

Informal document **GRE-85-38**
(85th GRE, 26 to 29 October 2021,
agenda item 9)

Signalling Road Projection

Presentation for GRE-85

Background and introduction

Background

GTB experts learned from the recent accident statistics for VRUs :

- Germany

: The number of bicycle accidents with fatalities and injuries is increasing from 2005 to 2020.

- OECD member countries

: Death toll of the bicyclist has not decreased significantly from 2010 to 2019.

- Japan

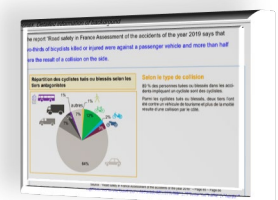
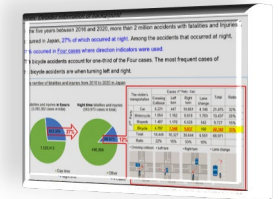
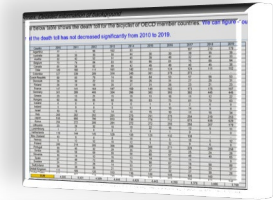
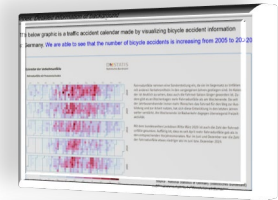
: From 2016 to 2020, there were 22,342 bicycle accidents with fatalities and injuries in the situations where the other vehicle's direction indicators were lit at night.

- Republic of Korea

: The main cause of the bicycle accidents with fatalities and injuries can be seen as the collision between the side of the bicycle and the side of the vehicle from 2017 to 2020.

- France

: Two-thirds of bicyclists killed or injured were against the passenger vehicle and more than half were the result of collisions on the side.





※ You can see the detailed information of the background in the annex page of this document.

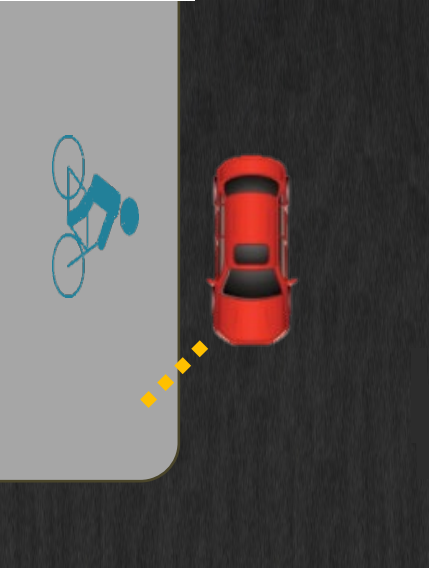

Introduction

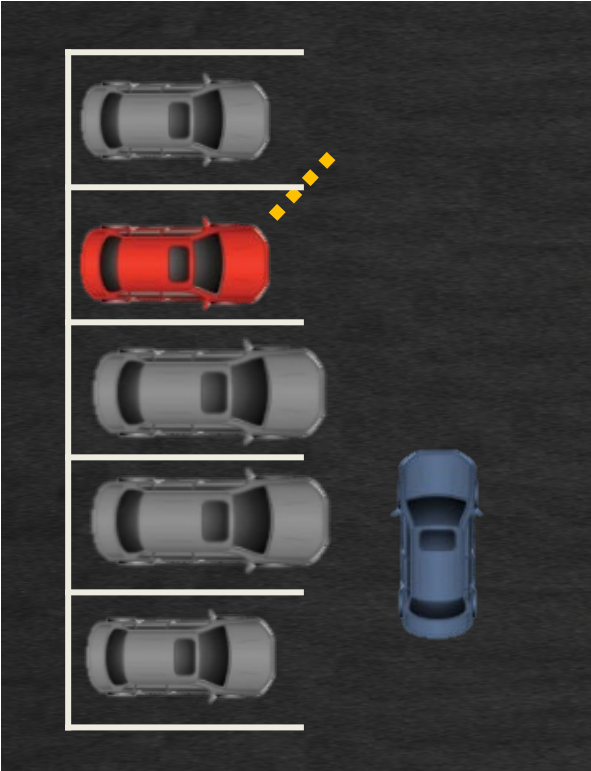

We would like to introduce a **signalling road projection** which provides **enhanced recognition to other road users as a part of the existing signalling devices** such as **direction indicator** and **reversing lamp**. We believe that the signalling road projection will improve the safety of other road users, especially for VRU.

