

ASECAP DAYS



MILANO 2024



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THE POWER OF AI IN DYNAMIC LANE MANAGEMENT SYSTEM TO UPGRADE ONE OF THE MOST TRAFFIC CONGESTIONED MOTORWAY SECTIONS

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Dynamic Traffic Flow System

General Overview

The system enables the dynamic management of the emergency lane. Thanks to a powerful technological platform to support the operators in the traffic control centre, the solution allows the transition from a configuration with lanes open to traffic plus emergency lane to one with all lanes open to traffic.



Dynamic Traffic Flow System on the A4 Torino-Trieste of Autostrade per l'Italia SpA

Functionalities and technologies:

Using radar, laser scanners and cameras equipped with artificial intelligence algorithms, the system continuously:

- scans the traffic,
- analyses the flow of traffic by making forecasts
- detects events by activating the opening of the emergency lane
- notifies users of lane usage and speed limit information

An Automatic Incident Detection system detects critical events, sending alerts to the central system for the automatic activation of closure or opening procedures of the lanes.

Benefits:

- Reduction of traffic congestion
- Lower CO2 emissions
- Increased level safety

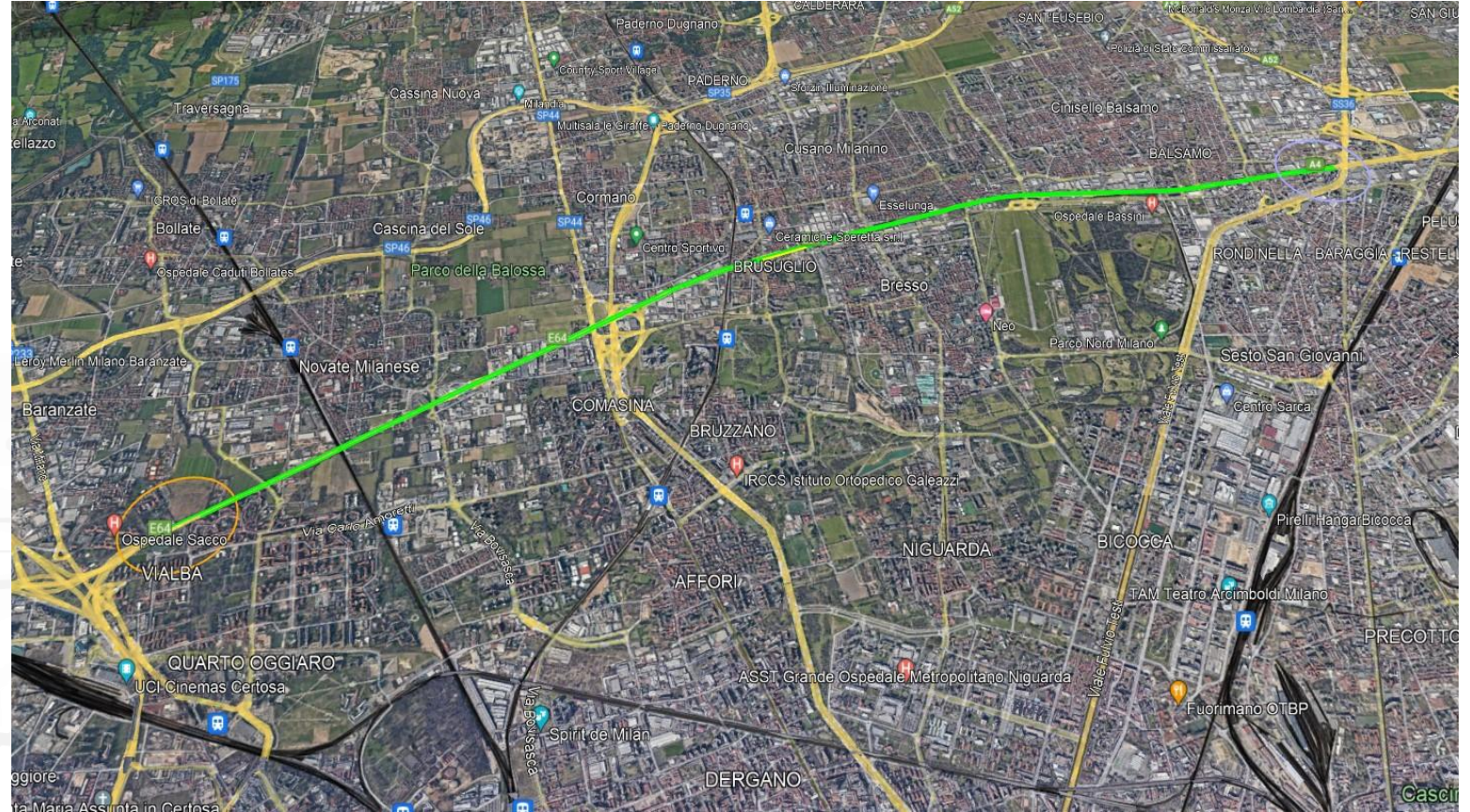
Dynamic Traffic Flow System

Dynamic Lane Section in Italy

Motorway A4 Torino-Trieste in both directions

Motorway section between *junction of Viale Certosa* and *junction of Sesto San Giovanni*.

Length of dynamic lane section: about 10 km



Dynamic Traffic Flow System

AID SYSTEM (Automatic Incident Detecion)

Detection of Stationary Vehicle and Pedestrian on the road through:

- Radar
- Laser
- Camera

COMMUNICATION SYSTEM

Towards travelers

- VMS (Variable Message System)
- LCS (Lane Control Signs)
- VSLS (Variable Speed Limit Signs)
- Traffic Lights
- Control Room

Towards operators:

Traffic Management Platform/VideoWall

TRAFFIC ANALISYS AND FORECAST SYSTEM

Vehicle flow analysis picking up data from various sensors like:

