RoboCup Iran open Self-driving Car league

rulebook

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Contents

1. Introduction

1.1. RoboCup

RoboCup is an international joint project to promote AI, robotics, and related fields. It is an attempt to foster AI and intelligent robotics research by providing standard problems where a wide range of technologies can be integrated and examined. More information can be found at http://www.robocup.org/.

1.2. RoboCup Self-Driving Car league

According to the statistics, 90% of road accidents are due to human error, and about 1.35 million people die each year as a result of road traffic crashes. Self-driving cars can ensure the safety of people and vehicles are becoming more valuable every day. Therefore, in this competition, our priority is safety. That means in scoring, obeying rules and driving safe, have more score than finishing in time. The competition's objective is the development of a 1/10 scale self-driving electric car that must accomplish different tasks, such as lane-keeping, acting according to traffic signs, giving way, parking, emergency braking, etc.

1.3. Participation in the Competition

Participation in Self-Driving cars league requires successfully passing a qualification procedure. This procedure is to ensure the quality of the competition event and the safety of participants.

1.4. Steps to Participate

All teams that intend to participate at the competition have to perform the following steps:

1. Preregistration (by sending email to the TC)
2. Submission of qualification material, including a team description paper and possibly additional material like videos or drawings.
3. Final registration (qualified teams only)

All dates and concrete procedures will be communicated in due time in advance.

1.5. Registration

- There is no limit on number of team members.
- The same members between the two teams are allowed if the robots of the two teams are completely different in software and hardware. It is up to the technical committee to determine this.

1.6. Team Description Paper

The Team Description Paper (TDP) is a central element of the qualification process and has to be provided by each team as part of the qualification process. The TDP should at least contain the following information in the author/title section of the paper:

- Name of the team (title)
- Team members (authors), including the team leader
- Link to the team web site (if any)
- Contact information

The body of the TDP should contain information on the following:

- focus of research/research interest
- description of the hardware, including an image of the robot
- description of the software, esp. the functional and software architectures
- innovative technology (if any)
- applicability and relevance to real-world tasks

The team description paper should cover in detail the technical and scientific approach.

2. General rules

2.1. Design of Car

The car used in these competitions must use electric motor(s) as the driving force. The car should have 4 wheels and both 4WD and 2WD cars are allowed. At least one axle must be steerable and Differential steering is prohibited.

All cars must meet the following requirements:

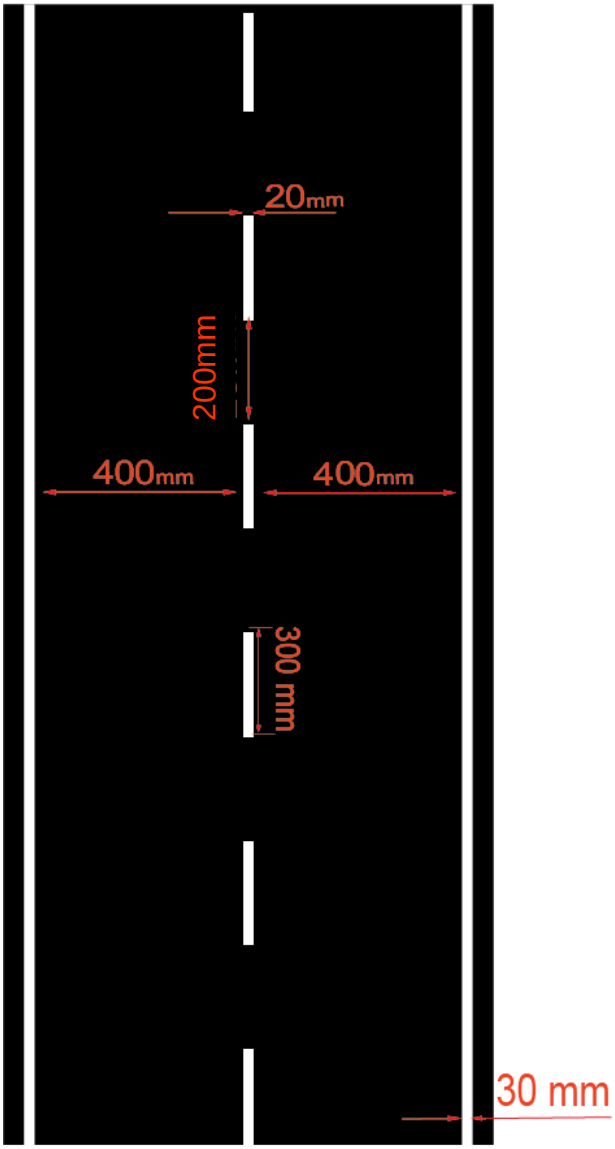
1. The wheelbase must measure at least 200 mm.
2. The track width must measure at least 160 mm.
3. The car, must not be wider than 350 mm, and higher than 350 mm.
4. The car must pass a gate with inner dimensions: height 350 mm and width 350 mm.
5. All processing must be onboard, and any external data or signal transmission during the race is prohibited, violation of this rule results in the elimination of competition.
6. Any ready-made solution is prohibited such as donkey car or jetRacer.
7. in term of using a remote control, a flashing light must be installed on the top of the car to indicate RC-mode.
8. The car is not allowed to save the race track.

