



BSI Standards Publication

Intelligent transport systems — Management of electronic traffic regulations (METR)

Part 2: Operational concepts (ConOps)

National foreword

This British Standard is the UK implementation of CEN ISO/TR 24315-2:2025. It is identical to ISO/TR 24315-2:2025.

The UK participation in its preparation was entrusted to Technical Committee EPL/278, Intelligent transport systems.

A list of organizations represented on this committee can be obtained on request to its committee manager.

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

This publication is not to be regarded as a British Standard.

© The British Standards Institution 2025
Published by BSI Standards Limited 2025

ISBN 978 0 539 31531 8

ICS 03.220.20; 35.240.60

Compliance with a Published Document cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 October 2025.

Amendments/corrigenda issued since publication

Date	Text affected
------	---------------

ICS 03.220.20; 35.240.60

English Version

Intelligent transport systems - Management of electronic traffic regulations (METR) - Part 2: Operational concepts (ConOps) (ISO/TR 24315-2:2025)

Systèmes de transport intelligents - Gestion des règles de circulation sous forme électronique - Partie 2: Concepts opérationnels (ISO/TR 24315-2:2025)

Intelligente Verkehrssysteme - Management von elektronischen Verkehrsregularien (METR) - Teil 2: Betriebskonzepte (ConOps) (ISO/TR 24315-2:2025)

This Technical Report was approved by CEN on 30 September 2025. It has been drawn up by the Technical Committee CEN/TC 278.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

This document (CEN ISO/TR 24315-2:2025) has been prepared by Technical Committee ISO/TC 204 "Intelligent transport systems" in collaboration with Technical Committee CEN/TC 278 "Intelligent transport systems" the secretariat of which is held by NEN.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

Any feedback and questions on this document should be directed to the users' national standards body/national committee. A complete listing of these bodies can be found on the CEN website.

Endorsement notice

The text of ISO/TR 24315-2:2025 has been approved by CEN as CEN ISO/TR 24315-2:2025 without any modification.

Contents

Page

Foreword	v
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Symbols and abbreviated terms	1
5 Current system or situation	2
5.1 General	2
5.2 Background, objectives and scope	3
5.2.1 Background	3
5.2.2 Objectives	3
5.2.3 Scope of application	4
5.3 Operational policies and constraints	4
5.3.1 Policies	4
5.3.2 Constraints	5
5.4 Description of the current situation	5
5.4.1 General	5
5.4.2 Terminators	6
5.4.3 Processes	9
5.4.4 Data flows	10
5.4.5 Additional stakeholders	10
5.4.6 Data details	12
5.5 Modes of operation for the current situation	15
5.6 User classes and other involved personnel	16
5.6.1 General	16
5.6.2 Users subject to rules	16
5.6.3 Entities that establish rules	17
5.6.4 Third party entities	18
5.7 Support environment	18
5.7.1 General	18
5.7.2 Sources of support	19
6 Justification for and nature of changes	20
6.1 General	20
6.2 Justification of changes	20
6.2.1 General	20
6.2.2 Evolving transport environment	20
6.2.3 Discrepancy reports	21
6.3 User need statements	23
6.3.1 Trustworthiness needs	23
6.3.2 User needs	35
6.3.3 Rule maker needs	44
6.3.4 Third party needs: auditing	48
6.4 Priorities	48
6.5 Deferred user needs	48
6.5.1 General	48
6.5.2 User needs deferred to a future release	49
6.5.3 User needs considered but not included	49
6.6 Assumptions and constraints	49
6.6.1 Assumptions	49
6.6.2 Constraints	51
7 Concepts for the proposed system	52
7.1 General	52

7.2	Background, objectives, and scope.....	52
7.3	Operational policies and constraints	52
7.3.1	Policies.....	52
7.3.2	Constraints.....	52
7.4	Description of the proposed system	52
7.4.1	Overview	52
7.4.2	Terminators	54
7.4.3	Processes.....	54
7.4.4	Data flows.....	56
7.5	Modes of operation	57
7.5.1	General.....	57
7.5.2	Normal mode	57
7.5.3	Degraded mode.....	58
7.5.4	Fallback mode	58
7.6	User classes and other involved personnel	58
7.7	Support environment.....	58
7.7.1	General.....	58
7.7.2	Rule discovery service	58
7.7.3	Service registration and discovery service.....	59
7.7.4	Security service.....	59
7.7.5	Technology services	59
7.7.6	METR certification	59
7.7.7	Maintenance.....	59
7.7.8	Enforcement.....	59
7.7.9	Academic research and advocacy.....	59
8	Summary of impacts	60
8.1	Operational impacts	60
8.2	Organizational impacts.....	60
8.3	Impacts during development.....	60
9	Analysis of the proposed system	61
9.1	Benefits	61
9.2	Disadvantages and limitations.....	61
9.3	Alternatives considered.....	61
	Annex A (informative) Operational scenarios	62
	Annex B (informative) Data flow diagram conventions	76
	Annex C (informative) Tentative categories for METR information.....	77
	Bibliography.....	80

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 278, *Intelligent transport systems*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

A list of all parts in the ISO 24315 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

0.1 System overview

0.1.1 General

The ISO 24315 series is intended to provide users access to geo-specific, trustworthy, timely, authoritative, machine-interpretable, traffic and transport related rules enacted by jurisdictional entities, including those who define rules for campuses (i.e. private grounds). This is conceptually shown in [Figure 1](#).