- Traffic detector
- Radar Counter & Classify functionality
- Spotter Bluetooth

Legenda corsie

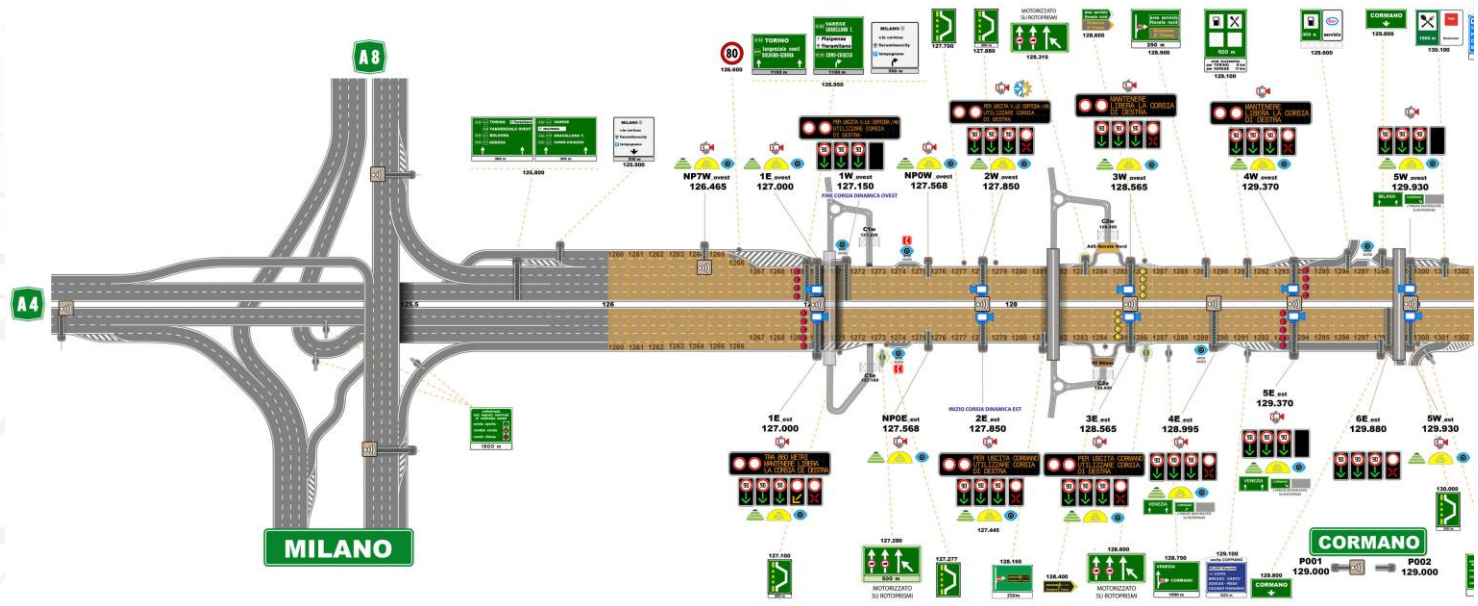
Zone radar

Legenda sostegni

FOA	BANDIERA (due carreggiate)
BANDIERA (occup. tutte corsie)	CAVALLETTO (esterno corsie)
BANDIERA (occup. 1 corsia)	ROTOPRISMA (esterno corsie)
PALO (itinerare)	

Legenda sensori

RADAR	TLC BRAND.
LASER SCANNER	WI-FI
TLC FISHEYE	RT
TLC TRAFFICO	METEO
TUTOR	



Dynamic Traffic Flow System

AID System

Each alarm comes from **radar** and **laser** sensors and is managed by the **camera control sub-system**:

- Identification of cameras to be involved in the shot
- Application of video analysis by using artificial intelligence

Video analysis through artificial vision tools with the use of neural networks is used to confirm the alarms due to detection of stationary vehicles by the radar and laser sensors distributed along the section.



Dynamic Traffic Flow System Communication System

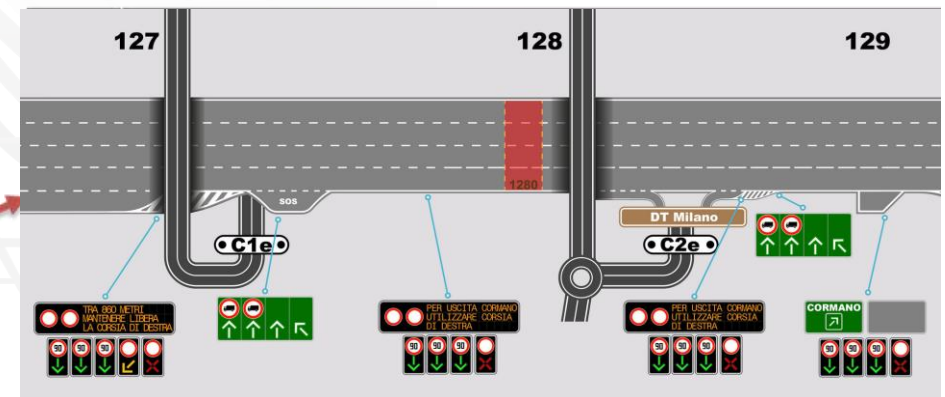
Live video of all the cameras associated to the warning are displayed on the videowall

The warning on the synoptic is represented with a specific icon (red section)



alarm-id #1

NP2E_est



Dynamic Traffic Flow System

Traffic Analysis and Forecast System

Traffic Analysis

Calculation of Service Level in according to the analysis of the following data:

- Travel time of the "sub-segments" measured by Spotter BT
- Start of "segments" measured by Traffic Detector
- Vehicles Speed of the "sections" measured by RADAR

Thanks to these measurements it is possible to calculate for each section of the Dynamic Lane all the traffic descriptive variables (Flow, Speed and Density) relating to a roadway.