Driver Assistance Projection and Signalling road projection are significantly different

Road projection	Driver Assistance Projection	Signalling road projection
Target	Own vehicle driver	Other road users around vehicle
Purpose	Driver assistance	Enhancing recognition
Image (Example)	 <p>* This image is taken from GRE-84-26</p>	

Direction indicator road projection

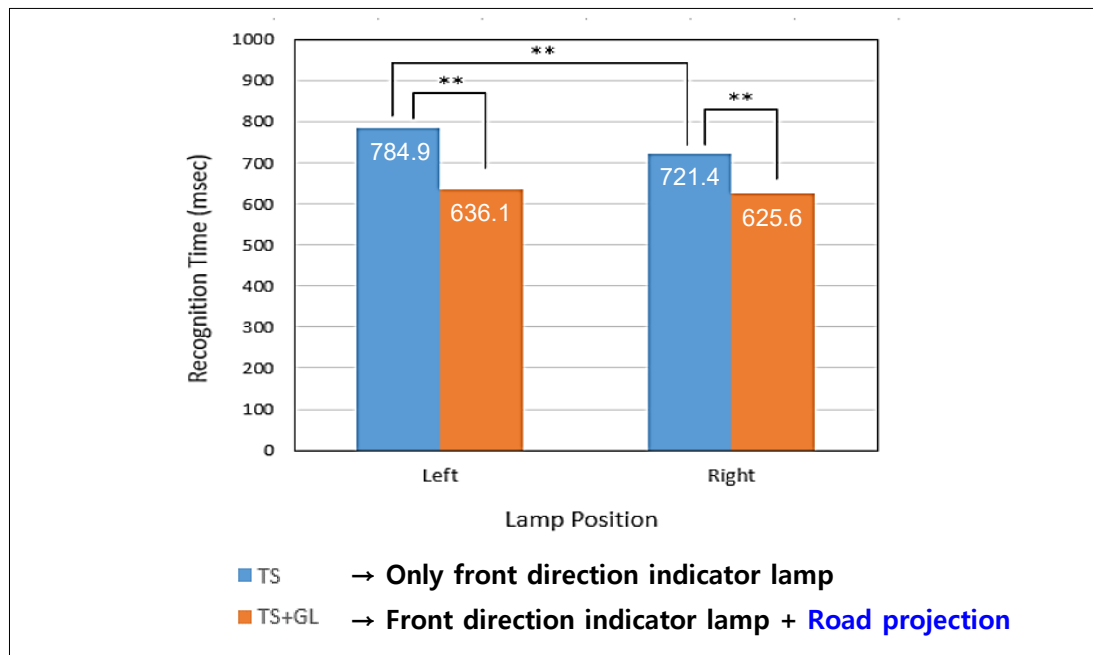
Situation – Change of direction	Video clip
 <p>The diagram shows a top-down view of a road. On the left, a blue cyclist is riding on a grey path. On the right, a red car is on a dark asphalt road. A dashed yellow line indicates the car's path as it moves towards the cyclist.</p>	 <p>The video clip consists of two side-by-side night-time street scenes. The left scene, labeled 'CYCLIST VIEW', shows a paved path leading towards a street. The right scene, labeled 'STREET VIEW', shows a street with a car's headlights illuminating the road ahead.</p>

Situation – Departure	Video clip (Upper : Without projection / Lower : With projection)
 <p>The diagram shows a top-down view of a parking lot. On the left, there is a vertical row of five parking spaces, each containing a grey car. The second space from the top contains a red car. A yellow dashed line indicates a path from the red car towards the right. To the right of this row, there is a single blue car parked. The background is dark, suggesting a night scene.</p>	 <p>The video clip consists of two frames. The upper frame shows a white truck on the left with its headlights on, illuminating a white car on the right. The lower frame shows the same scene, but with a bright, circular projection overlaid on the ground between the truck and the car, indicating the area of projection.</p>