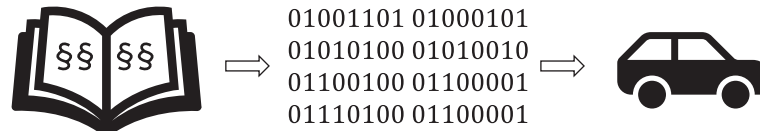


Figure 1 — METR concept

0.1.2 Purpose

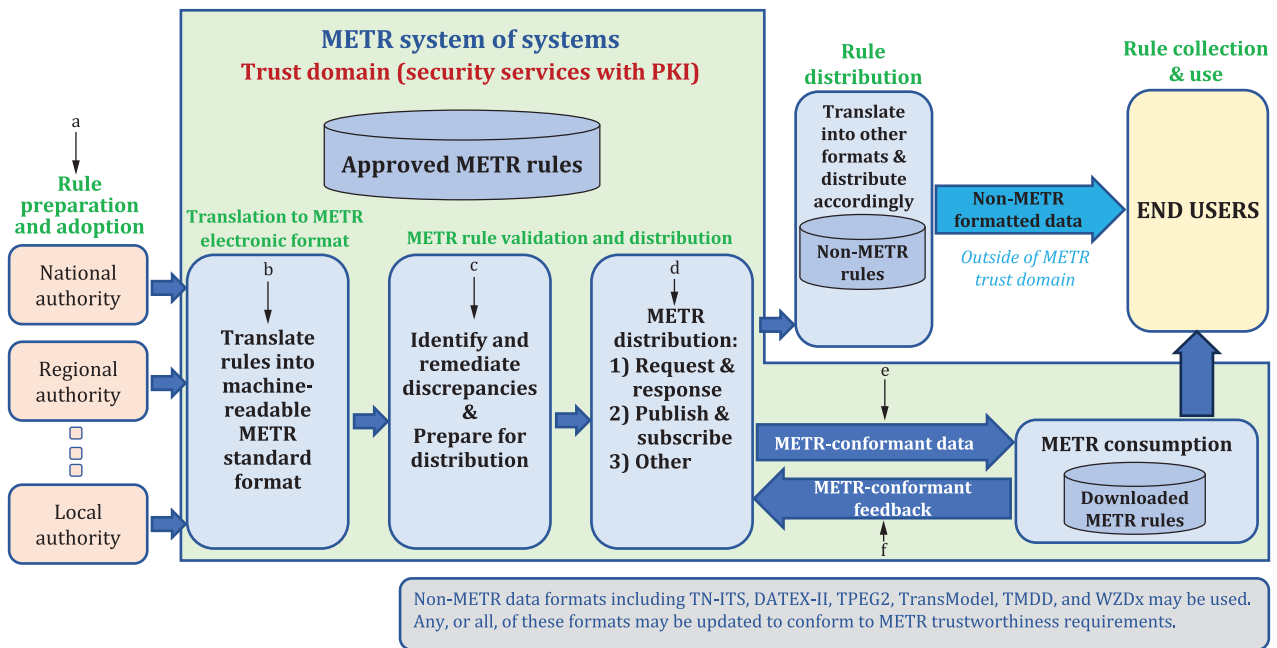
Management of electronic traffic regulations (METR) is designed to assist developers and manufacturers of driving automation systems (i.e. automation levels 1-5) and driver information systems (including those at automation level 0) to electronically obtain traffic rules to better enable:

- a) interacting safely with other road users;
- b) following instructions from law enforcement organizations, and those authorized to direct traffic;
- c) maintaining smooth and safe flow of traffic;
- d) complying with other rules enacted to support legislative policies (such as environmental protection, noise, manage height and weight restrictions, and societal aspects such as market days, fiestas, pedestrian zones)^[8].

METR is designed to provide a reference framework for the trustworthy distribution of electronic versions of legal traffic rules, however content and application of the traffic rules is outside of the scope of the METR standards and specifications.

0.1.3 Flow of information

The general flow of METR information is illustrated in [Figure 2](#) and subsequently described.



Key

- a METR starts with rule makers defining and enacting rules that are relevant to transport users.
- b Each legal rule is translated into a METR rule, which is a secure, standardized electronic representation that includes a digital signature of the rule signing organization.
- c METR rules are collected for a geographic area(s) and specific scope(s).
- d Rules are distributed to METR users based on their needs.
- e METR users become aware of the METR rules, verify their authenticity, and respond appropriately.
- f As needed, METR users can submit discrepancy reports to a discrepancy handler for investigation and correction.

Figure 2 — METR flow of information

0.1.4 Graphical overview

[Figure 3](#) provides an overview of the data and devices included within the scope of the METR environment.

A	freight rules
B	kerbside usage rules
C	ride sharing rules
D	micromobility rules
E	VRU rules
F	public transport rules
G	rules for automated driving systems
H	driving rules
I	lane use rules
J	public-area mobile robot rules
K	road work rules
L	pre-announced rules with subset of emergent rules and/or supporting data
M	emergent rules and/or supporting data
1	various communications and network infrastructure
2	roadside communication unit
3	METR user system

0.1.5 Rule distribution

- a) Electronic rules can be pre-announced (i.e. known and publicized well in advance of the user's need) or emergent (i.e. publicized and needed while previously obtained pre-announced rules are still considered fresh).
- b) Electronic rules can be distributed through a wide-area distribution mechanism or a local distribution mechanism.

- c) Electronic rules can be pulled by users well in advance of their need or pushed to users as special conditions necessitate.

It is expected that the characteristics of METR users and the limitations on data capacities for local distribution mechanisms mean that virtually all persistent rules will be pre-announced and distributed from a wide-area distribution source, likely using a pull mechanism. However, any emergent rule that is activated while previously distributed pre-announced rules are still considered fresh will require a push mechanism, often from a local distribution source. It is important to note that those two combinations are only typical use cases and that METR supports every possible combination of these three characteristics and addresses how discrepancies can be reported and resolved.

In addition, supporting data may provide context to the rules and can be transmitted by wide-area communication systems, roadside units, other vehicles, or on-board devices.

The rules cover virtually any rule related to surface transport systems; the graphic depicts rules for freight vehicles, kerbside usage, ride sharing, micromobility operations, vulnerable road users (VRUs), public transport usage, driving (i.e. human-in-the-loop, including driver support systems, which represent levels 1 and 2 of automation), automated driving systems (ADS, i.e. automation levels 3-5), lane usage, public-area mobile robots (PMRs), and road works. This information needs to be available and conveyed to all transport users including nomadic devices, PMRs, and vehicles equipped with driving automation systems (i.e. levels 1-5 of automation). Although not shown in the diagram, METR is also intended to be flexible enough to support rules relating to the use of ferries, passenger rail (e.g. trams, subways, and inter-city rail), and off-road environments.

0.2 Framework adaptation

METR is defined through the ISO 24315 series, which provides a comprehensive framework for the interoperable digitalization, distribution, and management of electronic traffic regulations. This framework will be defined at a relatively high-level and will support both regional adaptation and customization, as well as the use of non-METR protocols and data formats, as depicted in [Figure 4](#).

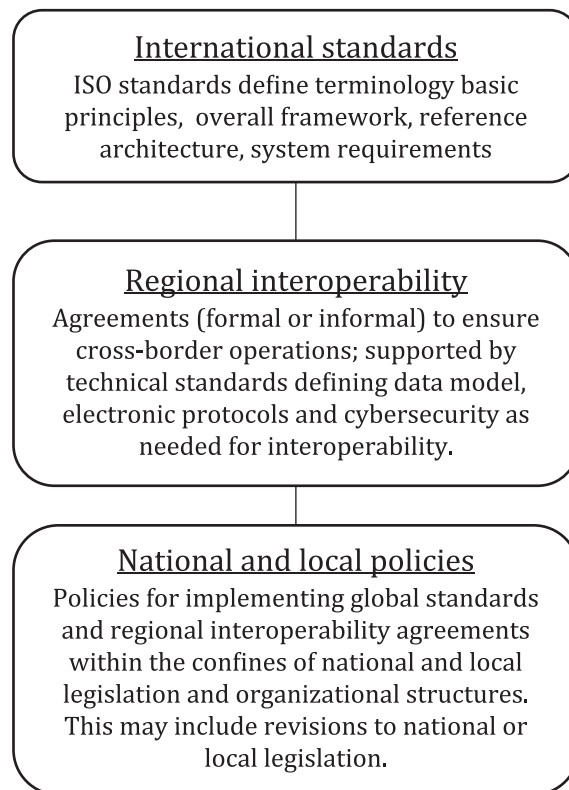


Figure 4 — METR three-tier framework

ISO standards are developed to address international stakeholder needs. Other international organizations (e.g. UNECE) also play a role in standards development and implementation policies. The first set of ISO documents of the ISO 24315 series provide a framework based on the ISO-specified systems engineering methodology, as defined by ISO/IEC/IEEE 29148, and consist of a vocabulary, a concept of operations, a reference architecture, and requirements for the METR system of systems (SoS). Subsequent documents in the ISO 24315 series will define requirements for each component system within the METR SoS and other requirements common to all component systems. The ISO 24315 series will promote semantic interoperability, but it will need to be interpreted and adapted for regional use to provide complete interoperability (i.e. including syntactic interoperability).