Traffic Forecasting

Thanks to an neural network the system is able to forecast the traffic trend in the short medium term. This result will be an input to decide if opening/closing the dynamic lane

direzione Est				direzione Ovest			
RADAR	WIFI	RT			RT	WIFI	RADAR
sezione E	sub-segmento	segmento	tratta	tratta	segmento	sub-segmento	sezione W
1265			126,5				1265
1266			T1E				1266
1267							1267
1268							1268
1269							1269
1270	127,000	127,000			127,000	127,000	1270
1271	SS1E	S1E					1271
1272							1272
1273							1273
1274							1274
1275							1275
1276							1276
1277						SS12W	1277
1278	127,850					127,850	1278
1279	SS2E						1279
1280							1280
1281							1281
1282							1282
1283							1283
1284					SSW	SS11W	1284
1285	128,565	128,565			128,565	128,565	1285
1286	SS3E	S2E					1286
1287							1287
1288							1288
1289	128,995						1289
1290	SS4E						1290
1291							1291
1292					S4W	SS10W	1292
1293	129,370	129,37	T2E	T2W	129,37	129,370	1293
1294	SS5E	S3E					1294
1295							1295
1296							1296
1297							1297
1298						SS9W	1298
1299	129,930					129,930	1299
1300	SS6E						1300
1301							1301
1302							1302
1303							1303
1304							1304
1305	130,580					SS8W	1305
1306	SS7E					130,580	1306
1307							1307
1308							1308
1309							1309
1310							1310
1311							1311
1312					S3W	SS7W	1312

Dynamic Traffic Flow System

Roadside Devices for AID System



AID System:

AID (Automatic Incident Detection): Detection of Stationary Vehicle and Pedestrian on the road

AID Features:

Coverage radius: ~400 m
Same % of detection day/night
Cone of shadow under the gantry

Radar Type:

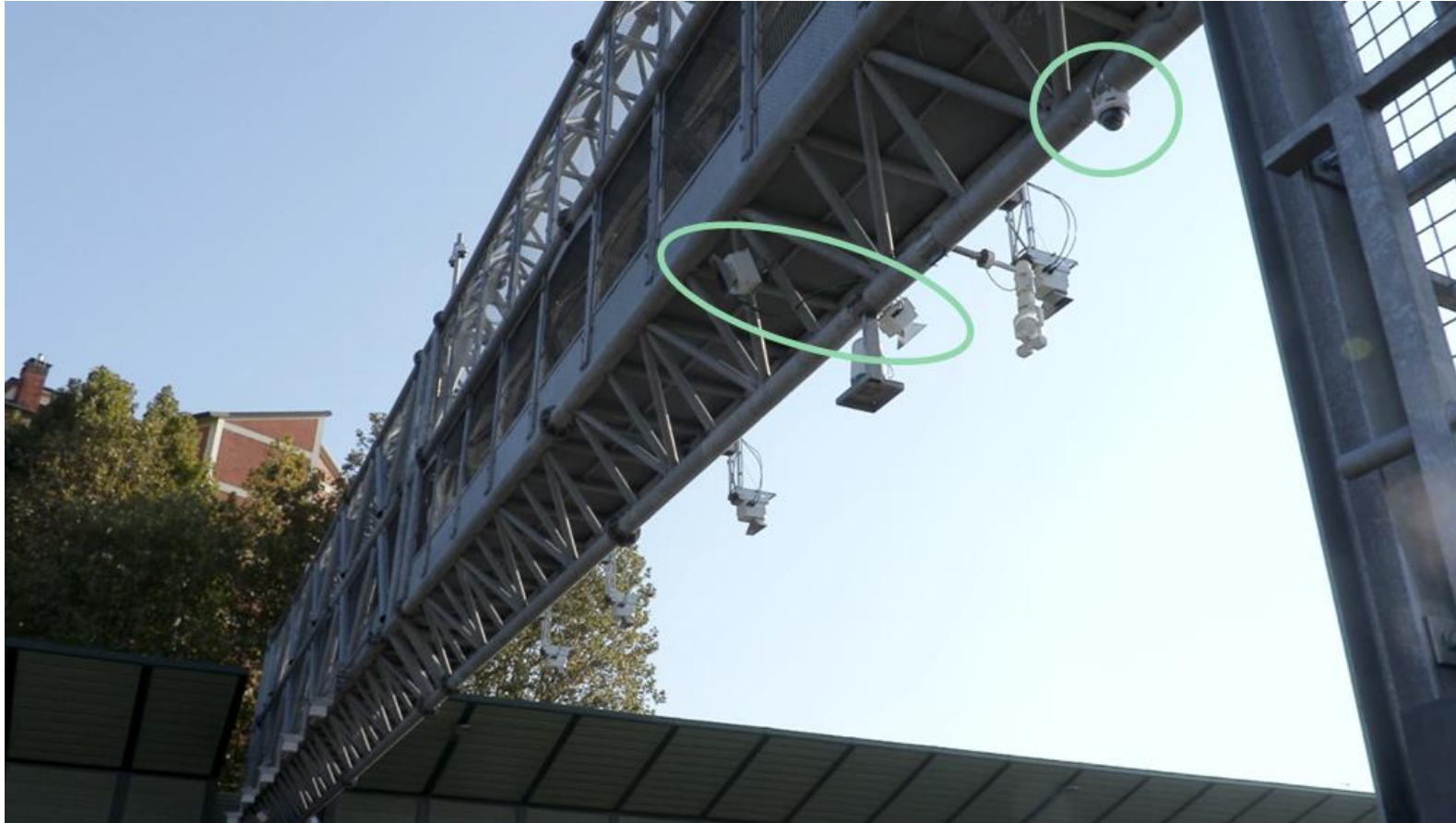
Navtech CTS 350-X

PTZ Camera Type:

Bosch MIC IP starlight

Dynamic Traffic Flow System

Roadside Devices for AID System



AID System:

- Detection of Stationary Vehicle and Pedestrian on the road in the cone of shadow of the radar under the gantry
- Coverage radius: ~25m under the gantry