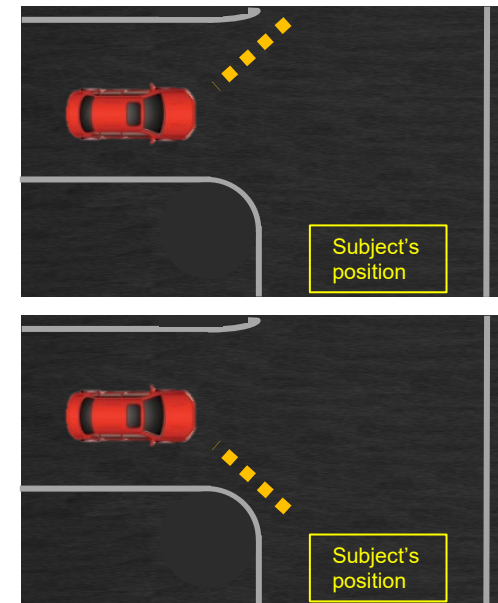
- ▶ Visibility improvement using Guide Function of Turn Signal Lamp researched by Yeungnam University, Korea (The report was published in ISAL 2019)

The report measured the time taken to recognize a vehicle with or without a road projection which was a part of front direction indicator lamp at a T-junction road by participants as pedestrians.

We are able to figure out that the average response time to the direction indicator lamp with the road projection was certainly decreased in comparison to the direction indicator lamp without the road projection.



- ▶ Example images of T-Junction road



Reversing road projection

Video clip (Pedestrian on street)



Video clip (Pedestrian in parking lot)



Safety benefit

- ▶ Safety impact of road projections departing indication researched by ELS, France (A summary of the report was published in ISAL 2019)

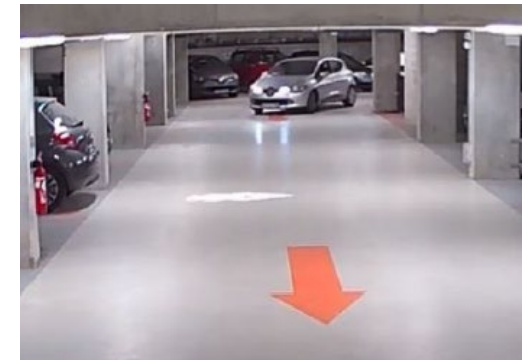
The report analyzed responses of drivers, cyclists and pedestrians with or without a road projection which was a part of reversing lamp. We can find out that the road projection drew a positive responses from participants including cyclists.

Configuration	Adopted behaviors by Drivers, Cyclists and Pedestrians ⊗ One user may have several behaviors.																																
Reversing lamp + Road projection	<table border="1"> <caption>Data for Reversing lamp + Road projection</caption> <thead> <tr> <th>Behavior</th> <th>Drivers</th> <th>Cyclists</th> <th>Pedestrians</th> </tr> </thead> <tbody> <tr> <td>USERS</td> <td>22</td> <td>20</td> <td>20</td> </tr> <tr> <td>DETECT SIGNAL</td> <td>18</td> <td>18</td> <td>20</td> </tr> <tr> <td>STOP</td> <td>2</td> <td>0</td> <td>0</td> </tr> <tr> <td>SLOW DOWN</td> <td>7</td> <td>12</td> <td>4</td> </tr> <tr> <td>BYPASS</td> <td>4</td> <td>11</td> <td>8</td> </tr> <tr> <td>LOOK AT BACKING CAR</td> <td>6</td> <td>9</td> <td>15</td> </tr> <tr> <td>NONE</td> <td>8</td> <td>2</td> <td>7</td> </tr> </tbody> </table> <p>* 'None' means no change of direction, speed and on subject's attention</p>	Behavior	Drivers	Cyclists	Pedestrians	USERS	22	20	20	DETECT SIGNAL	18	18	20	STOP	2	0	0	SLOW DOWN	7	12	4	BYPASS	4	11	8	LOOK AT BACKING CAR	6	9	15	NONE	8	2	7
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Only reversing lamp	<table border="1"> <caption>Data for Only reversing lamp</caption> <thead> <tr> <th>Behavior</th> <th>Drivers</th> <th>Cyclists</th> <th>Pedestrians</th> </tr> </thead> <tbody> <tr> <td>USERS</td> <td>22</td> <td>20</td> <td>20</td> </tr> <tr> <td>DETECT REVERSE LIGHTS</td> <td>9</td> <td>9</td> <td>17</td> </tr> <tr> <td>STOP</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>SLOW DOWN</td> <td>3</td> <td>0</td> <td>1</td> </tr> <tr> <td>BYPASS</td> <td>1</td> <td>4</td> <td>5</td> </tr> <tr> <td>LOOK AT BACKING CAR</td> <td>9</td> <td>8</td> <td>18</td> </tr> </tbody> </table>	Behavior	Drivers	Cyclists	Pedestrians	USERS	22	20	20	DETECT REVERSE LIGHTS	9	9	17	STOP	0	0	0	SLOW DOWN	3	0	1	BYPASS	1	4	5	LOOK AT BACKING CAR	9	8	18				
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▶ Example picture of Pedestrian