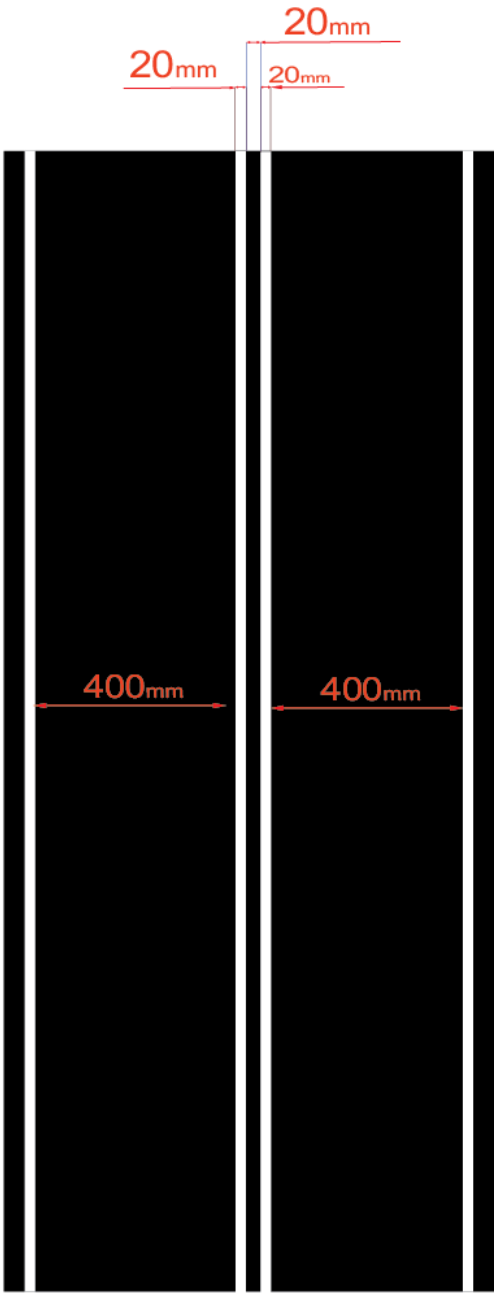
2.2. Competition track

2.2.1. Course

The competition track will be as described below.

- The course is dark black with white lines (like a street).
- The width of the lines is 30 mm for roadway boundaries (outer lines), 20 mm for lane boundaries (dashed centreline) and 50 mm for stop lines.
- Dashed lines have a length of 300 mm with a 200 mm distance in between.
- The inner roadway width is 400 mm.
- All bends are formed from circular segments with at least 2 m radius.

