Ontology-driven Data Acquisition: Intelligent Support to Legal ODR Systems

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Outline

- Introduction
  - ADR: European and Italian cases
  - Beyond the state of the art of ODR: eJRM Project
- Ontology-driven Data Acquisition
  - Ontological Structure
  - Logical Engine
- Application Scenario
  - Civil liability related to the use of motor vehicles

Introduction

- Alternative Dispute Resolution:
  - proceedings with no formal court hearing or litigation
  - 2011 European Parliament Report:
    - 410.000 cases in 2006
    - 473.000 cases in 2007
    - more than 500.000 cases in 2008
  - The Italian context:
    - 215.000 ADR cases from March 2011 to December 2012

Italy's Central Bank has estimated a **16 billion euro loss** in terms of DGP caused by the slowness of civil justice

Introduction

- Italian Ministry of Justice is encouraging ADR

1066 days for **in**-court-proceedings → **90 days** for **out**-of-court-proceedings

- These numbers have envisaged ICT to be the key action in this area

ALTERNATIVE DISPUTE RESOLUTION → **ONLINE DISPUTE RESOLUTION**

- ODR involves technology and the Internet to facilitate and speed up the resolution of **out**-of-court disputes.

Introduction

- Several initiatives have been investigated for supporting ODR
  - Commercial: Internet-based support toolsets (video conferencing, chat rooms,…)
  - Academic: intelligent technologies for helping the resolution of the disputes
    - DEUS, template-based system
    - SPLIT-UP, combination of rule-based systems and neural networks to assist disputes about properties distribution
    - FAMILY-WINNER, game theory-based approach for Australian family negotiations
    - BEST-project, semantic web technologies as support to law cases retrieval

Introduction

- Main limitation of existing approaches
  - collection of information for enabling any decision:
    - claims and requirements are collected by **a fixed-structure template**
    - **no** possibility for litigants to provide **argumentations** by using **natural language**
    - **absence** of intelligent tools to understand the **flexibility** of the parties
    - **absence** of intelligent tools to **suggest strategies** (to mediators) in order to achieve an **agreement**

- **eJRM**: **e**lectronic **J**ustice **R**elationship **M**anagement
  - Italian initiative aimed at dealing with semantic representation and machine-learning
    - to improve the awareness of citizens to personally evaluate the potential outcome of a litigation
    - to be guided to a non-conflict settlement
    - to be assisted in selecting the potential legal and mediation support

Self-Litigation

Online Mediation

Ontology-driven Data Acquisition

- GOAL:
  - mimic the exploratory behavior of mediators to acquire relevant information about the citizen case

- What is **O**ntology-drive **D**ata **A**cquisition [**ODA**]?
  - computer-based
  - self-administered
  - interactive

questionnaire

Self-Litigation

Online Mediation

- **ODA** selects pertinent questions depending on the citizen's individual responses:
  - It helps both citizen and mediator to save time
  - It offers a database for research
  - It collects only pertinent information related to the citizen's case

- The Ontology-driven Data Acquisition system (ODA) comprises two main components:
  1. **Ontological Structure**: modeling the juridical knowledge about a specific domain
  2. **Logical Engine:** exploring the ontological structure to provide questions and collect responses

Ontology-driven Data Acquisition

- Ontological structure:
  - a number of sub-ontologies aimed at modeling subset of questions
  - concepts and relationships represent the question/answer flow:
    - yes/no questions
    - multiple-choice questions
    - correspondence between answers and violation of specific norms

Ontology-driven Data Acquisition

- Ontological structure:
  - Relationships/Predicates
    - **assume**: **its object concept** needs to be verified throughout the question flow in order to proceed with presenting to the user the question concerning the subject concept
    - **assumeAND**: **all the object concepts** sharing the same subject must be verified in order to present to the user the question corresponding to the shared subject concept.
    - **assumeOR**: model **multiple-choice questions** and links a subject concept of a "Multiplechoice question" to an object concept "Answer to multiple-choice question"
    - **violatedWhen** and **verifiedWhen**: relationships linking a **norm** with a concept that could lead to its **violation** or **compliance**.

