surrounded by 35 cm of free-white space on both sides. The minimum space from the outer edges is 25 cm.

On the #-shape track, there will be test areas for the colours and the type of traffic signs.

The material for both tracks will be rigid panels (FOREX thickness 5mm), with white background and black surface for the tracks/lanes. Everything will be printed in four-colour ink process (CMYK).

The following colours will be printed on fabric or matte paper, in order to minimise light reflection.

The colours used in the tracks and in the traffic signals are:

White	CMYK: 0, 0, 0 ,0	RGB: 255, 255, 255
Black	CMYK: 0, 0, 0, 100	RGB: 0, 0, 0
Red	CMYK: 0, 100, 100, 0	RGB: 255, 0, 0
Green	CMYK: 100, 0, 100, 0	RGB: 0, 255, 0
Blue	CMYK: 100, 100, 0, 0	RGB: 0, 0, 255
Yellow	CMYK: 0, 0, 100, 0	RGB: 255, 255, 0

6.   Scenarios and objectives

There are two test scenarios in the JRC AUTOTRAC competition, one scenario corresponding to highway conditions, another to urban driving. The layout of the two test tracks is shown in Figure 1.

Highway Scenario and parking (J-shape track)

The Highway scenario takes place on the J-shape track. Each team sets up all four vehicles in the track. The 4 vehicles will be positioned on the red START line in a straight line. Intervehicle distance will be set to 5 cm. At their starting position, the vehicles must be positioned with both wheels on a portion of the black track; only the sensors (extra 3 cm) can be on the white background. The vehicles should drive as fast as possible and on the same time they need to keep as close as possible to each other without creating or being involved in a crash (accident), for the whole duration of the test, which lasts 3minutes. At the end of the run, the 4 vehicles will have 1 minute to park in the green parking area without contact. An additional score will be given for each correctly parked vehicle. Each team has 10 minutes available to position the vehicles, start the test, complete it and park the vehicles. The scoring of the teams will depend on an automated camera-based referee and the penalties as described in the "Scoring and Evaluation" section. Teams that do not manage to finish, won't be scored.

Urban Scenario (#-shape track)

The Urban scenario takes place on the #-shape track. Each team sets up all four vehicles in the four different initial positions of the track. The team will choose the colour to be assigned to each vehicle before departure. This can be done manually or automatically using the recognition with the camera of one of the signs on the track. At their starting position, the vehicles must be positioned with both wheels on a portion

of the black track; only the sensors (extra 3 cm) can be on the white background. When an action from the vehicle is expected (turn left or right) there will be a traffic sign with the corresponding colour at the intersection. The vehicle should be able to recognize the traffic signs through its sensors or camera(s). There will be signs only when the vehicle has to turn. If not, the car has to go straight. The vehicles should follow as quickly as possible the paths indicated by the signs of their assigned colour without creating or being involved in a crash (accident), for the whole duration of the test, which lasts 3 minutes. Each team has 10 minutes available to position the vehicles, start the test and complete it. The scoring of the teams will depend on the automated camera referee and the penalties as described in the "Scoring and Evaluation" section. Teams that do not manage to finish, won't be scored.

Please note:

Each starting position (colour assigned to the vehicle) and the position of the signs on the track will be the same for all teams.

This is a one-lane track. Each track will have a unique direction. Vehicles can meet only in the intersections.

Road signs will be positioned to avoid a "dead end".

Mixed tests (J-shape track)

After all teams will have completed their tests, they will be randomly divided in 4 groups. Each team will make available one or more vehicles for each group. The leading vehicle will be chosen randomly. The four newly formed fleets of four vehicles will repeat exactly the same tests described in the previous section for the highway scenario for the whole duration of the demonstration test, lasting 3 minutes. In these tests, the vehicles will not be able to cooperate but still they have to prove their capability to move safely and efficiently. The objective of these tests is to show the effect of the lack of cooperation on safety and driving efficiency.