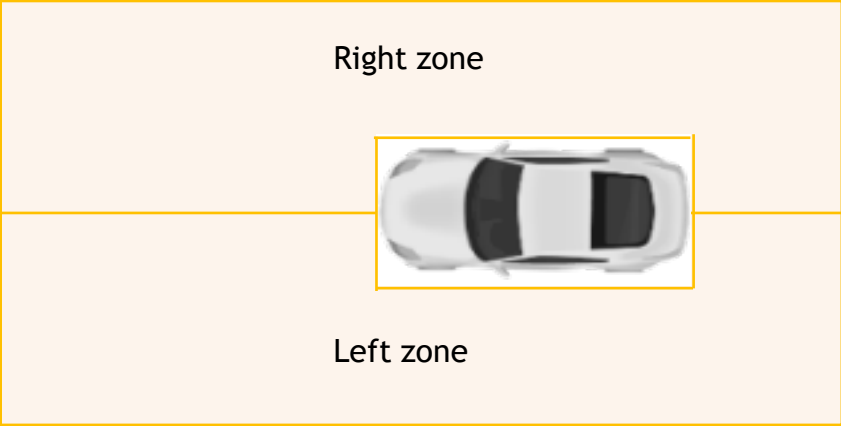
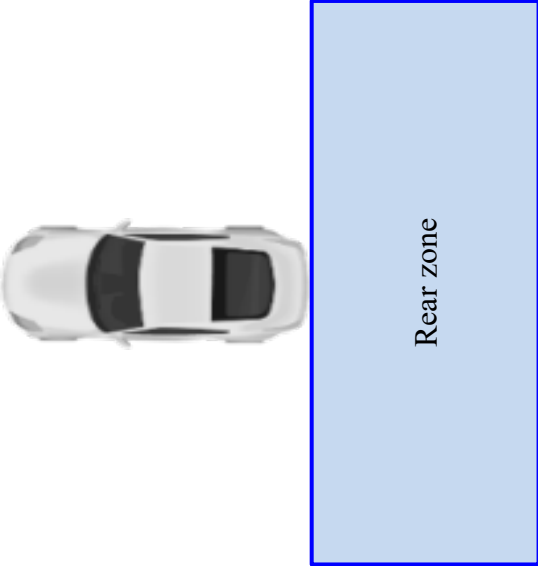


▶ Example picture of Driver



Detailed specification

Projecting area (still under discussion)

Direction indicator road projection (flashing)	Reversing road projection (steady)
 <p>The diagram shows a top-down view of a car centered within a light orange rectangular area. A horizontal line passes through the car, dividing the area into two sections. The upper section is labeled "Right zone" and the lower section is labeled "Left zone". The entire area is enclosed in a thin orange border.</p>	 <p>The diagram shows a top-down view of a car on the left side of a vertical light blue rectangular area. The area is labeled "Rear zone" and is enclosed in a thin blue border.</p>

GTB is conducting independent research studies to objectively assess the safety benefits of these projections.