Ontology-driven Data Acquisition

- Logical Engine:
  - explores the ontology to gather concepts to be characterized by the user
  - shows the question related to the given concept and acquires the response
  - Based on Last State-Next State Model (LSNS):
    - Short-term memory approach based on predicate priorities
    - A concept to be acquired (question currently processed) could lead to several potential subsequent concepts

Ontology-driven Data Acquisition

Algorithm 1 logicalEngine (Concept *currentConcept*)

```
1:  if currentConcept is acquired then return
2:  else
3:      get childConcept with assumeAND(currentConcept)
4:      if some childConcepts do not match the ontology properties then return
5:      else
6:          for each childConcept not yet acquired do
7:              show question and store 'response' for childConcept
8:              if question type is multiple-choice then
9:                  currentConcept = 'response'
10:                 logicalEngine(currentConcept)
11:             if question type is boolean & 'response'=false then return
12:     get childConcept with assume(currentConcept)
13:     for each childConcept do
14:         if childConcept is not yet acquired then
15:             show question and store 'response' for childConcept
16:             if question type is multiple-choice then
17:                 currentConcept = 'response'
18:                 logicalEngine(currentConcept)
19:     if all childConcept match the ontology properties then
20:         show question and store 'response' for currentConcept
21:         if question type is boolean & 'response'=true then
22:             set the superClass(currentConcept) as 'true'
23:         if question type is multiple-choice then
24:             currentConcept = 'response'
25:             set the superClass(currentConcept) as 'true'
26:             logicalEngine(currentConcept)
27:         else return
28:     get parentConcept related to currentConcept
29:     for any parentConcept do
30:         if parentConcept is 'law' & parentConcept is acquired then
31:             store norm violation (if any)
32:         else logicalEngine(parentConcept)
```