Each region (e.g. EU, Japan, Korea) customizes (e.g. extends, adapts) the ISO 24315 series based on their specific needs and environment, as necessary to provide cross-border interoperability within their region. The METR reference architecture is refined to provide regional implementation guidance. For example, in Europe, METR can eventually become part of the National Access point (NAP). Furthermore, non-METR data formats including TN-ITS,^[7] DATEX-II,^[6] TPEG2,^[2] TransModel,^[5] TMDD,^[9] and WZDx^[10] can be refined to support METR requirements or used as-is to deliver METR information to the extent that the data can be supported (i.e. non-METR distribution). The preferred solution is to update these formats to conform to the full set of METR trustworthiness requirements.

Translating and adapting international standards and regional interoperability agreements is achieved at the national level and can even be done at local levels. Operations, funding and governance are determined nationally, locally, or both. Legal implications of electronic rules provided through METR must be defined nationally or locally. Many locations are starting this digitalization of the rules at an informative supplemental level, rather than regulatory.

0.3 Document overview

The purpose of this document is to describe the operational concept (ConOps) for METR. A ConOps is a user-oriented document that describes system characteristics for a proposed system from the users' viewpoint. It includes a description of the key stakeholders along with the processes and data flows required to fulfil their responsibilities. It describes what the system will do (not how it will do it) and why (rationale). The ConOps is used to communicate overall quantitative and qualitative system characteristics to the acquirer, user, supplier, and other organizational elements (ISO/IEC/IEEE 29148). The ConOps is a critical tool in building consensus among stakeholders.

This document is designed to assist the following stakeholders in understanding and validating the proposed system:

- a) transport users (e.g. vehicle users, micromobility users, and vulnerable road users);
- b) transport infrastructure operators (e.g. traffic engineers, traffic managers and controllers, toll road operators, parking facility operators);
- c) maintenance and construction personnel (e.g. road crews, maintenance managers);
- d) transport service operators (e.g. public transport agencies, delivery companies, ridesourcing companies);
- e) transport entity owners (e.g. municipalities, campus owners, fleet managers);
- f) policy and rule-making entities (including elected officials, responsible legal authorities, and their staff);
- g) enforcement personnel (e.g. law enforcement, lawyers, insurance companies);
- h) manufacturers and developers (e.g. motor vehicle manufacturers, AMR manufacturers, driving automation system developers);
- i) technology specialists (e.g. ADS-equipped vehicle experts, location perception experts, video image processing experts);
- j) information support entities (e.g. map providers, navigation providers, traveller information providers); and

k) advocates (e.g. safety advocates, environmental advocates, disability rights advocates).

In addition, this document will assist stakeholders in verifying that the requirements, which will be documented in subsequent parts of this document series, meet defined user needs.

This document has been developed by ISO/TC 204 in coordination with many experts from countries around the world. It is designed to be sufficiently generic to be used as an international standard applicable to any national or regional authority that wishes to adopt its processes.

System developers and system operators within authorities that adopt the METR model are advised to become familiar with this document and use it as their guide in operations.

Intelligent transport systems — Management of electronic traffic regulations (METR) —

Part 2: Operational concepts (ConOps)

1 Scope

The management of electronic transport regulations (METR) provides trustworthy, authoritative, machine-interpretable, transport-related rules for using the road network.

This document describes the operational concept (ConOps) for METR in a format that is consistent with ISO/IEC/IEEE 29148.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/TS 14812, *Intelligent transport systems — Vocabulary*

ISO/TS 24315-1, *Intelligent transport systems — Management of electronic traffic regulations (METR) — Part 1: Vocabulary*

ISO/IEC/IEEE 24765, *Systems and software engineering — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC/IEEE 24765, ISO/TS 14812, and ISO/TS 24315-1 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

4 Symbols and abbreviated terms

3G	third-generation technology standard for broadband cellular
3GPP	3rd generation partnership project
4G	fourth-generation technology standard for broadband cellular
5G	fifth-generation technology standard for broadband cellular
ADS	automated driving system
C-ITS	cooperative intelligent transport systems

CCMS	cooperative ITS credentials management system
CV RSU	connected vehicle roadside unit
DDT	dynamic driving task
DSRC	dedicated short-range communications
FM	frequency modulation
GNSS	global navigation satellite system
HMI	human-machine interface
ITS	intelligent transport systems
LTE-V2X	long-term evolution vehicle-to-everything
METR	management of electronic traffic regulations
MUTCD	manual on uniform traffic control devices
OBE	on-board equipment
ODD	operational design domain
OEM	original equipment manufacturer
PMR	public-area mobile robot
TCD	traffic control device
TMDD	traffic management data dictionary
TN-ITS	transport network - intelligent transport systems
TPEG	transport protocol experts group
UNECE	United Nations Economic Commission for Europe
USDOT	United States Department of Transportation
UTC	universal coordinated time
Wi-Fi	wireless network protocols
WP	working party

5 Current system or situation

5.1 General

This clause describes the current situation that motivates the development of METR and provides readers with an introduction to the problems that have led to the development of this document.

The “current system” described in this document is intended to represent the typical approach used to distribute rules using traditional means (e.g. prior to electronic distribution), which is primarily through:

- a) signage;
- b) markings (e.g. pavement markings);

- c) published information (e.g. local laws, driver manuals).

The description of the current system is not intended to reflect every approach used to distribute rules in existence today.

5.2 Background, objectives and scope

5.2.1 Background

Even before Karl Friedrich Benz produced his first automobile in 1885, jurisdictional entities posted transport-related rules, such as [Figure 5](#).



Figure 5 — Fitch's bridge warning sign, UK^[11]

The sign reads: "Notice – To owners and drivers of traction engines. The bridge is insufficient to carry weights beyond the ordinary traffic of the district."

In fact, the world's first traffic signal was installed in December 1868 outside the Houses of Parliament in London. As travel speeds increased, the need for signage, pavement markings, and other rules increased as well. By 1915 the City of Detroit started posting stop signs and by the early 1920s regional movements began to standardize the types of signs and markings installed. Today, the signs and markings have largely been standardized within each region of the world, with significant coordination among the regions (e.g. most international symbols are consistent even when the shape of a warning sign is different.)

