49th ASECAP DAYS

Decarbonizing Road Infrastructure : Challenges, Perspectives and Actions in Tough Economy

ASECAP DAYS
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From Digital Infrastructure to C-ITS Services

Development and harmonisation of standards for enhanced Traffic Management Services

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Overview

- Road operator’s Digital Infrastructure challenges
- Data Driven ITS Services eco-system
- ITS Architectures and standards as key to interoperability
- Standardisation roadmaps and challenges
- A Data Driven model for roadworks C ITS service delivery

Autostrade per l'Italia and ITS Services

✓Road Operator in advanced Digital Transformation

- **Focus on Digitalisation for**
  - **Road Information**
  - **Road Network Management**
    - **Among several TCCs**
  - **Collaborative ITS Services development**

✓ Institutional Service Provider

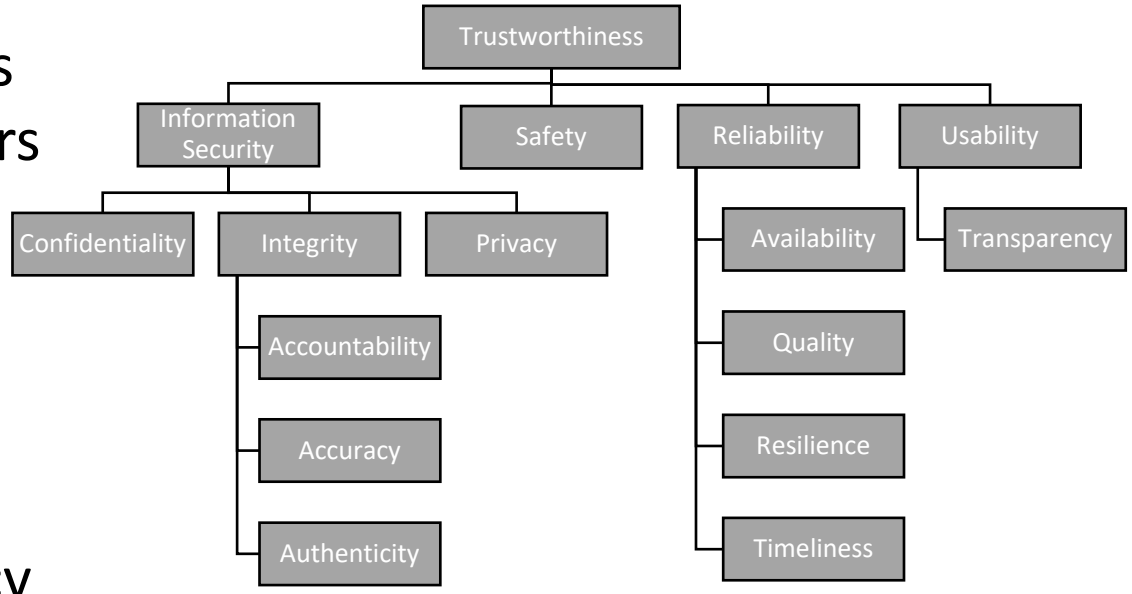
- Directly involved in **Standardisation Organisations** (DATEX II, CEN, ISO) and **Deployment Projects** (Eu Corridors, C Roads, etc.)

- **3000 km Network**
- **9 operated (+ 3 owned) Traffic Managent Center**
- **1 Traffic Information Center**
- **46.111 Million Km travelled in 2022**