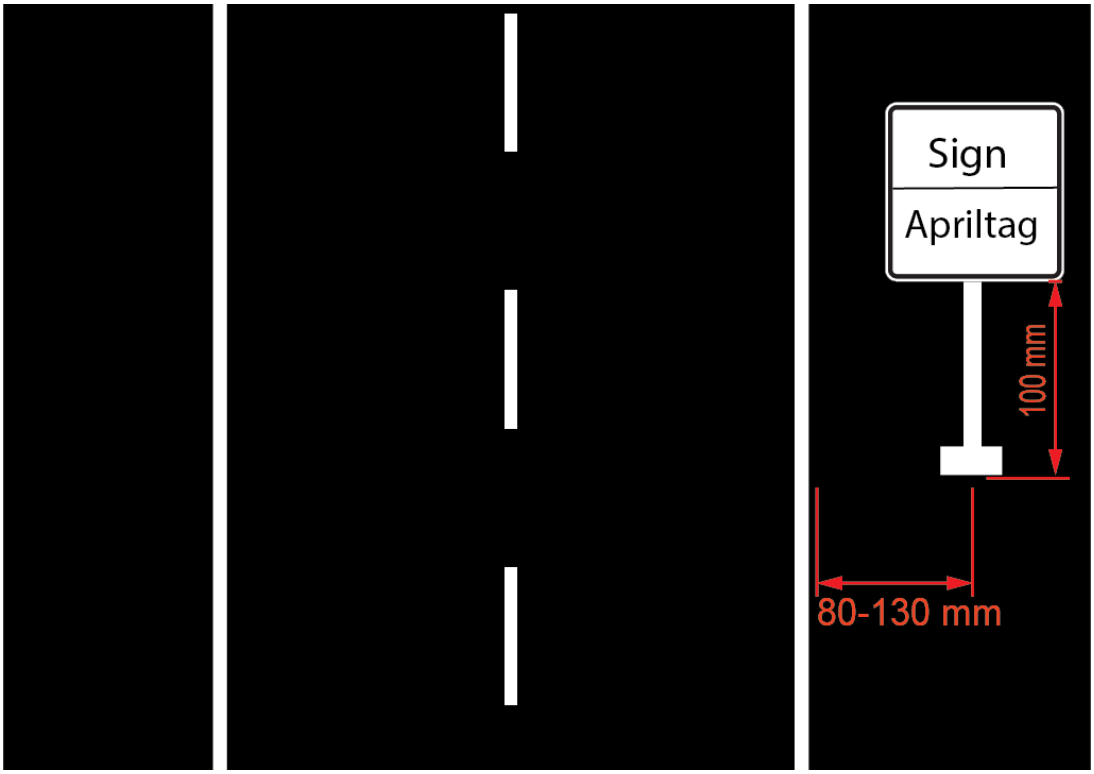

20mm
200mm
400mm
400mm
300 mm
30 mm

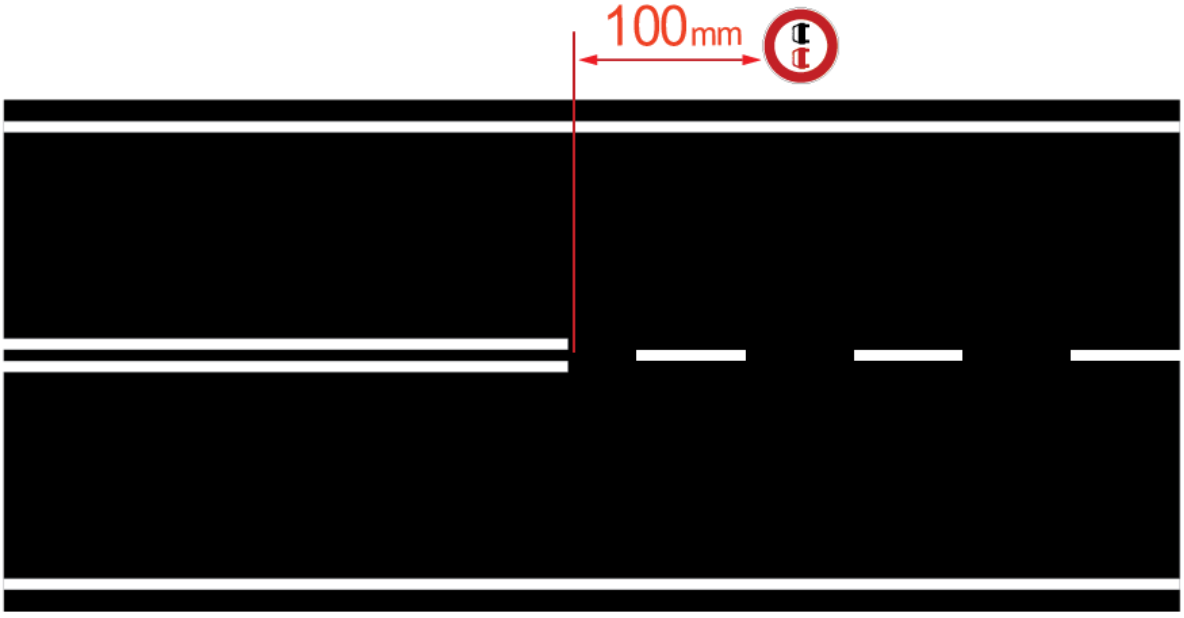

20mm
20mm
20mm
400mm
400mm

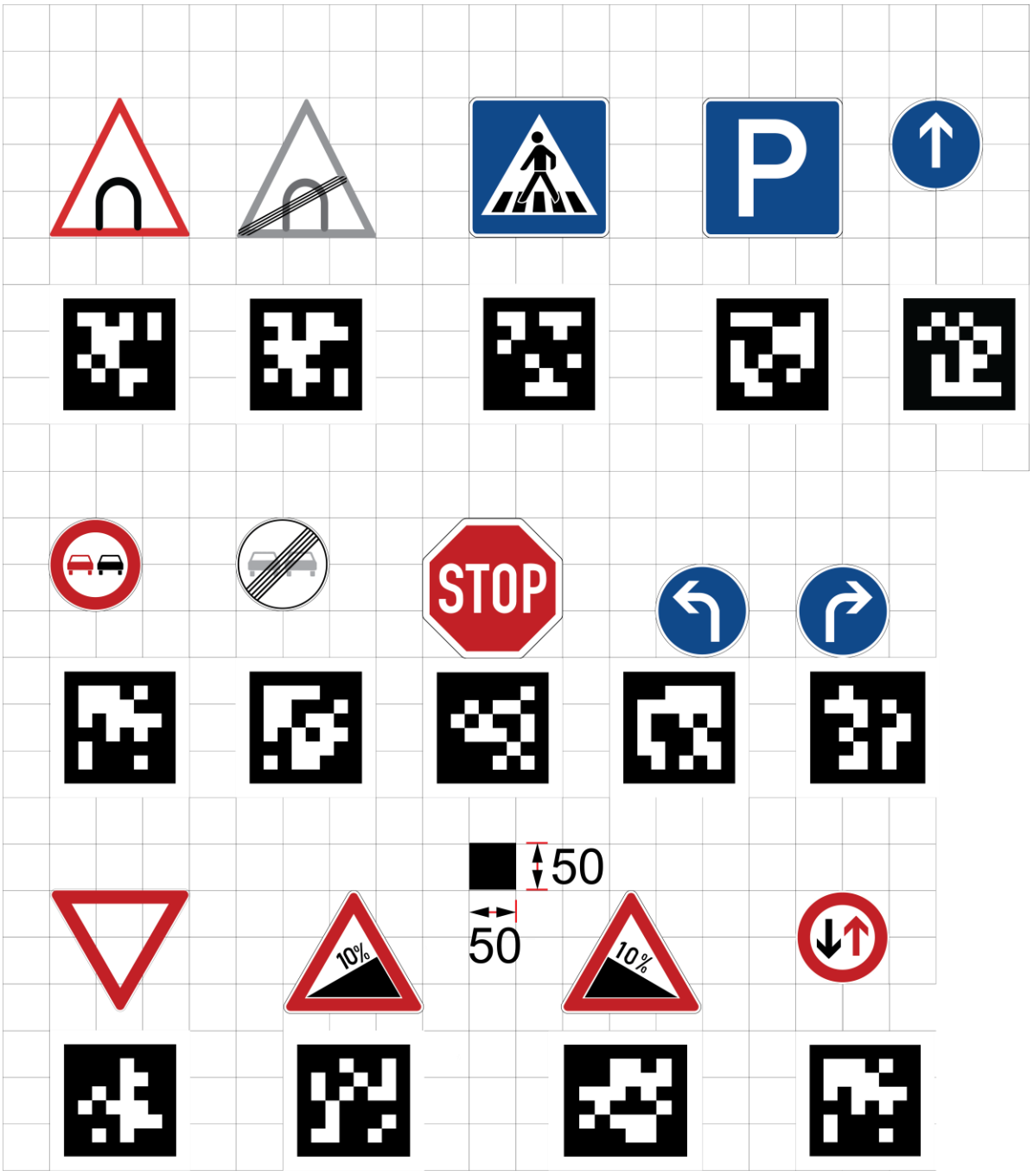
2.2.2. Traffic signs

The type and position of traffic signs on the competition track is described as below.

Traffic signs can also be replaced with an April tag upon competitors request which has a minimum size of 100 mm x 100 mm.