Laser Scanner type:

Comark LSR2001

Dome Camera type:

Axis P3807-PVE

Dynamic Traffic Flow System

Roadside Devices for Traffic Analysis and Forecast System



Radar type

Counter & Classify Functionality:

Navtech CTS 350-X

Traffic Detector type:

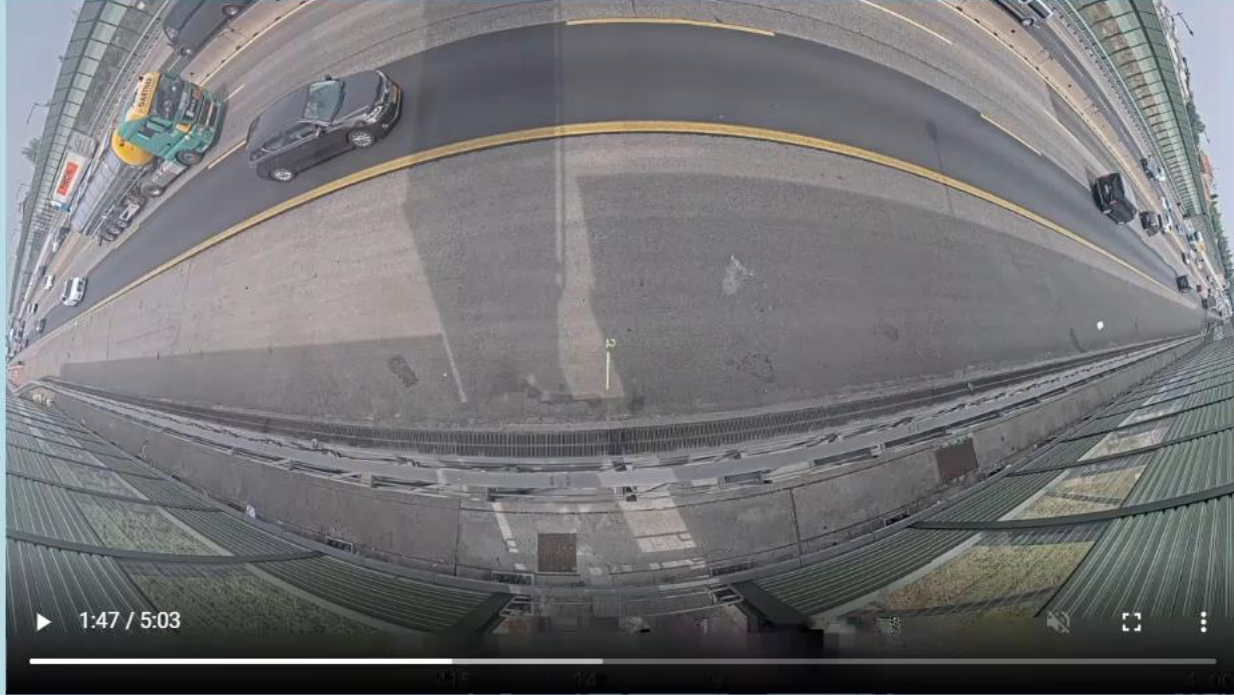
Comark RSR 4001

Spotter Bluetooth type:

Geoin Spotter BT

Allarme: 2022-06-21 11:24:19.6842981 Sezlone: 1278 Corsia: 1 Codice Telecamera : [7808, 7796]

21/06/2022 - 11:24:01



11:20:14

11:37:11

Nascondi colonna

Id allarme	Id radar	Inizio	Fine	Durata	Sezioni	Km Inizio	Km fine	Corsia	Carreggiata	Frame	Mappa	Invoke Preset	Conferma Manuale	Note
489289	4	21/06/2022 11:24:19	21/06/2022 11:24:45	0:0:26	1278	127.8	127.9	1	2			21/06/2022 11:24:26.677	Veicolo Fermo (In emergenza)	

Allarme: 2022-04-12 13:20:39.6399057 Sezione: 1279 Corsia: 1 Codice Telecamera : [7796]

12/04/2022 - 13:20:00



A04 km 127,8 2E 10.169.130.22

12.Apr 2022 13:20:00



237

13:16:00

13:36:00

Nascondi colonna

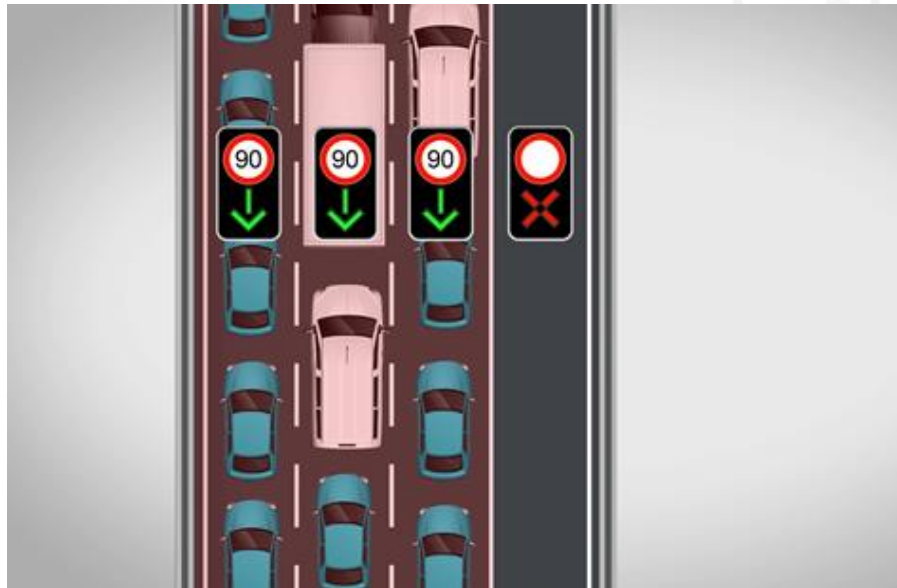
Id allarme	Id radar	Inizio	Fine	Durata	Sezioni	Km Inizio	Km fine	Corsia	Carreggiata	Frame	Mappa	Invoke Preset	Conferma Manuale	Note
387532	4	12/04/2022 13:20:39	12/04/2022 13:21:03	0:0:24	1279	127.9	128	1	2			12/04/2022 13:20:44.812		

Dynamic Traffic Flow System

Dynamic Lane Opening Criteria

The opening of the dynamic lane is enabled if one of the following conditions occurs:

- The AID System detects NO event like vehicle stopped
- There is NO impeding event on the Traffic Management Platform
- Route congestion prediction conditions by the Traffic Analysis and Forecast System