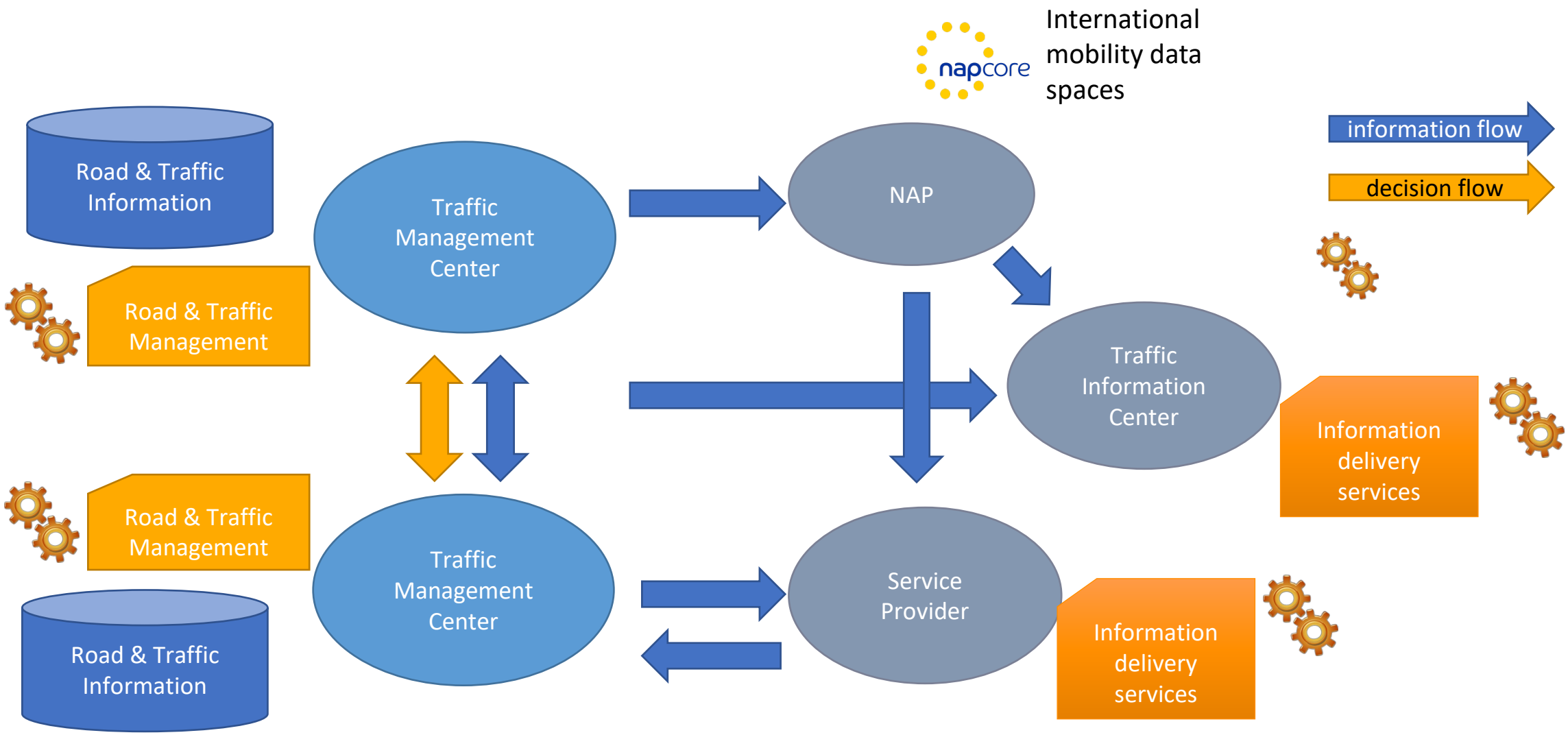
Traffic Information Services features

- Delivery of Digitalised Information on road and traffic condition
  - Triggering Traffic management operations
  - Triggering ITS Services by Service Providers
  - Digital Information is the core of any possible action to ease:
    - Network performances
    - Individual travel optimisation
- Key points for information
  - Quality ➔ Reliability, Timeliness, Accuracy
  - Trust ➔ Trustworthiness ** (ISO TR 24028)
    - Resilience and Trust crucial for Automated Driving