Suggestions and feedback from CPs are welcome!

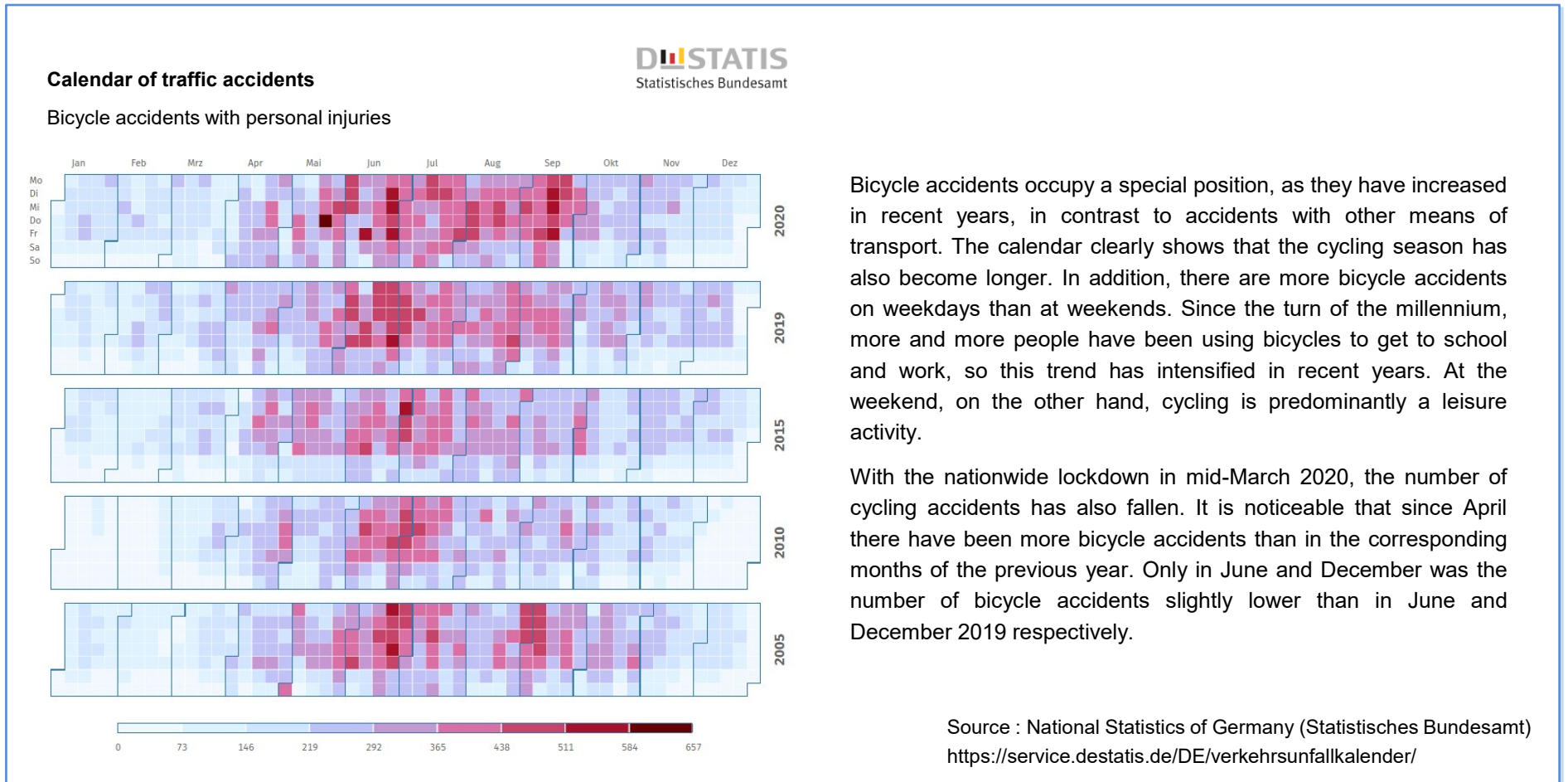
Thank you for your attention

Annex.