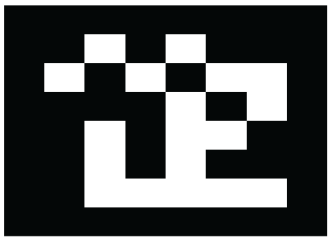





P
STOP
50
50
10%
10%

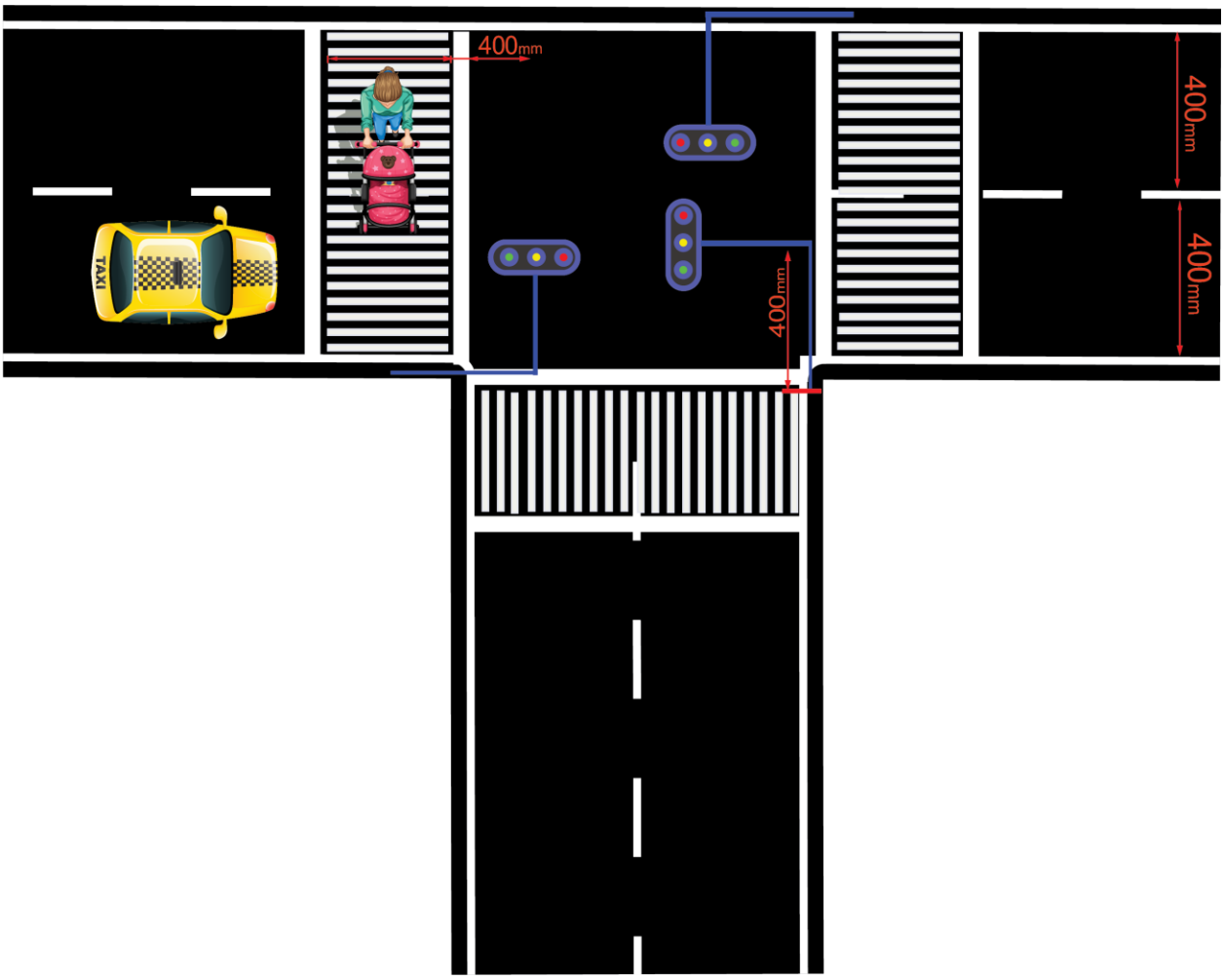
Stop		
Priority over		
Barred area		
Steep hill	 uphill grade	
Steep hill	 downhill grade	
Turn left		

Tunnel Beginnig	 beginning	
Tunnel End	 end	
Cross walk	Crosswalk 	
Parking zone	Parking Zone 	
No - passing zone	 beginning	
No - passing zone	 end	

Turn right		
go straight		

2.2.3. Traffic lights

Traffic signs will be present at intersections. As shown below.



2.2.4. Tunnels

There will be a tunnel along the race track that may have lighting or not. The tunnel will be on the straight track, and indicates by tunnel sing 10 cm before tunnel.

2.2.5. Buildings

It is possible that buildings or building-like structures are set up adjacent to the road.