1° predicate: assumeAND

2° predicate: assumeOR

3° predicate: assume

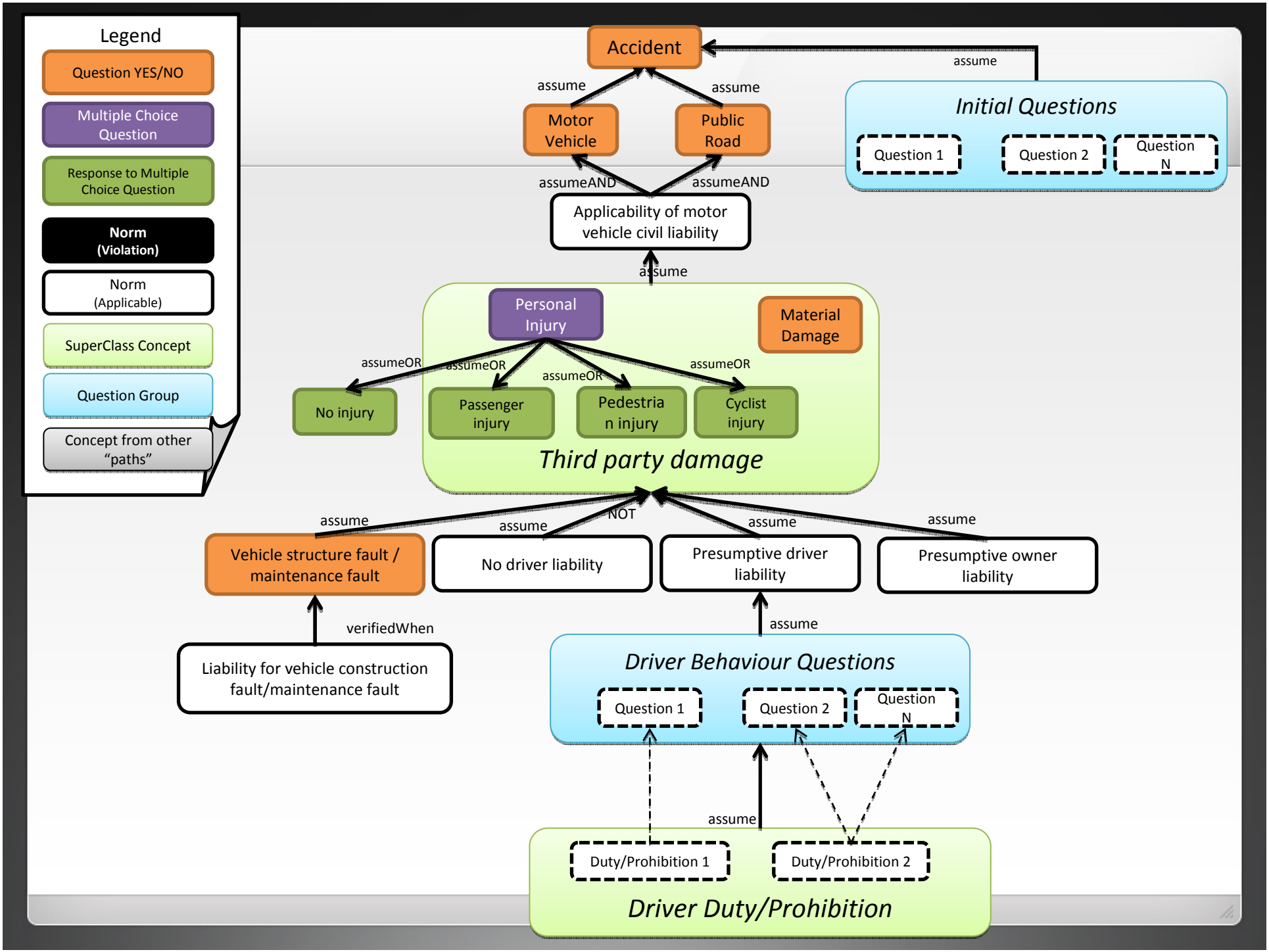
Application scenario

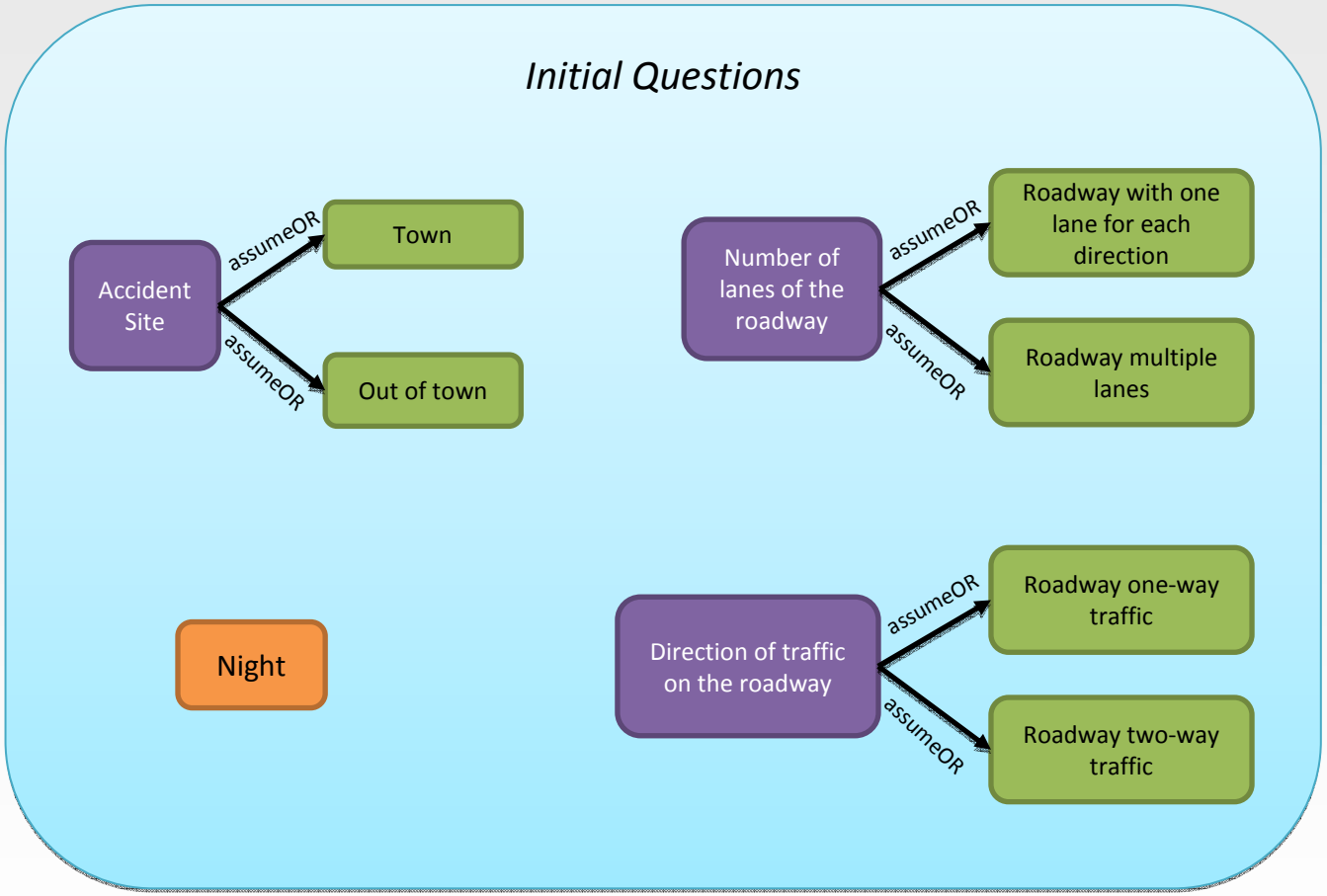
- **Civil Liability** related to the use of **Motor Vehicles (CLMV)**: the **Italian Case**
  - **Justices of the Peace**:
    - 462.435 in-court-proceeding in 2011 (up to €20,000)
    - 20% of the total number of cases of such office
  - **Compulsory Mediation** (now voluntary for CLMV):
    - 29% of all mediation proceedings about CMV (6 months in 2012)
  - Material and Resources:
    - Italian Code for Private Insurance
    - Italian Civil Code
    - Italian Traffic Regulation