Please note that the mixed test is made only for demonstration purposes. It will not affect the assessment procedure. The teams can chose to participate with any car they want. For this demonstration it will be possible to modify the vehicle's hardware and software.

7.   Traffic signs

There will be two types of traffic signs in the Urban Scenario to signal vehicles to turn right or turn left. **If there is no sign at an intersection, the car has to go straight. If this is not possible, they have to turn left (counter-clockwise)**. All signs have a diameter of 8 cm as shown in Fig. 2. They will be placed in the proximity of some intersection, on the right or left of the lane, at a height of 10 cm from the ground (total height 18 cm) as shown in Fig.2. To indicate two different directions, three signs will have a white arrow in the middle of a red, green or blue colour background, whereas one sign will have a black arrow on a yellow background.
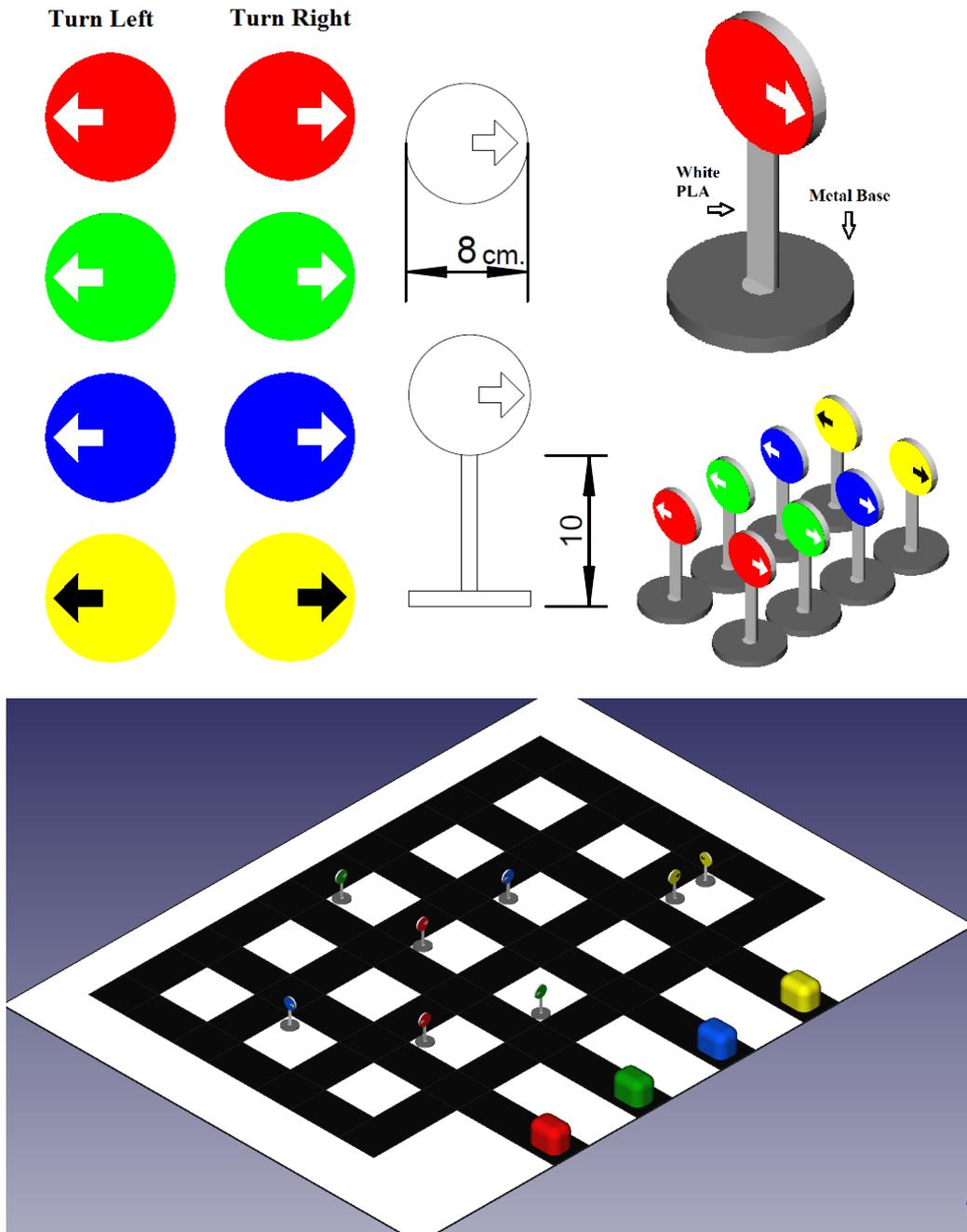