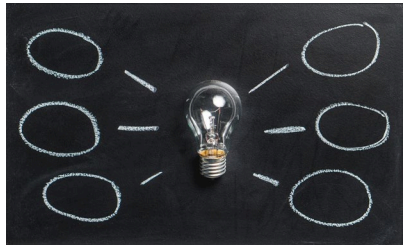
ISO/IEC TR 24028:2020

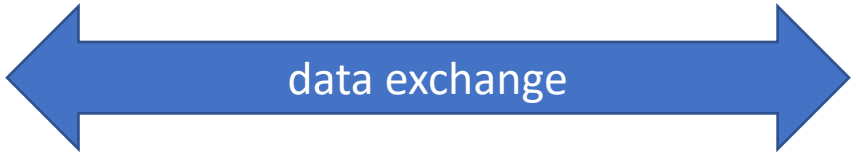


ITS Services Data Exchange eco-system



Collaborative Traffic Management by Data Exchange





Exchange Levels

1. Information Delivery
2. Processing
3. Collaborative Management

   Agreement and Monitoring

   1. VMS Setting
   2. TMPlan operation
   3. Rerouting

Data Driven ITS Services and Standards

adaptation interface

adaptation interface

Digital Infrastructure

Coded Standardised Information

GDF
TN-ITS
Map Update Exchange
DATEX II

Service Messages

TMC
TRAFFIC MESSAGE CHANNEL
TPEG
TRANSPORT PROTOCOL EXPERTS GROUP
C ITS
Sensor-IS

monitors manages

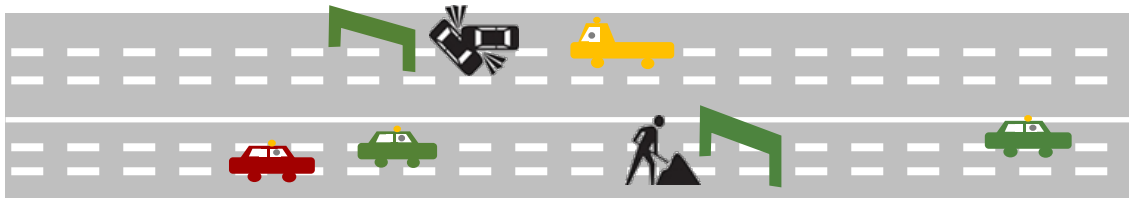
NAPs

deliver services collect data

Road Operator

ITS Service Provider

Physical Infrastructure

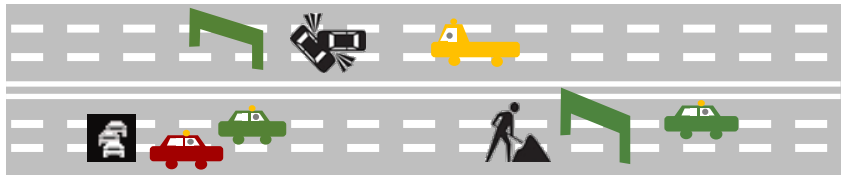


cars
OBE
mobile

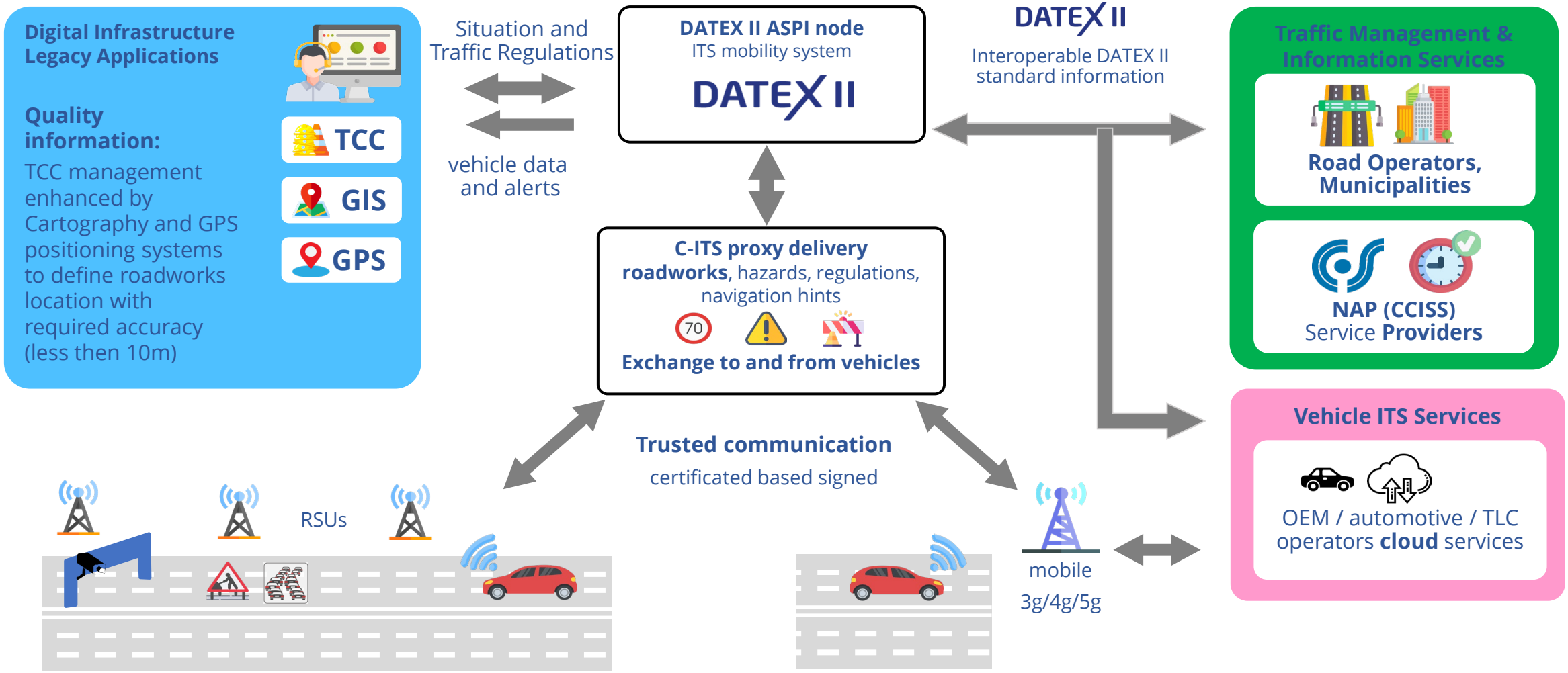
Information Encoding for Application

Different views to structure data	Information	Goals	Standardised Interface
Road operator	road conditions, accidents, traffic regulation items along the road network	Safe and sustainable road Traffic Management Level of Services	DATEX II, TN-ITS Map Update Exchange, GDF