Detailed information of background

Annex. Detailed information of background

The below graphic is a traffic accident calendar made by visualizing bicycle accident information of Germany. We are able to see that the number of bicycle accidents is increasing from 2005 to 2020.



Annex. Detailed information of background

The below table shows the death toll for the bicyclist of OECD member countries. **We can figure out that the death toll has not decreased significantly from 2010 to 2019.**

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Argentina	77	-	96	102	83	-	-	187	210	179
Australia	38	35	33	50	44	30	30	39	35	39
Austria	32	42	52	51	45	39	48	32	41	33
Belgium	73	74	84	83	82	90	81	75	88	94
Canada	61	56	62	69	42	49	49	40	45	38
Chile	189	166	111	161	142	163	124	124	111	102
Colombia	327	339	289	314	343	381	379	375	-	-
Czech Republic	80	63	78	74	68	84	53	57	56	53
Denmark	26	30	22	33	30	26	31	27	28	31
Finland	26	19	19	20	27	31	26	23	21	23
France	147	141	164	147	159	149	162	173	175	187
Germany	381	399	406	354	396	383	393	382	445	445
Greece	23	13	21	15	19	11	18	11	12	22
Hungary	92	85	85	68	98	83	75	81	70	63
Iceland	0	0	0	0	0	1	0	2	0	0
Ireland	5	9	8	5	13	9	10	14	9	8
Israel	18	16	12	14	10	15	10	11	16	34
Italy	265	282	292	251	273	251	275	254	219	253
Japan	938	868	790	813	738	770	712	676	636	629
Korea	294	272	286	281	272	272	255	260	207	179
Lithuania	23	26	32	18	19	22	16	13	9	11
Luxembourg	1	2	0	0	0	0	1	0	3	0
Netherlands	119	144	145	129	133	125	132	139	-	-
New Zealand	10	9	8	8	10	6	5	18	5	12
Norway	5	12	12	10	12	5	12	9	6	6
Poland	280	314	300	306	286	300	271	220	285	258
Portugal	33	45	32	29	35	25	33	25	24	26
Serbia	65	56	69	59	50	68	57	48	40	65
Slovenia	16	14	12	16	13	14	13	11	-	9
Spain	67	49	72	69	75	58	67	78	58	80
Sweden	21	21	28	14	33	17	22	26	23	17
Switzerland	34	39	35	21	33	37	32	37	38	26
United Kingdom	111	109	120	113	116	100	105	103	100	-
United States	623	682	734	749	729	829	853	806	871	846
SUM	4,500	4,431	4,509	4,446	4,428	4,443	4,350	4,376	3,886	3,768

Source : IRTAD database of OECD. Stat (https://stats.oecd.org/index.aspx?DataSetCode=IRTAD_CASUAL_BY_AGE)

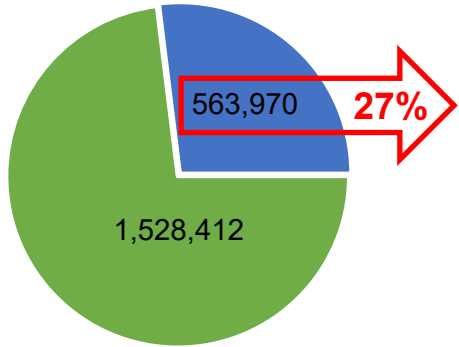
Annex. Detailed information of background

In the five years between 2016 and 2020, more than 2 million accidents with fatalities and Injuries occurred in Japan, **27% of which occurred at night**. Among the accidents that occurred at night, **12% occurred in Four cases where direction indicators were used**.

The bicycle accidents account for one-third of the Four cases. The most frequent cases of the bicycle accidents are when turning left and right.