Fig. 2 - The traffic signs (the position of vehicles and traffic signs is only indicative).

8.   Scoring and Evaluation

The scoring for each team participating in the competition will be comprised by the aggregated points. The evaluation will be performed by a group of individual referee experts (IRE) and by an automated camera-based referee system (ACRS). A real-time visualization of the results will take place during the competition.

The performance of each team will be assessed based on three factors:

1. **Documentation (mandatory)**
2. **Presentation (mandatory)**
3. **Participation**

Documentation: The documentation should describe with clarity the vehicle sensors, the algorithms used for environmental perception, and any implemented control logic or data fusion process used. *The final documentation should be no more than 10 pages of MS Word and should be submitted by the day of the competition to the JRC.*

Presentation: Each team will have to present their participation (fleet of AVs, control logics, development stages, validation, sensors, data fusion, machine learning, etc.) in the JRC during the first day.

Participation: The assessment of each team will be based on the following metrics:

- Collision: each vehicle that manages to finish without collision will be awarded with 25 points. Each collision costs 5 points. No points are awarded for vehicles with more than four collisions. After a collision and with the agreement of the judges, a team member will be allowed to reposition the vehicles involved in the collision. The vehicles should be as close as possible to the collision point.
- Lane keeping: each vehicle that manages to stay within the lanes and finishes will be awarded with 25 points. A vehicle will be considered out of lanes when at least two wheels are outside the route. Every time a vehicle drives out of the lane, it will lose 5 points. No points are awarded for more than four lane keeping infringement.
- Leave suggested path: (only for urban track): if a vehicle leaves the suggested path, it becomes disqualified (0 points for this vehicle) and it will be removed from the track.
- Reverse direction: if a vehicle reverses its direction on the track, it becomes disqualified (0 points for this vehicle) and it will be removed from the track.
- Parking (only for highway track): For the Highway scenario each vehicle parked correctly will be awarded with 25 points. A correct parking means no contact with other vehicles and outside the main track lane.
- Time gap (only for highway track): For each of the three following vehicles, the ACRS will record their instantaneous time gaps with a regular frequency and after the successful completion of the task by the team, it will report the following value:

$$TG_j = \sum_{i=1}^{3} \{tg_{med} + tg_{perc90} + tg_{perc70}\}_{i,j}$$

  where tg_{med} is the median time gap and tg_{perc90} and tg_{perc70} are the 90th the 70th percentiles in the time gap values distribution, i the number of the vehicle and j the participating team. The final score will be computed as follows:

$$\widehat{TG_j} = 1 - \frac{(TG_j - TG_{min})}{TG_{max} - TG_{min}}$$

  where TG_{max} and TG_{min} are the minimum and maximum time gap values computed from all the teams that managed to complete the challenge. The final score $\widehat{TG_j}$ will be in the range $[0,1]$ and the total points for the team j are determined by the product of $\widehat{TG_j} * 100$, a value in the range $[0,100]$. Teams that do not manage to complete the challenge get no points for this challenge.