As technology continues to evolve, vehicles are becoming more intelligent and connected. With this evolution, there is a need to provide machine-interpretable rules to information and automation systems, especially driving automation systems, so that they can better comply with rules and ensure safe operations. There is also a need to support the array of vehicles and users that are emerging, such as PMRs.

5.2.2 Objectives

Rules for the use of road transport are implemented for a variety of societal reasons including:

- a) safety (e.g. requirements for taillights, speed limits, intersection controls, warnings);
- b) efficiency (e.g. traffic signal logic, high occupancy vehicle lane restrictions, hard shoulder running rules);

- c) comfort (e.g. guidance information, including information about amenities);
- d) mobility (e.g. parking restricted to travellers with disabilities);
- e) sustainability (e.g. requirements for the use of catalytic converters, congestion charge zones).

The objective of METR is to provide travellers and their systems with trustworthy information, which will assist society in fulfilling these goals.

5.2.3 Scope of application

Within the current situation, most established rules relate to the use of motor vehicles, largely because of the safety implications involved. However, there are rules that relate to other modes, such as:

- a) limitation on road use for pedestrians and cyclists;
- b) prohibition of certain forms of micromobility on some facilities (e.g. “no skateboarding”);
- c) pedestrian signals at intersections;
- d) guidance to pedestrians on which direction to look when crossing the road;
- e) sidewalk closures for construction activities; and
- f) rules for the operation of PMRs.

The scope of rules considered in the design of METR includes all transport-related rules for using any portion of a road network. This includes any pathway network designed for pedestrians, micromobility vehicles, PMRs, motor vehicles, etc.

The METR design can also be applicable for other environments, even if they were not considered in the above list.

NOTE The intent is that this document can support the distribution of the full breadth of rules; whether the full breadth of rules are entered into a specific implementation will be determined by those implementing the system.

5.3 Operational policies and constraints

5.3.1 Policies

The typical current system is assumed to follow the following operational policies.

- a) The set of rules that govern behaviour vary by location.
- b) The set of rules that govern behaviour at a location can vary by time.
- c) The set of rules that govern behaviour can vary based on external factors that can be monitored with supporting data (e.g. environmental conditions).
- d) Rules are made publicly available prior to becoming applicable.
- e) The set of rules that apply at any given location and time are an aggregation of the active rules that have been adopted by all jurisdictional entities that have jurisdiction (ISO 24315-1) over the location. For example, a location on a campus might be subject to national and local rules in addition to any campus-specific rules.

NOTE While the term “campus” is often used to refer to universities, the METR documentation uses a broader meaning that includes any area excluding transport facilities managed by the local government. This includes land owned by public and private universities, airports, hospitals, harbours, and any landowner with the authority to impose rules.

- f) All vehicles and travellers are aware of all rules that govern their behaviour.

- g) All vehicles and travellers have confidence that the rules are trustworthy.
- h) Rules are conveyed in a manner that minimizes distraction from other dynamic driving tasks.
- i) Jurisdictions make rules publicly available using approved traffic control devices (TCDs), to the extent reasonable (e.g. approved sign types, marking types, signal types).
- j) Jurisdictions have competing demands that affect policies regarding how they make rules publicly available, such as:
 - 1) available budget;
 - 2) sustainability concerns, such as a desire to minimize visual clutter along streets;
 - 3) access to locations (e.g. physical or legal barriers).

5.3.2 Constraints

The typical system is assumed to have the following constraints.

- a) Only appointed rule makers issue rules.
- b) The applicable location for each rule does not extend beyond the jurisdictional boundaries of the jurisdictional entity that the rule maker represents.
- c) Rules issued by rule makers of overlapping jurisdictions specify precedence.
- d) Rules clearly identify the times and conditions when they are active.
- e) Rules support multi-lingual environments.
- f) Approved rules can have a delayed inception time and/or a known termination time.
- g) Jurisdictions are responsible for making rules publicly available prior to their enforcement.

5.4 Description of the current situation

5.4.1 General

[5.4](#) provides an overview of how transport rules are distributed in an environment without METR by identifying the primary functions performed, the data flows associated with each function, and the assignment of functions to key stakeholders. [Figure 6](#) provides an overview of the key functions and relationships as a data flow diagram. The diagram conforms to the rules for Yourdon-Demarco data flow diagrams,^[13] which are summarized in [Annex B](#). Each terminator, process, and data flow is further explained in [5.4.2](#), [5.4.3](#), and [5.4.4](#). [5.4.5](#) and [5.4.6](#) provide additional details about the other stakeholders and the data identified in [5.4.3](#) and [5.4.4](#).