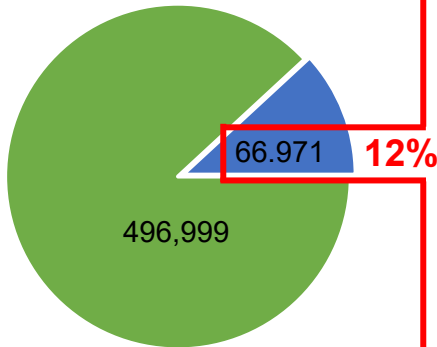
The number of fatalities and injuries from 2016 to 2020 in Japan

Fatalities and injuries in 5 years
(2,092,382 cases in total)



■ Day time
■ Night time

Night time fatalities and injuries
(563,970 cases in total)



■ Other
■ 4 Cases

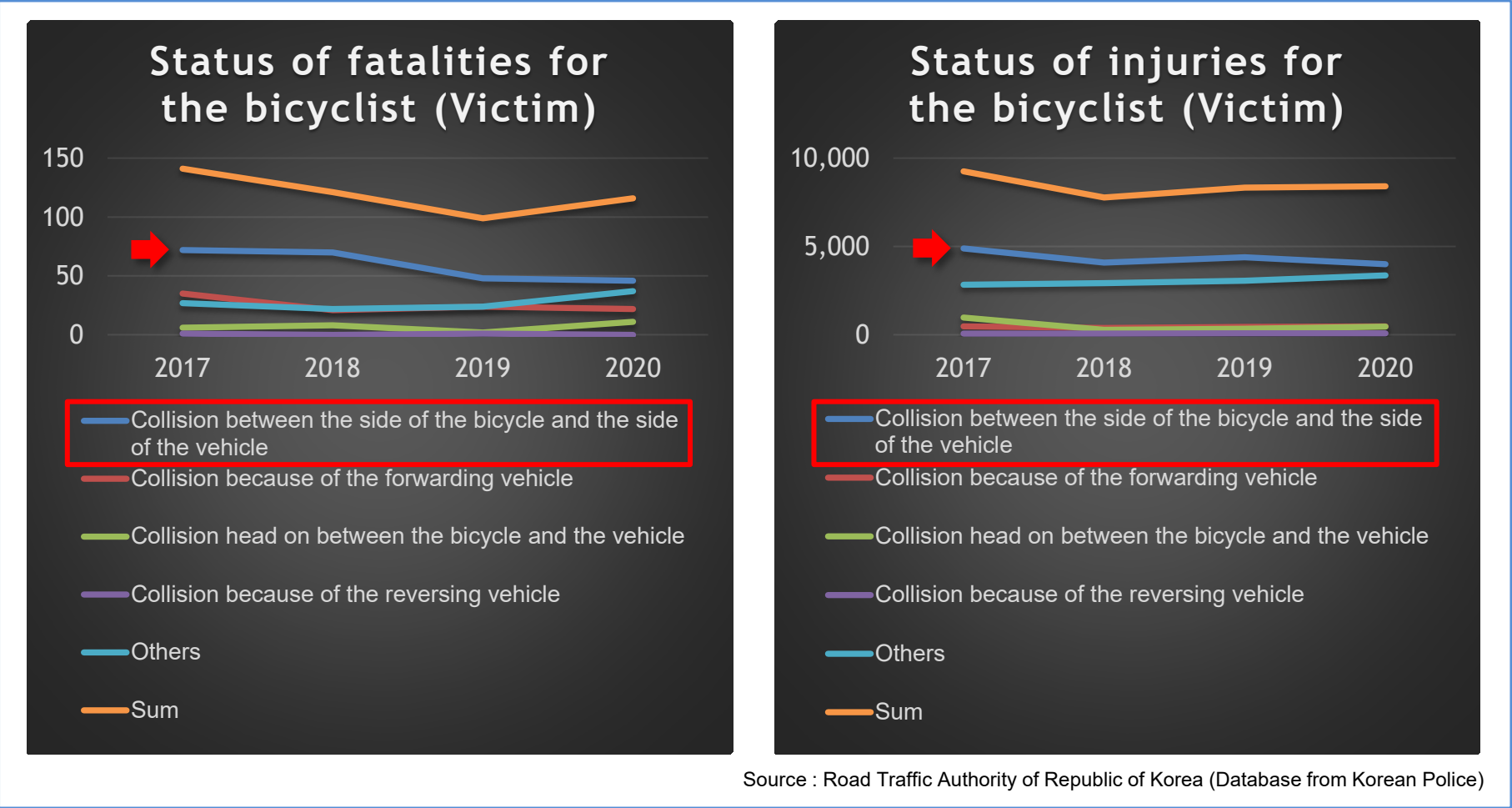
The victim's transportation	Cases (1 st Party : Car)				Total	Ratio	
	Crossing Collision	Left turn	Right turn	Lane change			
2 nd Party	Car	6,221	447	10,661	4,146	21,475	32%
	Motorcycle	1,954	1,162	8,618	1,703	13,437	20%
	Mopeds	1,487	1,170	6,528	542	9,727	15%
	Bicycle	4,797	7,548	9,837	160	22,342	33%
Total	14,449	10,327	35,644	6,551	66,971		
Ratio	22%	15%	53%	10%			