Traveller	origin to destination, multiple path choices, best itinerary based on travellers specific goals	Safe comfortable travel Cost awareness Green and Sustainable travel	TMC TRAFFIC MESSAGE CHANNEL, TPEG TRANSPORT PROTOCOL EXPERTS GROUP
Automated Vehicle	driving condition along the roadway based on the chosen itinerary.	safe, secure, efficient, sustainable travel	C ITS Sensori-IS

Same reality
Different perspectives
Views for Application optimisation



Data Driven ITS Services in ASPI



ITS and C ITS delivery system architecture by autostrade per l'italia MOVYON

Quality and Reliability

- Key factors to improve Quality:
  - **Data Quality** for Road Information
    - Accurate and up to date information
      - Semanthic & Onthology
      - Data classification
    - Location Precision
      - HD/3D maps Digital Maps with increasing accuracy
  - **Collaborative / Cooperative process** ➔ improve reliability, timeliness, accuracy
    - Data Fusion, floating car data
    - Collaborative ITS Services
    - Cooperative ITS
  - **Security & Trustworthiness**
    - **Cybersecurity aspects**
    - **Robust and Resilient Data Exchange**

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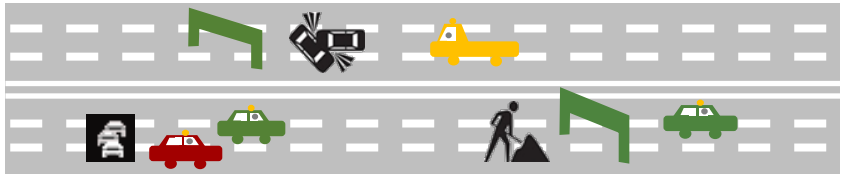
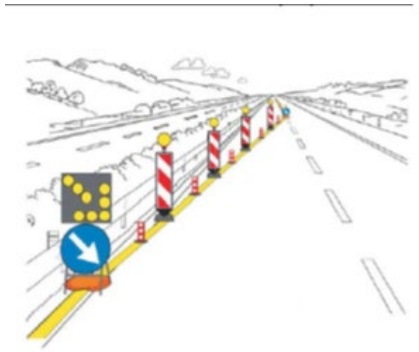
Roadworks Information to C ITS