2.2.6. Plants

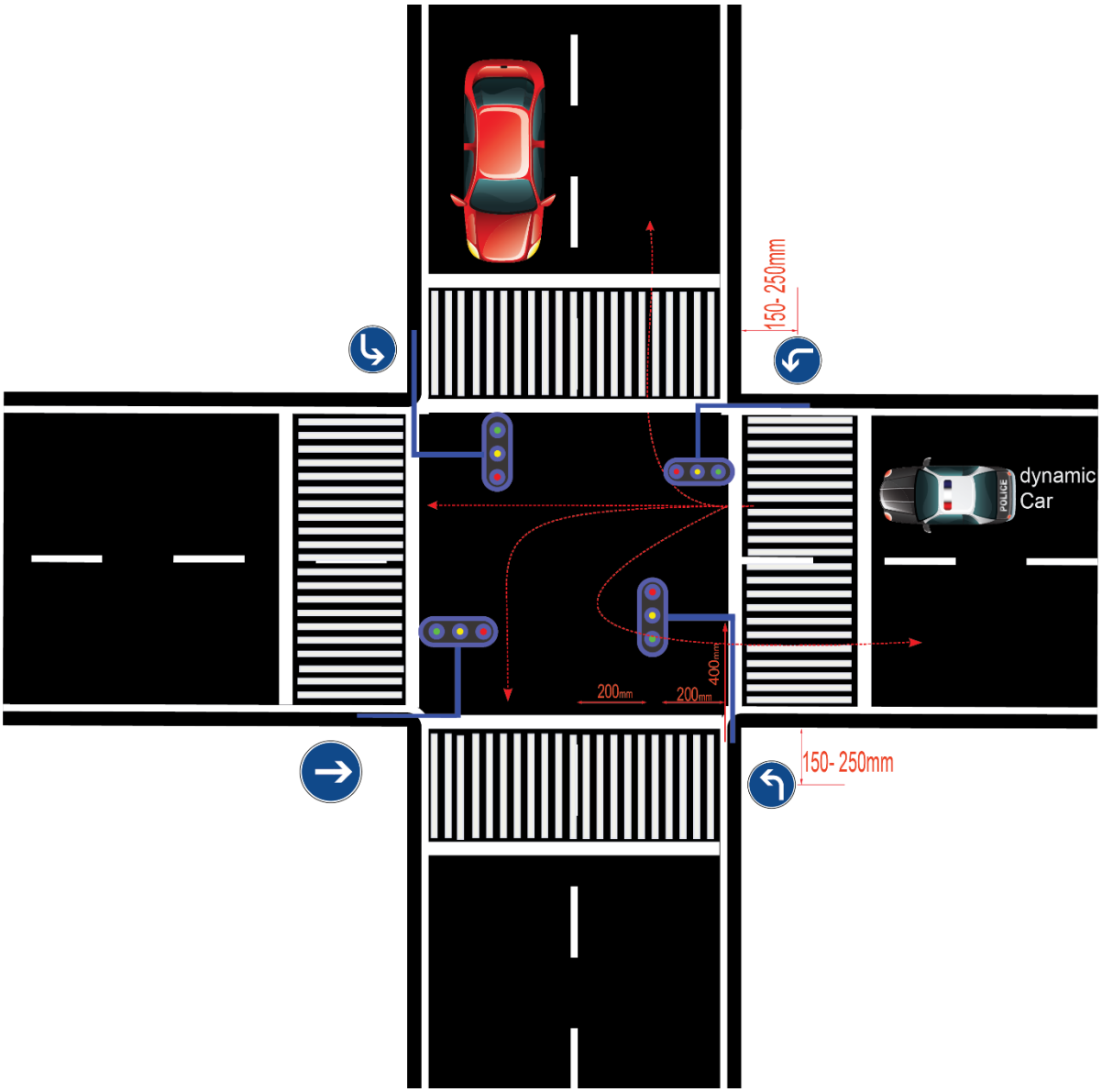
It is possible that trees or other plants are set up adjacent to the road.

2.2.7. Static Obstacles

Static obstacles may be present anywhere in the track. The obstacles are model cars or dolls.