• Crossing collision	• Left turn	• Right turn	• Lane change

Source : ITARDA (Institute for Traffic Accident Research and Data Analysis) and compiled by Stanley Electric co., Ltd.

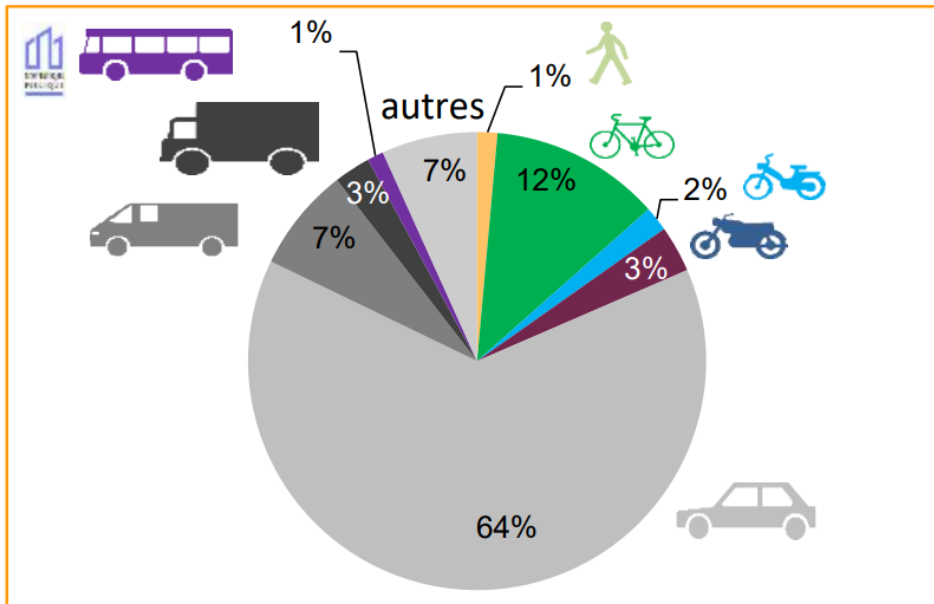
Annex. Detailed information of background

The below graphs show the number of fatalities and injuries for the bicyclist who were the victims of the traffic accidents in Republic of Korea from 2017 to 2020. The main cause of the accidents can be seen as the collision between the side of the bicycle and the side of the vehicle.



The report “Road safety in France Assessment of the accidents of the year 2019” says that **two-thirds of bicyclists killed or injured were against passenger vehicles and more than half were the result of collisions on the side.**

Distribution of cyclists killed or injured according to third parties



By type of collision

89% of those killed or injured in accidents involving a cyclist are cyclists.

Of the cyclists killed or injured, two thirds were killed or injured against a passenger vehicle and more than half were the result of a side collision.

Source : "Road safety in France Assessment of the accidents of the year 2019." – Page.65 ~ Page.66
published by Observatoire national interministériel de la sécurité routière

https://www.onisr.securite-routiere.gouv.fr/sites/default/files/2020-09/Bilan_2019_version_site_internet_24_sept.pdf