- Distance travelled: For each of the vehicles, the ACRS will estimated their total distance travelled and if the vehicle finishes it will report the estimated distance travelled.

$$DT_j = \sum_{i=1}^{3} \{DT\}_{i,j}$$

where DT_j is the accumulated distance traveled by all vehicles i of the team j. The final score will be computed as follows:

$$\widehat{DT_j} = \frac{DT_j - DT_{min}}{DT_{max} - DT_{min}}$$

where DT_{max} and DT_{min} are the minimum and maximum distance travelled values computed between the teams that managed to complete the challenge. The final score $\widehat{DT_j}$ will be in the range [0,1] and the total points for the team j are determined by the product of $\widehat{DT_j} * 100$, a value in the range [0,100]. Teams that do not manage to complete the challenge get no points for this challenge.

The final score for each team will be computed by aggregation of the individual metric scores.

Table I. Assessment table (scoring)

	Metric	Maximum points
Highway / Urban Scenario	Collision	100
	Lane keeping	100
	Distance travelled	100
Only highway Scenario	Time gap	100
	Parking	100

9.   Next steps and Competition

Qualification

Each team selected for participation in the JRC AUTOTRAC should provide the following by **30 April 2020**:

- **A short video file (not more than 30s) with the vehicles and a 1-page document describing the development updates.**

Competition

The competition will last 3 days. The first day the JRC will present the EU activities on the topic and each team will present its proposed solution. During the afternoon, teams will be able to inspect the tracks and the space where the competition with take place. The second and third day, the teams will compete in the AUTOTRAC 2020 on the J-shape and #-shape tracks respectively. The participation order will be random and extracted on the day of the competition. The order of the participation in the in the **J-shape track**, will be reversed on the **#-shape track**. The team participating as first in the **J-shape track**, will be the last on the **#-shape track**.

Each day, once the competition has started, no modifications on the algorithm of the vehicles are allowed. When the time comes for a team to compete, the workflow described in the competition rules document will be followed:
"A buffer of 30min plus 10min for competition will be given to each participating team. This practically means that the teams will have the time to prepare their vehicles on the track. After 30min or when a team is ready, it will start in the competition. Any team who does not manage to successfully complete the challenge will receive zero points in the evaluation procedure."

Further information will be communicated to the teams **via email** when the date of the competition approaches. Questions can be sent to JRC-AUTOTRAC@ec.europa.eu

10 - Indicative agenda – JRC-AUTOTRAC 2020

1st day	**2nd day**	**3rd day**
9:00 – 12:00 Participants arrival – Registration 12:00 – 13:00 Welcoming lunch 13:00 – 13:15 Welcome from the hosting institution 13:15 – 13:30 The exploratory research programme at JRC 13:30 – 13:45 Engaging the makers into research and presentation of the JRC Makerspace 13:45 – 14:00 About the JRC AUTOTRAC competition 14:00 – 15:40 Presentation of the projects by the teams 15:40 – 16:00 Coffee/tea break 16:00 - 18:00 Free time for tests on J-shaped track 18:00 End of day 1 and departure to the Hotel 19:30 Social dinner	8:30 – 9:30 Participants arrival 9:30 - 14:30 Competition on the J-shaped track 14:30 – 15:30 Lunch break, analysis of the first results and preparation of the #-shaped track 15:30 – 18:00 Free time for tests on #-shaped track 18:00 End of day 2 and departure to the Hotel	8:30 – 9:30 Participants arrival 9:30 - 14:30 Competition on the #-shaped track 14:30 – 15:30 Lunch break, analysis of the first results and definition of the final rank 15:30 – 16:00 Award ceremony 16:30 – 17:00 Closing remarks and future events 17:00 End of the competition

11 - Revision history

10/05/2019 – Rev.01- First version

30/10/2019 – Rev.02

Please read the second version carefully as it has been updated on several parts of the document. Interesting updates include:

- The competition is organized by the Joint Research Center (JRC) of the European Commission and it will take place in Ispra (VA) from March 30 to April 1 2020.
- The document has been updated with the Scoring and Assessment procedure.
- The first, second and third team will be awarded with the amount of 3.000€, 2.000€, 1.000€ respectively. Furthermore, for the winning team of the challenge there will be the possibility to develop a demonstrator in the Ispra site of the JRC with a contract of around 15.000€. Finally, the winning team will have the opportunity to demonstrate their performance during the 2020 Transportation Research Arena conference, which will be held on April 27-30, 2020 in Helsinki (https://traconference.eu/).
- The JRC will provide fixed financial support for travel and accommodation for all the participated teams.
- The vehicle's maximum weight should be 3kg.
- Each vehicle must be equipped with at least one camera for environment recognition.
- It is possible to use smartphones or tablets (not PCs) beyond the maximum measurements and weight of the rules.
- During the competition (3nd day) the hardware of the vehicle must not be modified except in case of supervised repair.
- The software can be changed during the competition (3nd day), but not during the run
- Each team is free to apply V2V connectivity between its vehicles. No WiFi network for such reason will be provided by the JRC.
- Update GREEN colour CMYK: 100, 0, 100, 0   RGB: 0, 255, 0
- Updated: Urban Scenario (#-shape track)
- Mixed event is only for demo purposes. It will not affect the assessment procedure. The teams can chose to participate with any car they want.
- The technical specifications will freeze one month before the competition. From the moment that the list of participant is fixed, any updates will be communicated via email and not via the website.
- Up to 4 members of each team are allowed to attend the competition in the Ispra premises of the JRC. However, there is no restriction the individuals that contribute in the preparation of the team.
- There will be signs only when the vehicle has to turn. If not, the car has to go straight.
- Update the colours of the yellow / black signal
- The car should be able to read and memorize its colour in the beginning of the race. During the race, the colour will not change.
- Mixed test is only for demonstration purposes

03/04/2020 – Rev.03

Please read the second version carefully as it is updated on several parts of the document. Interesting updates include:

- ***Section 2 – General information***
- The competition is organized by the Joint Research Center (JRC) of the European Commission and it will take place in Ispra (VA) from 5 to 7 October 2020.
- Six teams have already confirmed their participation.
- For other teams, the application is extended until 30 April 2020.
- Each team selected for participation in the JRC AUTOTRAC should provide (only if not already done) specific documentation 30 April 2020 (see qualification section).
- ***Section 3 – Participation***
- Each team should participate with exactly 4 vehicles (the vehicles can be different).
- All teams will receive a compensation of approximately 2.000€. The compensation will be in the form of a European Commission expert contract to the team leader. The expert contract will be paid upon receipt of