Dynamic Lane close



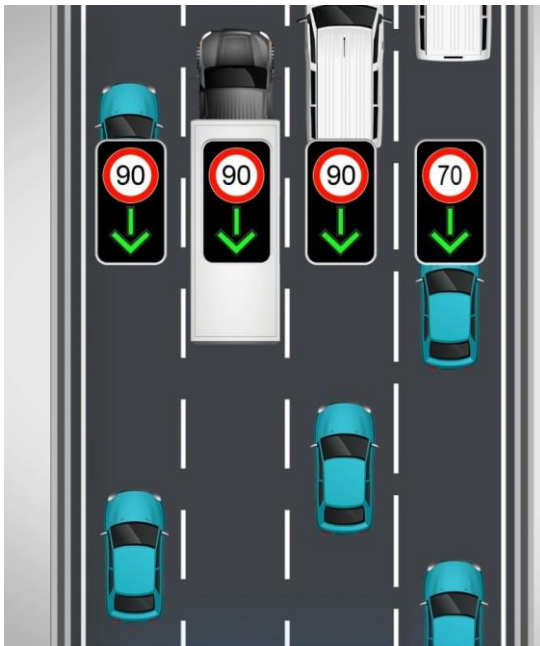
Dynamic Lane open

Dynamic Traffic Flow System

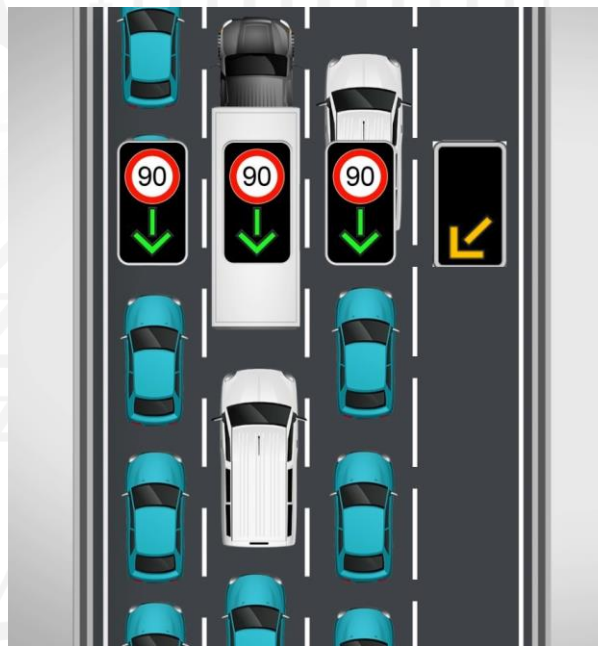
Dynamic Lane Closing Criteria

The closing of the dynamic lane is enabled if one of the following conditions occurs:

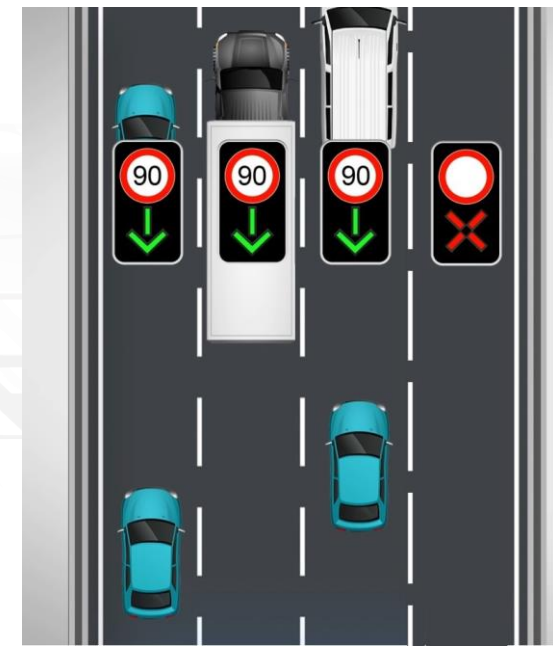
- The AID System detects event like vehicle stopped
- There is impeding event on the Traffic Management Platform
- Traffic conditions are missing from the route congestion measurements



Dynamic Lane open



Transitory of 30 sec



Dynamic Lane close

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**THANK
YOU**

GRAZIE

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