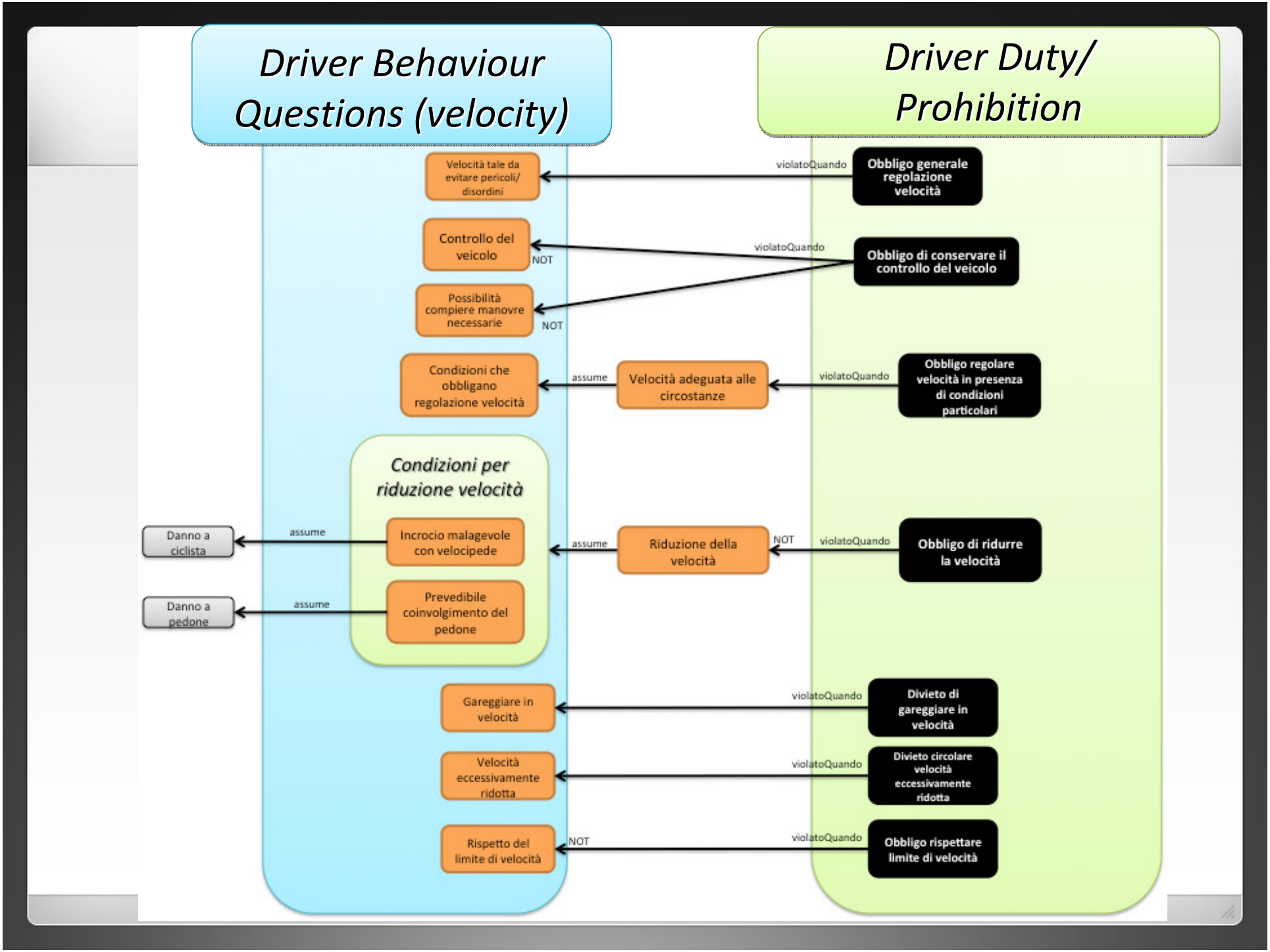
Application scenario

- Modeling Issues:
  - key concepts established by the rules of law
  - modeled concepts are connected by (juridical) relationships

- Modeled Concepts:
  - applicability of the motor vehicle civil liability
  - responsibility of the driver and/or owner of the motor vehicle
  - behavior of involved subjects (passengers, cyclists, pedestrians, owner, driver)
  - norms and prohibition rules