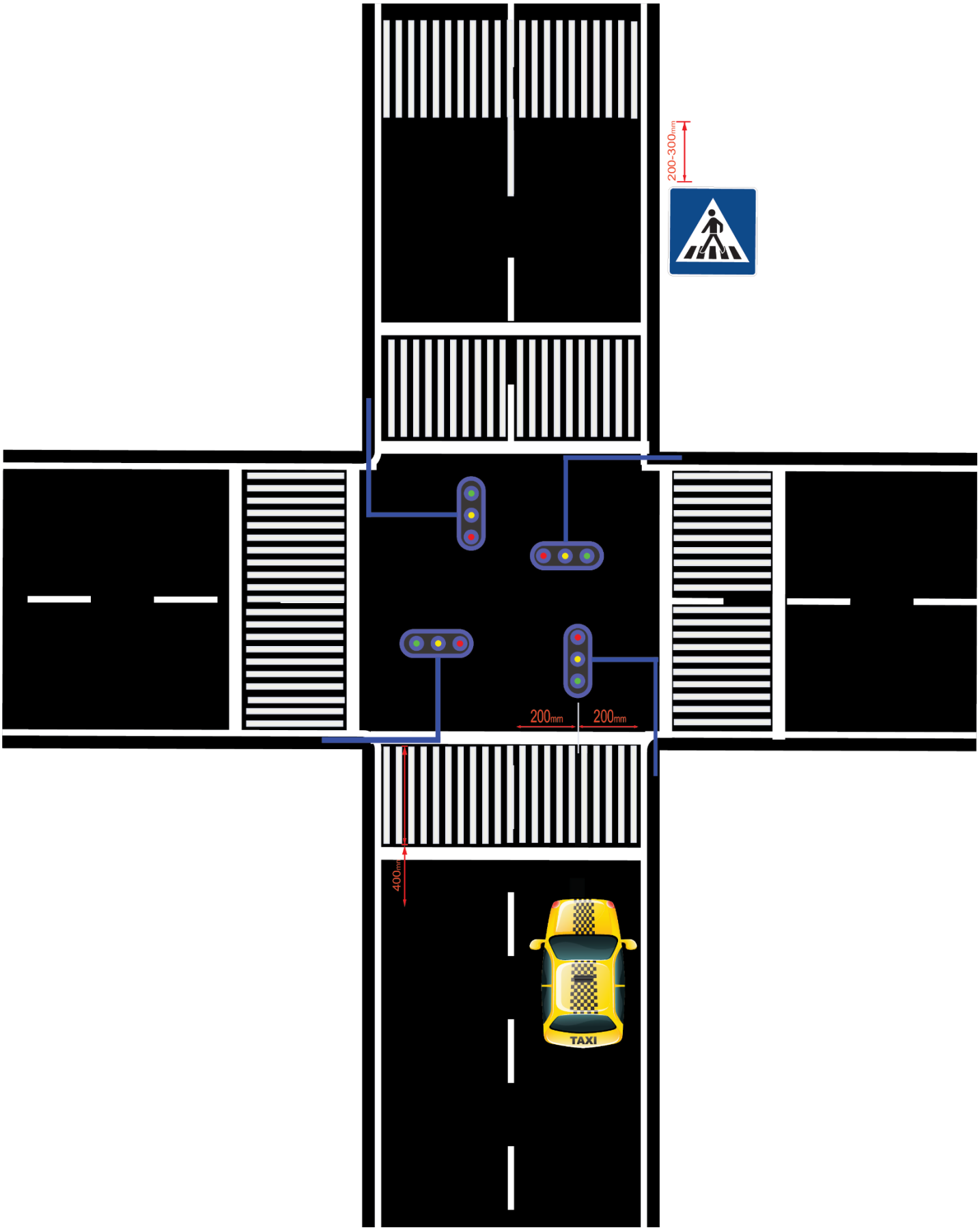
2.2.8. Dynamic Obstacles

There will be dynamic obstacle on the track. Its shape resembles the static obstacles. Dynamic obstacles will act like human driving.