- the technical description of your solution that should be delivered by 30 June 2020 (afterwards you will be of course allowed to further improve the performances of your fleet until the date of the competition).
- Finally, the winning team will have the opportunity to demonstrate their performance during a high-level scientific event organized in 2021. More information about the specific event will be provided following the end of the competition.
- A technical area will be available to the teams near the competition area with 220V electric power supply and work tools.
- Customized "JRC AUTOTRAC 2020" T-shirts will be provided to all teams.
- Visitors accompanying the team are exceptionally allowed upon approval by the organizers. In any case they are excluded from participation and reimbursement schemes.
- *Section 4 – Vehicle requirements*
- To facilitate the recognition of the 4 vehicles by the judges and the camera, 4 stickers (will be provided by the organization) with a different colour (red, green, blue and yellow) will be positioned at the 4 corners of each vehicle. The vehicle must provide an adequate flat space (white to avoid interference with the detection system) on top to position these stickers.
- The stickers will have a white background with a size of 4x4cm with inside the colored sticker with a diameter of 3cm.
- The vehicle must be completely automated. Any kind of interaction with the team members or any other remote entity during the runs is forbidden with the consequent exclusion from the competition.
- The vehicle must have a remote control which should be used for start or stop. The remote control can also give commands before the start of the run such as: choice of the scenario (J or #) or assignment of the colour.
- The vehicles must be based on a chassis with maximum dimensions 250x250x250mm (width, length, height); only sensors for external lines/spaces recognition can exceed the dimensions of the vehicle by a maximum of 3 cm on all sides.
- The vehicle's maximum weight should be 3kg.
- 2nd and 3rd day, when the competition begins, the hardware of the vehicle cannot be modified except in case of supervised repair.
- Each team is free to apply Vehicle-to-Vehicle (V2V) connectivity between its vehicles. Own private WiFi router/network, Bluetooth, radio transmission, etc... is allowed (including communication between PC and vehicle). However, participants are reminded that remote control of vehicles is prohibited, except for start and stop, choice of the scenario (J or #) or assignment of the colour). No WiFi network for such reason will be provided by the JRC.
- *Section 5 – Tracks*
- The track figures ((J-shape track and #-shape track are now exactly like those that will be used during the competition.
- The size of the mobile obstacle (tram) is approximately 150x150x150mm with a (almost) constant speed of about 0.1m/s.
- To improve the recognition of the tram by vehicles, two stickers (diameter 3mm.) of different colours is positioned on the right (red) and left (green) side, approximately 10 cm above the ground. The red sticker will be positioned in the direction of the starting line.
- The 'tram' is not responsible to recognize approaching vehicles. On the contrary, the vehicle should be able to predict the movement of the 'tram' and regulate their movement accordingly.
- There is no restriction on whether all vehicles should wait for the 'tram' or the car-platoon should be splitted. If this happens then the remaining vehicles should be able to catch up the car-platoon.
- *Section 6 –Scenarios and objectives (#-shape track)*
- The team will choose the colour to be assigned to each vehicle before departure. This can be done manually or automatically using the recognition with the camera of one of the signs on the track.
- The vehicle should be able to recognize the traffic signals through its sensors or camera(s).
- Each starting position (colour assigned to the vehicle) and the position of the signs on the track will be the same for all teams.
- Road signs will be positioned to avoid a "dead end".
- *Section 7 – Traffic signs*
- In Fig.2 the position of vehicles and traffic signs is only indicative.
- There will be two types of traffic signs in the Urban Scenario to signal vehicles to turn right or turn left. If there is no sign at an intersection, the car has to go straight. If this is not possible, they have to turn left (counter-clockwise).

- They will be placed in the proximity of some intersection, on the right or left of the lane, at a height of 10 cm from the ground (total height 18 cm)
- ***Section 8 – Scoring and Evaluation***
- A real-time visualization of the results will take place during the competition.
- Documentation: The documentation should describe with clarity the vehicle sensors, the algorithms used for environmental perception, and any implemented control logic or data fusion process used. The final documentation should be no more than 10 pages of MS Word and should be submitted by the day of the competition to the JRC.
- … After a collision and with the agreement of the judges, a team member will be allowed to reposition the vehicles involved in the collision. The vehicles should be as close as possible to the collision point.
- Leave suggested path: (only for urban track): if a vehicle leaves the suggested path, it becomes disqualified (0 points for this vehicle) and it will be removed from the track.
- Reverse direction: if a vehicle reverses its direction on the track, it becomes disqualified (0 points for this vehicle) and it will be removed from the track.
- ***Section 9 –Next steps and Competition***
- Each team selected for participation in the JRC AUTOTRAC should provide the following by 30 April 2020:
- Each day, once the competition has started, no modifications on the algorithm of the vehicles are allowed.
- "A buffer of 30min plus 10min for competition will be given to each participating team. This practically means that the teams will have the time to prepare their vehicles on the track. After 30min or when a team is ready, it will start in the competition. Any team who does not manage to successfully complete the challenge will receive zero points in the evaluation procedure."
- ***Section 10 –Indicative Agenda – JRC AUTOTRAC 2020***
- Update Agenda