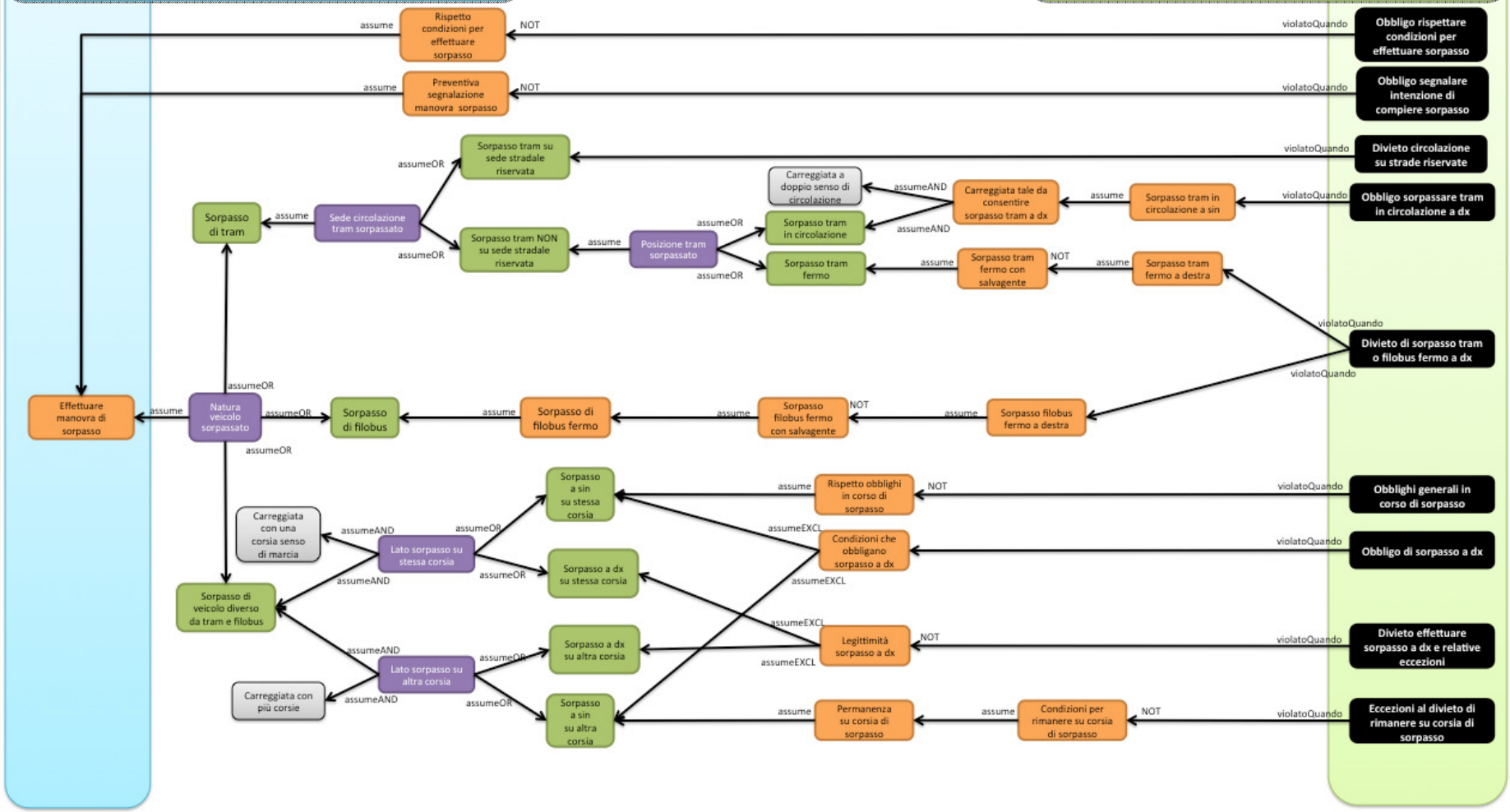

Legend
Question YES/NO
Multiple Choice Question
Response to Multiple Choice Question
Norm (Violation)
Norm (Applicable)
SuperClass Concept
Question Group
Concept from other "paths"
Accident
assume
assume
assume
Motor Vehicle
Public Road
Initial Questions
Question 1
Question 2
Question N
assumeAND
assumeAND
Applicability of motor vehicle civil liability
assume
Personal Injury
Material Damage
assumeOR
assumeOR
assumeOR
assumeOR
No injury
Passenger injury
Pedestria n injury
Cyclist injury
Third party damage
assume
assume
NOT
assume
assume
Vehicle structure fault / maintenance fault
No driver liability
Presumptive driver liability
Presumptive owner liability
verifiedWhen
assume
Liability for vehicle construction fault/maintenance fault
Driver Behaviour Questions
Question 1
Question 2
Question N
assume
Duty/Prohibition 1
Duty/Prohibition 2
Driver Duty/Prohibition