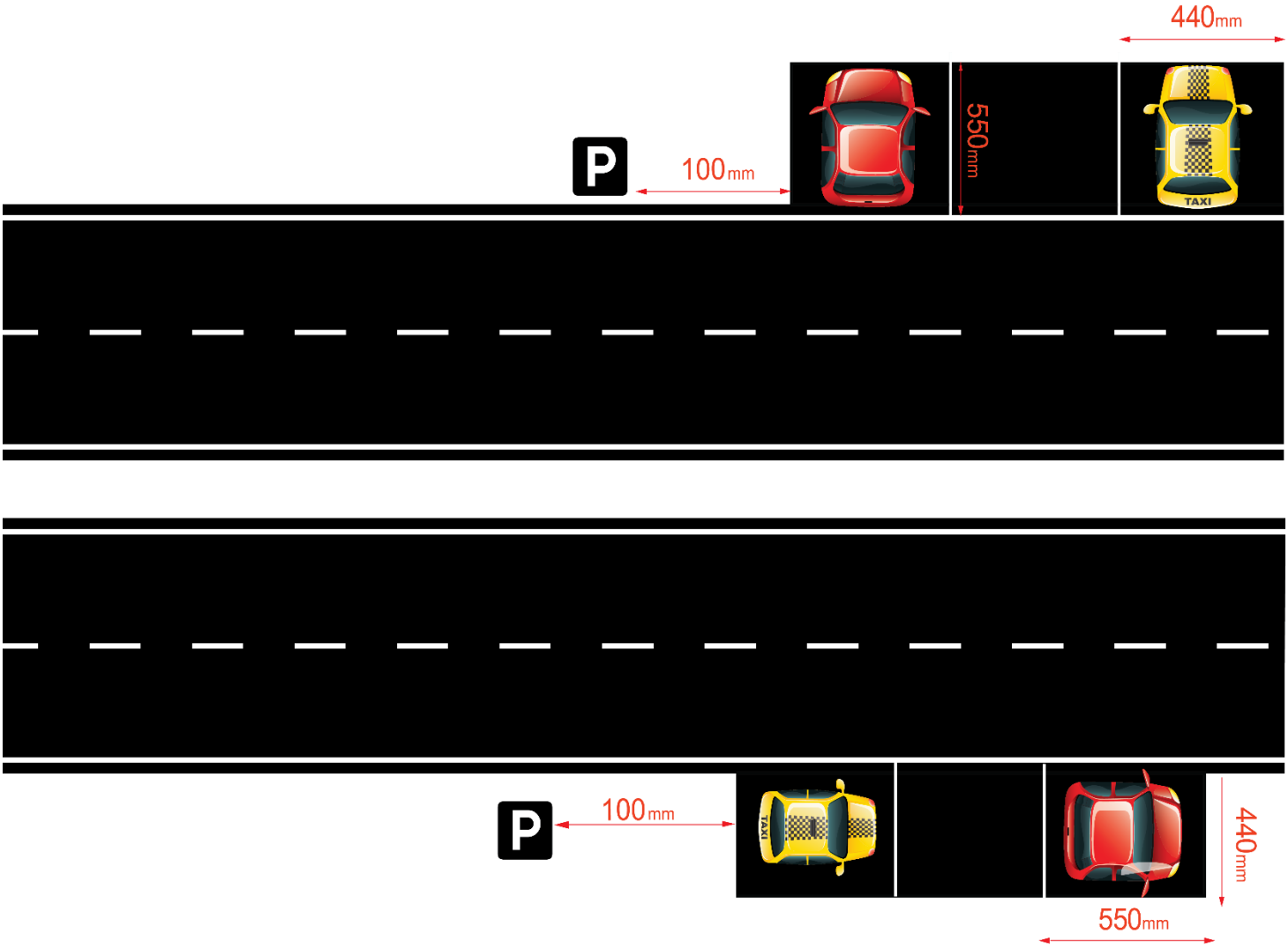
2.2.9. Crosswalks

There will be crosswalks on every junction that is described in the pictures as well as crosswalks may be present in the track. Crosswalk in the track other than intersections is indicated by a corresponding traffic sign. On the roadside, at each crosswalk, a pedestrian may wait to cross the road. The cars must stop on both sides whenever a pedestrian steps onto the crosswalk. If there is no pedestrian on a crosswalk, the car must stop for three seconds and then pass.


200-300mm
200mm
200mm
400mm
TAXI

2.2.10. Parking

There will be two parking areas on the track. One cross parking on the right and one parallel parking on the left of the road. After passing the parking sign, the car shall find a parking spot within the parking areas and maneuver into it, without touching the surrounding obstacles.



2.3. Competition procedure

The competition consists of two stages with different tasks, each of which consists of several items as described below. There are a start line and a finish line, which are indicated by a stop sign. The car must start the race when the stop sign is removed and stop between 20 cm to 1 cm from stop sign. Every team has 3 runs and, in every run, it is possible to use three resets in each stage. There are checkpoints along the specified route, and crossing each checkpoint has positive points. The last checkpoint which car passes is the total run time and scoring calculation reference.

- You can only use the reset when the car goes entirely off the race track.
- Only the Capitan can call for reset.
- In case of the reset call, only the captain has the right to put the car inside the raceway. The car has to be placed before the last checkpoint. The captain can also press a reset button, if any.

3. Scoring and Ranking

3.1. Scoring

In general, the criterion for scoring is race completion time and the number of errors.

3.1.1. Crossing task

Car arriving at a crossing must act according to signs, and it must give way at all of the following:

- at give way signs (for 3 seconds)
- at stop signs (for 3 seconds)
- turning across the path of an oncoming car at an intersection
- turning from a terminating road onto the ongoing road at a T-intersection
- if you're turning at an intersection, you must also give way to pedestrians crossing the road you are entering.
- Give way to pedestrian crossing in crosswalks in middle of the road.

3.1.2. Parking task

The end of the parking procedure must be signaled by a stop of at least 5 Seconds. Car parking is optional and has positive points.

3.1.3. Tunnel

Crossing the tunnel is optional, and the correct crossing has positive points.

3.1.4. Crosswalks

Skip the crosswalk procedure has negative points.

3.1.5. Obstacles

Each touching an obstacle has negative points.

3.1.6. Track

if the car completely Get off the track, it has negative points, and it can continue the race only if the captain calls for reset.

3.1.7. Traffic signs

Failure to maneuver correctly based on the associated traffic sign or April tag has negative points. Correct maneuvering based on the associated traffic sign has extra positive points. April tags have no such extra points.

3.1.8. Traffic lights

Detection and enforcement of traffic lights are optional and has positive points.

3.1.9. Timing

Each run has a specific time to complete, and it is determined before the race. Each checkpoint reference time is total time divided by the number of checkpoints. Any extra seconds it takes to complete the last checkpoint has negative points.

3.1.10. Scoring table

description	points
Time	((number of passed checkpoints ÷ total checkpoints) × total time) – Run Time
Collision with pedestrian	-300
Collision with obstacles	-200
Get completely off the track	-300
Each **correct** traffic sign detection	500 ÷ number of signs along the track

Each **false** traffic sign or April tag detection	-50
Park the car correctly	+300
Pass the tunnel correctly	+100
Each wrong turn in junctions	-150
Each **correct** traffic light detection	+200
Each checkpoint pass	2000 ÷ number of checkpoints along the track
Cross the line in the no overtaking zone	-100

3.2. Ranking

- there will be a 1st, 2nd, and 3rd place award trophies (first and second place only when the number of teams is eight or less).
- In order to value very specific capabilities required in self-driving cars technical challenges are part of self-driving cars league. technical challenge is separately awarded.
- There will be the best car body design award.

*all numbers may have 5% tolerance.

*technical committee has right to change the rules at any time until competition day.