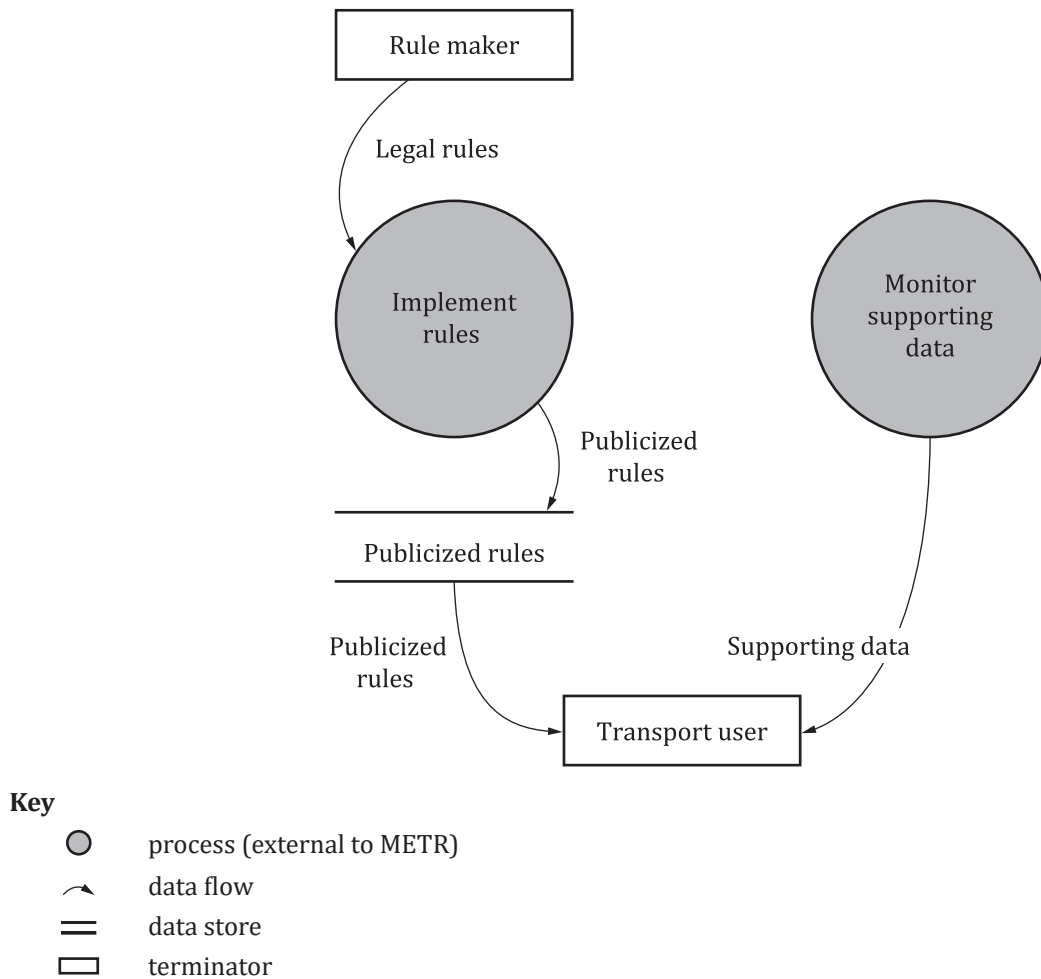


Figure 6 — Existing roles

5.4.2 Terminators

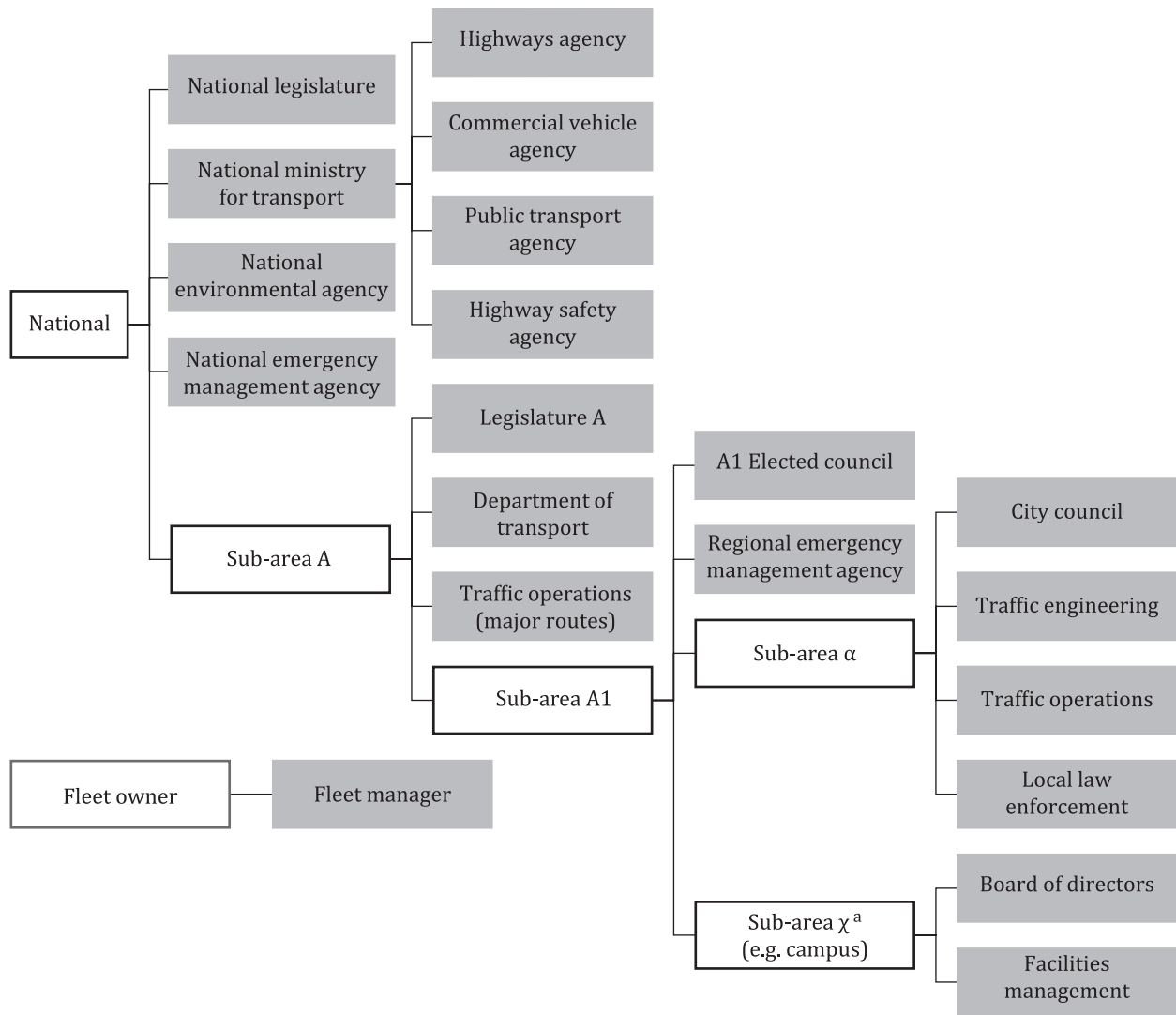
5.4.2.1 Rule maker

A rule maker represents an entity with the authority and responsibility to establish and maintain a defined set of legal rules for a jurisdictional entity. This includes maintaining an updated, persistent record of the rules, addressing impacts of new legal decisions and technologies [e.g. ensuring rules are updated as needed to properly apply to automated driving systems (ADS)], and ensuring rules are unambiguous.

To ensure that the rules are unambiguous, all key characteristics of the rule are defined (e.g. where does it apply, when does it apply, who does it apply to), key terms are defined (e.g. “TRUCKS”), and clauses containing numerous conditions and/or limits are precisely constructed. Further, the rules need to be conveyed to the travelling public, often in a busy and dynamic environment. This requires the rules to be clear and concise.

Most locations fall within a jurisdictional hierarchy as shown in [Figure 7](#). For example, a particular location might be in a campus parking lot (e.g. “Campus x”), which is within a jurisdictional area (e.g. village, town, or city), which itself is within a larger jurisdictional area (e.g. county, parish), which itself is within a larger jurisdictional area (e.g. prefecture, province, state), which itself is part of a larger jurisdictional area (e.g. a country). The exact number of levels of hierarchy can vary based on location, but most locations have 3 or more levels of jurisdictional hierarchy. Each level of this hierarchy can typically be associated with multiple rule makers, with each rule maker having the authority to issue certain types of rules for their jurisdictional area. While most rule makers establish rules for a jurisdictional area (i.e. either a governmental area or a campus), some rule makers can establish rules for a vehicle fleet (e.g. a fleet owner might establish rules

for its fleet, an original equipment manufacturer (OEM) might want to establish rules for all vehicles that it manufactures).



Key

- rule maker
- jurisdictional entity

^a Campuses can occur at any level.

Figure 7 — Jurisdiction and rule maker hierarchy

EXAMPLE 1 Legislative bodies often establish unposted rules (e.g. default speed limits), authorize other rule makers, and define the legal meaning and context for rules.