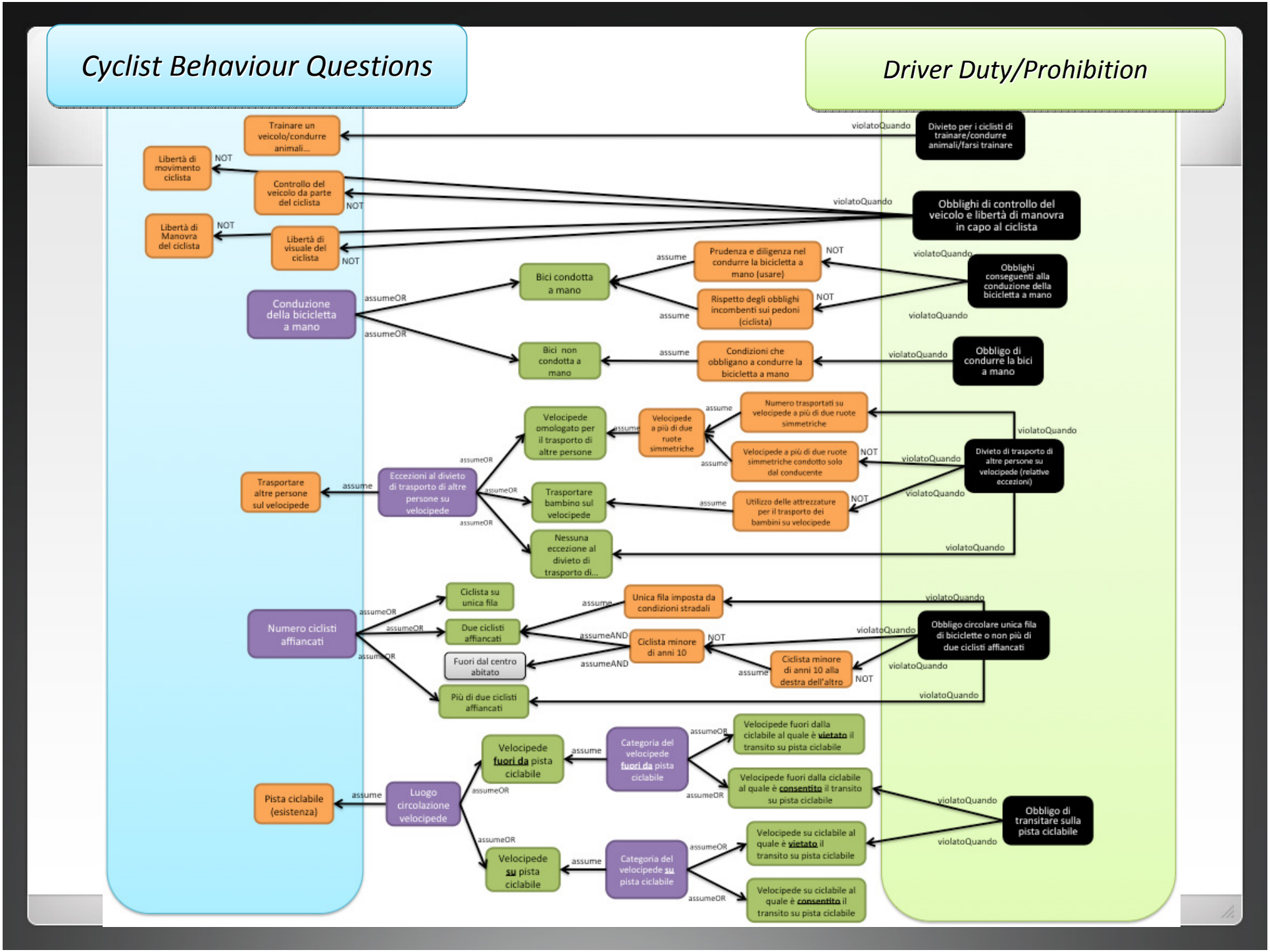

Initial Questions
Accident Site
assumeOR
Town
assumeOR
Out of town
Number of lanes of the roadway
assumeOR
Roadway with one lane for each direction
assumeOR
Roadway multiple lanes
Night
Direction of traffic on the roadway
assumeOR
Roadway one-way traffic
assumeOR
Roadway two-way traffic