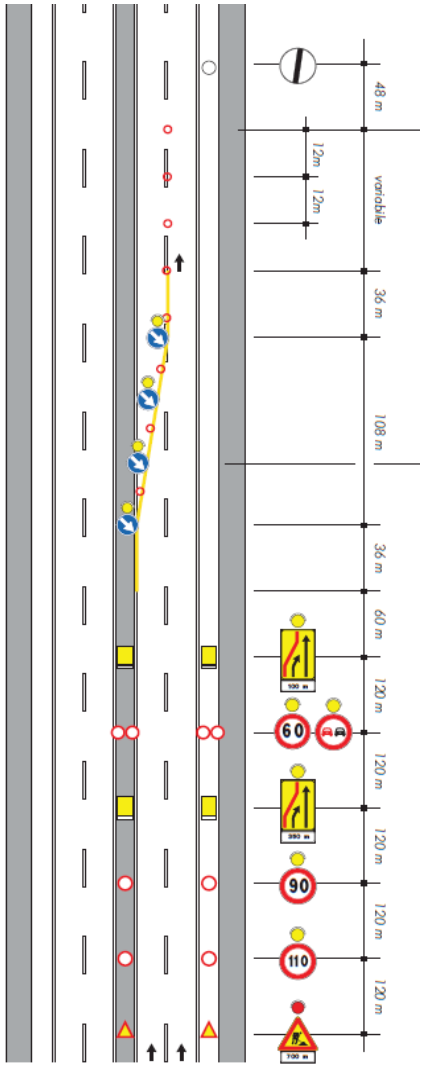
A DATEX II model to support C ITS delivery for Extended Road Work Zones

Carriageway and Lanes Location accuracy



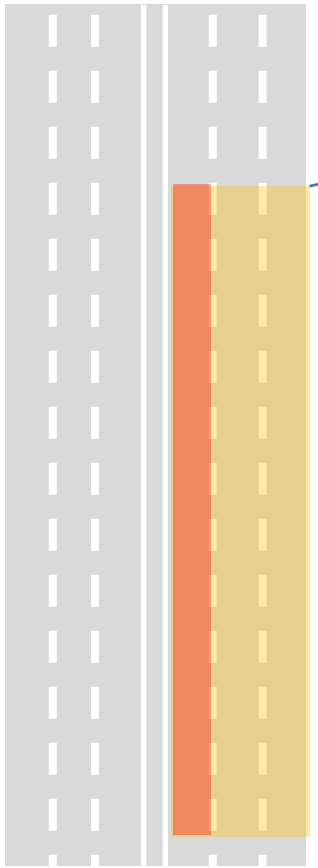
Roadwork A22 km 324+400, overtaking lane closed





- RoadWorks as basic information lacks of precise lane management details
  - GPS devices for enhanced position location are in operation.
- Vehicle automated / assisted driving need precise information about:
  - Location of specific regulations
  - Lane usage
  - Speed regulation per lane
  - Lanes restriction per vehicle categories
- New systems to refine the position of the roadworks signs are under development.