EXAMPLE 2 Regional government transportation agencies typically establish the meanings of specific TCDs and establish posted rules for regional facilities.

EXAMPLE 3 Local government transportation agencies typically establish posted rules for local facilities.

EXAMPLE 4 Separate government entities sometimes exist that establish rules related to the operation of specialized vehicles (e.g. heavy goods vehicles, PMRs).

EXAMPLE 5 Maintenance agencies often establish temporary rules while maintenance operations are performed.

EXAMPLE 6 Emergency response agencies can establish temporary rules in response to emergency response activities.

EXAMPLE 7 Private entities can establish rules for their campus(es) and/or vehicle fleet.

NOTE Rules established by any rule maker can often be constrained by rules established by a rule maker at a higher level in the hierarchy.

Rule makers are responsible for establishing rules of the road, regulations, advisories, and guidance, as appropriate. Not all rules are enforceable or associated with any penalty for non-compliance (e.g. advisories, guidance).

Rule makers are ultimately responsible for ensuring that the rules are made publicly available, although this responsibility is often delegated to one or more implementers with a formal agreement where the rule maker agrees to provide the rules to the implementers and the implementers agree to notify the public through driver education, TCDs, and other means.

Rule makers also need to work with other rule makers (both internal and external to their jurisdictional entity) to minimize the potential for rules that cause conflict or confusion. For example, if a jurisdictional entity adopts a normally unposted rule for its entire jurisdictional area that a neighbouring jurisdictional entity does not adopt, they might wish to post a sign at major entry points to educate travellers of the difference in rules.

5.4.2.2 Transport user

5.4.2.2.1 General

Each transport user has the primary responsibility to comply with all relevant rules. To do this, each user is expected to:

- a) be aware of all relevant rules;
- b) be aware of the environment;
- c) be aware of their location;
- d) be aware of the precedent of each rule (e.g. avoiding a pedestrian has a higher precedent than pulling over for an emergency vehicle); and
- e) comply with the active rule environment.

5.4.2.2.2 Awareness

Regardless of the complexities of the jurisdictional structure, transport users are responsible for adapting to the local variations that exist and expected to understand the rules in effect, which requires knowledge of their location and the jurisdictional authorities that have issued rules. If they fail to comply with issued rules, they are more likely to be subject to enforcement actions; furthermore, they are more likely to be complicit in causing, or being involved in, traffic incidents, and consequently they can be subjected to enforcement actions.

A transport user needs to be able to accurately locate:

- a) jurisdictional boundaries;
- b) the location of each rule;
- c) their location.

5.4.2.2.3 Location accuracy

Within the existing system, a transport user is generally able to identify the location of a posted rule with respect to themselves based on the location of the TCD(s). This relies on the TCD(s) being installed at the location legally defined within the rule. If the rule issued by the rule maker states one location (e.g. a lower speed limit starting 300 meters upstream from a school) and the implementer incorrectly locates the TCD

(e.g. at 200 metres), a legal ambiguity arises. Within the existing system defined by this document, accurately locating TCDs is the responsibility of the implementer and accurately interpreting TCDs (e.g. stopping at the stop bar) is the responsibility of the user.

5.4.2.2.4 Context

Determining the precise location of a jurisdictional boundary or unposted rule can be more challenging, especially if there are not any signs or visual clues to denote the boundary. This can potentially affect posted rules as well because the legal meaning of a TCD is dependent upon the jurisdiction where it is located. For example, a red circle with the number “50” in it, as shown in [Figure 8](#), might mean a maximum speed limit of “50 kph” in one jurisdiction and “50 mph” in another.



Figure 8 — Speed limit of 50

Unposted rules can also change by jurisdiction. For example, local rules might indicate whether an emergency responder is allowed to direct traffic, overriding the indication on a traffic signal.

The environment can also impact the applicability of rules. For example, the maximum speed limit can be reduced when it is raining, parking restrictions can be imposed by time of day, or a vehicle can be required to pull over to give right-of-way to an emergency response vehicle. The environment (e.g. rain, time of day, presence of an emergency response vehicle) is not a rule, but it can impact the activation of rules that override other rules.

Transport users are expected to maintain awareness of their location and environment and to understand:

- a) the precedence of various rules, including those issued by the various layers of jurisdictional hierarchy;
- b) the location-specific meaning of rules;
- c) the location-specific meaning of TCDs;
- d) the conditions under which rules become applicable.

5.4.2.2.5 Proper judgement

Transport users are also expected to exercise good judgement in providing a safe environment taking all rules into effect. For example, a regulation can require a transport user to give way to an emergency vehicle, but it is the transport user’s responsibility to perform the dynamic driving task (DDT) in a manner that ensures safely reaching this state without putting others in danger.

5.4.3 Processes

5.4.3.1 Implement rules

Implementing a legal rule requires notifying relevant parties through established channels. Within the current situation, rules that are general in nature (e.g. headlights must be used at night, the meaning of a

stop sign) are typically publicized using the public record. Rules that are location specific (e.g. a stop sign for a specific approach of a junction) are typically posted using conventional TCDs.

5.4.3.2 Monitor supporting data

To understand the applicability of rules, transport users need to be aware of their overall environment. This can include direct observations and awareness by the transport user (e.g. it is midday so daytime speed limits apply) but can also include indirect observations obtained as supporting data from support systems (e.g. it is precisely 15:01 meaning the school zone speed restriction that starts at 15:00 is in effect). This process represents the functionality of support systems that provide the necessary supporting data to understand the applicability of rules.

5.4.4 Data flows

[Table 1](#) describes the content of each data flow.

Table 1 — Data flows for the existing situation

Output from	Data flow	Input to	Description
Rule maker (terminator)	Legal rules	Implement rules (process)	The rules as defined in official records of the jurisdictional entity
Implement rules (process)	Publicized rules	Publicized rules (data store)	
Publicized rules (data store)	Publicized rules	Transport user (terminator)	The rules as publicized to the public
Monitor supporting data (process)	Supporting data	Transport user (terminator)	Data that can impact the interpretation of a rule

5.4.5 Additional stakeholders

5.4.5.1 Implementer

5.4.5.1.1 Publicizing rules

An implementer is responsible for performing the required actions to inform affected parties of the rules that have been established by rule makers. Within the existing system, this is usually achieved through:

- a) maintaining the public record through driver education and public information campaigns, which raise awareness of rules that apply even if they are not conveyed to a traveller during a journey (e.g. which side of the road to drive on, speed limits when not posted, requirements on when to use headlights, the legal meaning of rules within the jurisdiction);
- b) maintaining TCDs, which notify travellers of rules and supporting data along their journey. TCDs include:
 - 1) signs, including regulatory signs (e.g. stop signs), warning signs (e.g. stop ahead sign), guide signs (e.g. destination signs);
 - 2) pavement markings, such as lane markings, stop bars, marked crosswalks;
 - 3) signals, such as traffic signals and flashing beacons;
 - 4) channelization devices, such as traffic cones, kerbs, or Jersey barriers;
 - 5) traffic calming measures, such as rumble strips;
 - 6) facility access control measures, such as ramp meters and gates.