Driver Behaviour Questions (velocity)
Driver Duty/ Prohibition
Velocità tale da evitare pericoli/ disordini
violatoQuando
Obbligo generale regolazione velocità
Controllo del veicolo
NOT
violatoQuando
Obbligo di conservare il controllo del veicolo
Possibilità compiere manovre necessarie
NOT
Condizioni che obbligano regolazione velocità
assume
Velocità adeguata alle circostanze
violatoQuando
Obbligo regolare velocità in presenza di condizioni particolari
Condizioni per riduzione velocità
Danno a ciclista
assume
Incrocio malagevole con velocipede
assume
Riduzione della velocità
NOT
violatoQuando
Obbligo di ridurre la velocità
Danno a pedone
assume
Prevedibile coinvolgimento del pedone
Gareggiare in velocità
violatoQuando
Divieto di gareggiare in velocità
Velocità eccessivamente ridotta
violatoQuando
Divieto circolare velocità eccessivamente ridotta
Rispetto del limite di velocità
NOT
violatoQuando
Obbligo rispettare limite di velocità

Driver Behaviour Questions (overtaking)

Driver Duty/ Prohibition




Cyclist Behaviour Questions
Driver Duty/Prohibition
Trainare un veicolo/condurre animali...
Libertà di movimento ciclista
Controllo del veicolo da parte del ciclista
Libertà di Manovra del ciclista
Libertà di visuale del ciclista
NOT
Divieto per i ciclisti di trainare/condurre animali/farsi trainare
Obblighi di controllo del veicolo e libertà di manovra in capo al ciclista
violatoQuando
Conduzione della bicicletta a mano
assumeOR
Bici condotta a mano
Bici non condotta a mano
assume
Prudenza e diligenza nel condurre la bicicletta a mano (usare)
Rispetto degli obblighi incombenti sui pedoni (ciclista)
Condizioni che obbligano a condurre la bicicletta a mano
Obblighi conseguenti alla conduzione della bicicletta a mano
Obbligo di condurre la bici a mano
Trasportare altre persone sul velocipede
Eccezioni al divieto di trasporto di altre persone su velocipede
Velocipede omologato per il trasporto di altre persone
Velocipede a più di due ruote simmetriche
Trasportare bambino sul velocipede
Nessuna eccezione al divieto di trasporto di...
Numero trasportati su velocipede a più di due ruote simmetriche
Velocipede a più di due ruote simmetriche condotto solo dal conducente
Utilizzo delle attrezzature per il trasporto dei bambini su velocipede
Divieto di trasporto di altre persone su velocipede (relative eccezioni)
Numero ciclisti affiancati
Ciclista su unica fila
Due ciclisti affiancati
Fuori dal centro abitato
Più di due ciclisti affiancati
assumeAND
Unica fila imposta da condizioni stradali
Ciclista minore di anni 10
Ciclista minore di anni 10 alla destra dell'altro
Obbligo circolare unica fila di biciclette o non più di due ciclisti affiancati
Pista ciclabile (esistenza)
Luogo circolazione velocipede
Velocipede fuori da pista ciclabile
Velocipede su pista ciclabile
Categoria del velocipede fuori da pista ciclabile
Categoria del velocipede su pista ciclabile
Velocipede fuori dalla ciclabile al quale è vietato il transito su pista ciclabile
Velocipede fuori dalla ciclabile al quale è consentito il transito su pista ciclabile
Velocipede su ciclabile al quale è vietato il transito su pista ciclabile
Velocipede su ciclabile al quale è consentito il transito su pista ciclabile
Obbligo di transitare sulla pista ciclabile

The working system

eJRM

Electronic Justice Relationship Management

Ontology-driven Data Acquisition

Thank you!