Roadworks information encoding in DATEX II



B

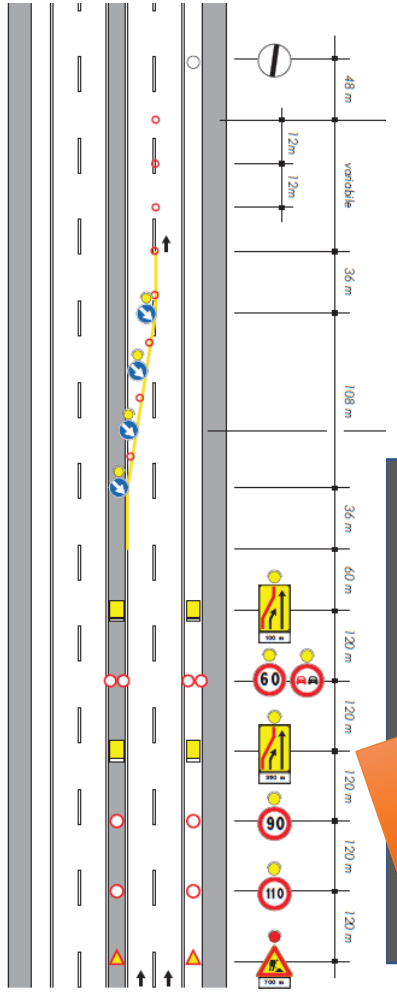
A

DATEX II situation Publication EN 16157-3

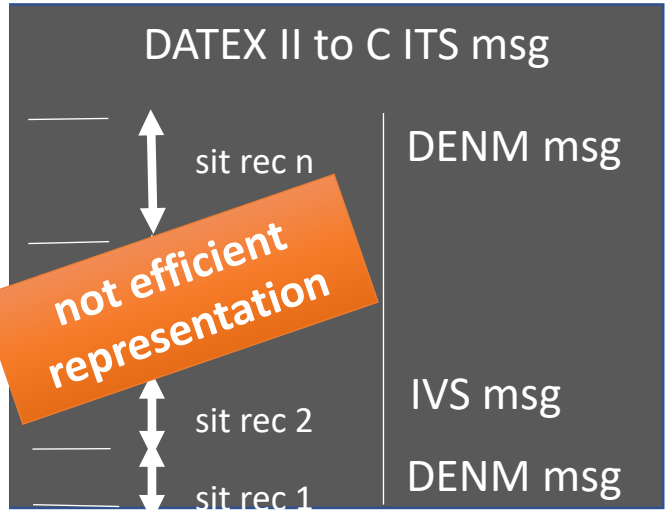
1 Situation with 1 Situation record
Roadworks with 1 closed lane

DATEX Situation / Situation Record
Operator Action Type : Roadworks
Extent Linear from **A → B**
Positive carriageway
1 closed lane: lane 2 = overtaking lane

lanes usage details



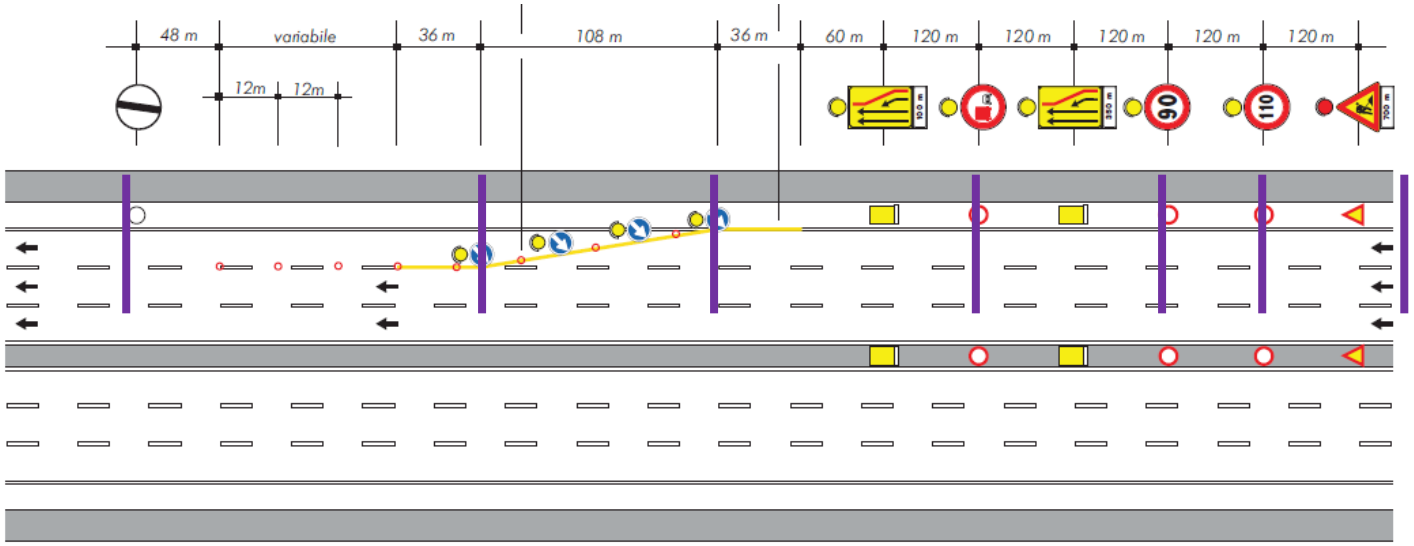
Uniform lane management sections to be represented separately when delivering information to vehicles