Properly performing these actions can require the implementer to coordinate with the rule maker to ensure that the rules can be conveyed in a concise and unambiguous manner.

5.4.5.1.2 Challenges

These methods of publicizing rules are not perfect. Examples of challenges with these publication methods include:

- a) posted rules can become unobservable (e.g. faded, missing, obscured);
- b) posted rules might not be understood by transport users (e.g. a traveller might not understand the language or symbols used on the sign);
- c) unauthorized sources might attempt to post rules;
- d) transport users (especially those from foreign areas) might not be aware of unposted rules.

In recent years, these problems have become more significant due to the increased mobility of global populations coupled with an aging infrastructure in many areas.

5.4.5.1.3 Rule implementation

In most cases, an unposted rule will typically be specified to be implemented at a specific inception time, which is often months after its approval. This allows the implementer adequate time to properly publicize the rule through the public record well in advance of the inception time.

By comparison, a posted rule is typically implemented when the associated TCD becomes visible to the travelling public. There can be separate entities for installing a TCD (e.g. with a cover on it to prevent its visibility to the public) and for implementing a TCD. This document is only concerned about when the TCD is implemented and recognizes that while the installation activity is important, it is outside the scope of this document.

In some cases, a new TCD can be associated with an advance warning sign to alert travellers to the changed condition downstream. New rules can also be associated with an official or unofficial grace period before enforcement actions are associated with a penalty. This document is only concerned about the rules and when they become applicable (i.e. implemented).

5.4.5.2 Supporting data provider

At times, it is possible that the transport user needs to combine rule information with other data. For example, rules can be based on time of day (e.g. parking restrictions), weather conditions (e.g. use of headlights), number of occupants within a vehicle (e.g. high-occupancy vehicle restrictions), vehicle characteristics (e.g. bridge weight restrictions), vehicle status (e.g. giving way to an emergency vehicle in response mode), or other factors.

It is the responsibility of the transport user to be aware of a variety of facts and to fuse this information with the relevant rules. A supporting data provider can assist users in the task of monitoring some of these characteristics so that the transport user can more accurately determine when a rule is active. Supporting data providers can even provide informative, electronic representations of rules (e.g. a navigation system showing the speed limit); however, in the current situation, these support systems are generally not fully trustworthy (e.g. navigation systems can be inaccurate in showing temporary speed limits that are associated with road work).

EXAMPLE 1 A transport user can use in-vehicle clock to help determine if a time-of-day parking restriction is currently active.

EXAMPLE 2 A transport user can watch a traffic signal head to determine whether a specific manoeuvre is currently allowed.

EXAMPLE 3 A transport user can use a navigation system display to determine their location on a map.

EXAMPLE 4 A transport user can use a navigation system display as an unofficial indication of the current speed limit and use this as to supplement other observations (e.g. does the navigation-system speed limit seem realistic given that the user might be driving through a work zone).

Within the existing system, information provided by a supporting data provider is generally informational and the transport user can be held responsible for complying with the official, reasonable interpretation of the rule even when the supporting data provider provides incorrect information. For example, a transport user is unlikely to avoid a parking fine due to their clock being incorrect.

5.4.6 Data details

5.4.6.1 Rules

5.4.6.1.1 General

The rules established by a rule maker need to be unambiguous. This includes ensuring that all key characteristics of the rule are defined (e.g. where does it apply, when does it apply, who does it apply to), key terms are defined (e.g. “TRUCKS”), and clauses containing numerous conditions and/or limits are precisely constructed. Further, the rules need to be conveyed to the travelling public, often in a busy and dynamic environment. This requires the rules to be conveyed in a concise and unambiguous form.

5.4.6.1.2 Rule life cycle

Rules change over time at varying rates. Some rules are intended to last for decades, especially those established as laws. At the other extreme, some rules might only be in effect for minutes, such as temporary restrictions imposed with road works or incident response. And many rules fall between these two extremes. In all cases, the rules conveyed need to be maintained to be up to date.

[Figure 9](#) indicates how rules can transition states through their life cycles.

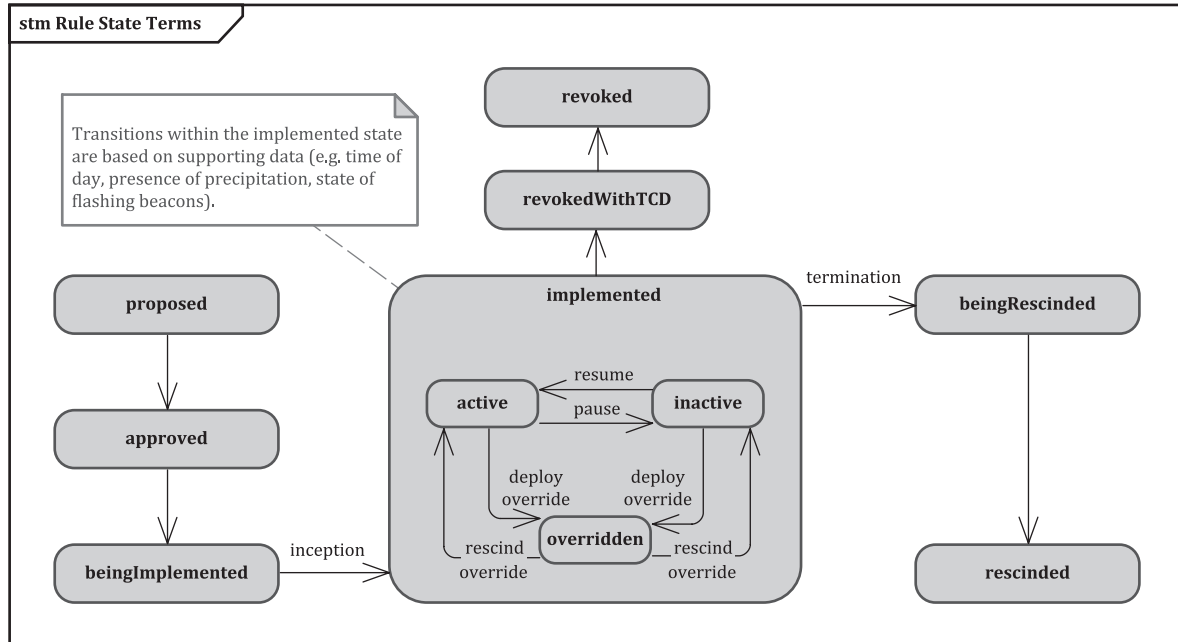


Figure 9 — Rule states

A proposed rule can be approved by a rule maker through legislation, the completion of a traffic warrant, a traffic response plan, or other means. Once approved, the rule is properly publicized, which can require time; during which the rule is in the “beingImplemented” state. Once the rule is properly publicized and becomes

applicable as conditions warrant, it reaches its inception time and the rule transitions to the implemented state. A rule in the implemented state will always be in one of three substates:

- a) active — the rule is currently in effect;
- b) inactive — the rule is not in effect due to some condition not being met (e.g. the rule only applies during daylight hours, and it is currently night-time);
- c) overridden — the rule is not in effect due to another rule with a higher precedence overriding the rule (e.g. a posted speed limit on a motorway that is overridden by a lower speed limit that is in effect due to an emergency vehicle stopped on the shoulder).