Several distinct situation records in a roadwork situation

Sections Concept in Roadwork management

Introducing Section and Lanes along the roadwork Segment



1:1 mapping to C-ITS messages **per section**

- **Roadwork Zone**
- **Sections** with homogenous management status
  - allowed speed / regulations
  - number of lanes
- **Lane** status
  - open
  - closed
  - deviated
  - Allowed speed
  - Overtaking ban
- **Traffic Regulation**
  - Information according to DATEX II TS 16157-11

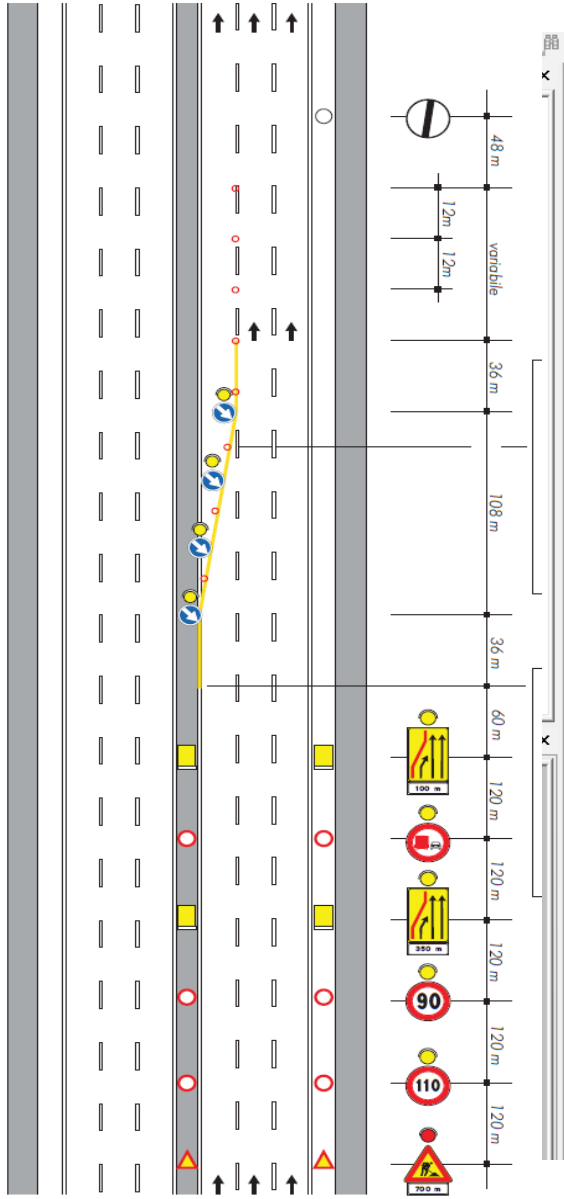
New DATEX II model for Roadworks supporting C ITS

Compact description and 1:1 mapping to C ITS messages:

1) Carriageway location definition
2) Segment Section and Lanes defined by offset or with precise location referecing options depending on application
3) Any section and lane associated to features groups with Traffic Regulation
4) Deviated lanes specification in opposite carriageway

NOTE: C ITS messages in Roadworks reference guide, activity ongoing in C ROAD EU platform.

Carriage Lane Management Model Documentation
https://datex2.eu/implementations/extension_directory/lane-carriageway-management-extension

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Conclusions

- **Digital Infrastructure / Digital Twin managament** is key toward automation to achieve safe, sustainable, efficient solutions to smart green mobility
  - **Accurate, Trusted, Reliable, Quality** data are to be provided
- **Data Driven ITS Services** and **NAPs mobility data spaces architecture** are under developing
  - **Several Standards** are developed to implement different ITS Services views
  - **Convergence** is needed in road standards to grant interoperable solution
- **Road Operator experience** is needed to drive the standard development and easy to keep the tight connestion along the different domains
  - **Interoperability driven standards** is key
- **C ITS & CCAM development leading fast to full digitalisation**

NAPCORE www.napcore.eu
DATEX II www.datex2.eu
C ROADS www.c-roads.eu
CEN www.itsstandard.eu
CCAM www.ccam.eu

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THANK YOU FOR YOUR ATTENTION

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