A rule can transition between states multiple times during its lifetime. At some point (i.e. the termination time) the rule can be rescinded, at which point it no longer applies. Similar to the implementation process, the process to rescind a rule can take time to remove related TCDs and a “beingRescinded” state is defined for this transition period.

Rules can also be revoked, which means that they were determined to not be enforceable even when they were published. For example, a court can determine that a rule imposed a restriction that the authority did not have the right to impose.

NOTE When rules are defined with an expected termination time (e.g. a rule associated with road works) it is called a temporary rule and a rule that is defined without an expected termination time is called a persistent rule. Within the context of this document, temporary rules do not require the expected termination time to be known. For example, a rule related to a multi-year road work project might not initially have a known termination time, but there is still an expectation that it will be terminated.

5.4.6.1.3 Rule characteristics

While the standards for TCDs cover typical scenarios, it can still be challenging to convey complex characteristics associated with rules concisely and unambiguously. The following examples describe three distinctly different conditions; creating a TCD that adequately conveys the intended meaning unambiguously would be a challenge for any of them.

EXAMPLE 1 A lower speed limit applies at night on weekends during winter months when snow is on the ground (i.e. all stated conditions apply).

EXAMPLE 2 A lower speed limit applies 1) at night, 2) on weekends, 3) during winter months, or 4) when snow is on the ground (i.e. any of the four conditions trigger the rule).

EXAMPLE 3 A lower speed limit applies 1) at night on weekends during winter months or 2) when snow is on the ground.

Including multiple conditions on a rule, as in these examples, is discouraged because it can overload the user while performing the DDT.

5.4.6.1.4 Rule precedence

Rules need to be unambiguous in their precedence with respect to other rules. For example, posted rules generally take precedence over unposted default rules (e.g. the default speed limit for a rural road) while other unposted rules can take precedence over posted rules (e.g. a national government can impose a new speed limit that overrides existing posted speed limits). It is the responsibility of rule makers to ensure that the rules themselves are unambiguous and are devoid of conflicts.

5.4.6.1.5 Jurisdictional boundaries

Rules are limited by geographic boundaries, often jurisdictional in nature; transport users need to be aware of differences between jurisdictions and when rules apply, which includes an understanding of which rules have been adopted by which layers of the hierarchy.

Properly understanding and applying rules can be more complex than one might initially think. For example, in the US, the town of Bristol is located on the border of two US states, Tennessee and Virginia, with the state border running down the centre of the town’s State Street. A driver with a “beginner’s” or “learner’s”

permit is not allowed to drive between the hours of 10:00 pm and 6:00 am in Tennessee, but there is no corresponding restriction in Virginia. So, a transport user that might be legally allowed to operate a vehicle on one side of the street might not be allowed to operate on the other side (in the other direction). It is the responsibility of the transport user (e.g. driver, driving automation system) to be aware of these anomalies.

5.4.6.1.6 Conclusion

Rules that apply to the transport environment can become quite complex and confusing. Encouragingly, rule makers, enforcers, and adjudicators have recognized the challenges presented to transport users in accurately understanding complex and/or confusing rules and have either avoided them or provided some level of grace to violators. However, evolution of technology can change expectations in the future.

5.4.6.2 Traffic control devices

5.4.6.2.1 General

TCDs are one way by which implementers can convey rules to users. Previous standardization efforts have overcome some of the challenges in concisely expressing rules. These efforts have combined the needs to establish rules with the practical constraints in conveying the rules. For example, the breadth of transport-related rules that are posted can generally be characterized through TCDs defined by the contents of documents such as:

- a) publications of UNECE WP.1 World Party on Road Traffic Safety;
- b) publications of UNECE WP.29 World Forum for Harmonization of Vehicle Regulations;
- c) the Vienna Convention on Road Signs and Signals; and
- d) similar regional, national, and local publications (e.g. the MUTCD).

While these documents are informative and promote common meaning of symbols (e.g. a stop sign, the international symbol for wild animal), none of these materials directly have the force of law, rather they can be incorporated into law via legislation. In other words, every country has a sovereign right to adopt its own rules. While many countries and local entities have adopted laws based on one or more documents in this list, they can and often do vary and extend these guidelines.

As an example, within the United States, US. Code §109 requires that all projects receiving US federal funds install signs, pavement markings and signals in a manner that promotes the safe and efficient use of highways subject to the approval of the state transportation department with the concurrence of the US secretary of transportation. Most states have enacted laws that require their transportation department to establish a uniform system of TCDs within the state. As a result of these laws, the USDOT supported the development of the MUTCD to promote consistent rules across the country; however, each state can extend or modify the manual for its own purposes and traditions. For example, the Texas manual includes a “Don’t Mess With Texas” sign for anti-litter campaigns. Similar hierarchies of legal authorities occur within many other regions of the world.

5.4.6.2.2 Maintenance

In addition, the infrastructure used to post rules will degrade over time and will need proper maintenance by support staff as well. For example, signs and markings can:

- a) become obscured;
- b) fade (e.g. see [Figure 10](#));
- c) be damaged or vandalized.



Figure 10 — Faded stop sign

Legal requirements to maintain TCDs vary by jurisdiction, however most jurisdictional entities that post rules have a responsibility to ensure that TCDs remain functional (e.g. visible, legible, operational).

5.4.6.2.3 Public record

In addition to TCDs, the implementer can announce unposted rules by using the public record. While the precise mechanism for using the public record varies by jurisdictional area, the basic concept is that the rule is announced through recognized channels sufficiently that adjudicators consider the rule to be adequately announced to be enforceable. The complete process of announcing the rule can include issuing updates to legal documents, publishing articles in newspapers or online sources, radio announcements, discussions in driver training courses, etc.

5.4.6.2.4 Environment

Most jurisdictions have rules requiring users to maintain awareness of their environment as a part of providing for the safe operation of their vehicle or device, especially since the operational environment can affect which rules are currently active. The user can monitor this environment directly or can sometimes use supporting data providers to assist in this activity.

5.4.6.2.5 Vehicle or device

Within the context of the ISO 24315 series, vehicle or devices represent the resources that users operate while complying with all active rules.

5.5 Modes of operation for the current situation

The current situation can be described by the following modes of operation, all of which are location specific. For example, most of a system might be under normal operations with one traffic signal experiencing a power failure.

- a) Normal: the regulations that are in force are represented by the TCDs that are in place.