ITS AMERICA

V2X Application Mapping in Networked V2X

The V2X Application Mapping in Networked V2X was developed by the ITS America Beyond 5.9 Working Group in conjunction with the ITS America V2X and Connected Transportation Committee.

This document is intended as a practical guide for members of the Intelligent Transportation Systems (ITS) community – particularly ITS and Connected and Automated Vehicle (CAV) specialists at state, county, and local DOTs – who are seeking to better understand, plan for, and potentially implement networked V2X solutions. Rather than focusing solely on conceptual definitions or theoretical capabilities, this document maps out real-world use cases where networked V2X is already being deployed to deliver measurable safety and mobility outcomes. It also builds on the expansive foundation of V2X applications identified and developed by V2X stakeholders over more than two decades, all originally envisioned for deployment within the 5.9 GHz band before the emergence and rapid proliferation of networked V2X.

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Introduction

As Departments of Transportation (DOTs) at every level look to modernize infrastructure and improve roadway safety, connected vehicle technologies are playing an increasingly central role. Vehicle-to-Everything (V2X) communication, which was once pursued exclusively through the lens of dedicated short-range communication (DSRC) or direct Cellular-V2X (C-V2X) operating on the 5.9 GHz band, is now evolving into a broader ecosystem that includes network-based communication over commercial cellular networks. This evolution has enabled a new category of deployable applications known collectively as *networked V2X*.

This document is intended as a practical guide for members of the Intelligent Transportation Systems (ITS) community – particularly ITS and Connected and Automated Vehicle (CAV) specialists at state, county, and local DOTs – who are seeking to better understand, plan for, and potentially implement networked V2X solutions. Rather than focusing solely on conceptual definitions or theoretical capabilities, this document maps out real-world use cases where networked V2X is already being deployed to deliver measurable safety and mobility outcomes. It also builds on the expansive foundation of V2X applications identified and developed by V2X stakeholders over more than two decades, all originally envisioned for deployment within the 5.9 GHz band before the emergence and rapid proliferation of networked V2X.[1]

Leveraging that baseline set of established and accepted use cases, this document provides a summary of how select V2X use cases are being addressed by networked V2X today. Each use case includes:

- A clear description of the safety use case or operational challenge being addressed;
- An explanation of how networked V2X enables a solution via cellular connectivity and cloud-based services;
- A reference to relevant ARC-IT services to help align with national ITS architecture frameworks;
- Examples of actual deployments by vendors, agencies, or collaborative pilot efforts (the included lists of example deployments are not intended to be exhaustive).

These use cases demonstrate how DOTs can leverage cellular networks to deploy connected vehicle applications today for immediate, day-one V2X benefits. From wrong-way driver detection and emergency vehicle preemption to pedestrian safety and queue alerts, the applications detailed here span a range of operational scenarios that are relevant to agencies of all sizes and geographies. Ultimately, our goal is to demystify networked V2X for transportation professionals, providing the knowledge and examples necessary to incorporate these technologies into near-term planning and deployment strategies. By grounding these applications in current practice and aligning them with national architecture, we hope to accelerate the adoption of network-based V2X as a critical component of a safer, smarter transportation future.

[1] *V2X/Connected Transportation Advocacy Materials*. ITS America. https://itsa.org/advocacy-materials/; *V2X*. U.S. Department of Transportation. https://www.transportation.gov/tags/v2x.

Notes

A note on references to ARC-IT Services:
This document intends to provide an application map for several V2X use cases that can be addressed in some form or another over networked V2X. One item of interest included for each use case is its relationship to existing ARC-IT services, including reference links. We also include a detailed appendix on mapping Networked V2X use cases to ARC-IT services, including diagrams tailored for Networked V2X. The Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT) currently defines 157 services, sixteen of which are referenced in this report. Additional information about each cited ARC-IT service, including functional, physical, standards, system requirements, and security, is available at www.arc-it.org.

A note on definitions and service terminology:
The *ITS America Beyond 5.9 GHz Deployment Plan* differentiates the keywords "alert" and "warning."[2] An alert refers to a service provided over any communication link where delay is tolerable. A warning refers to the output to a driver from a so-called "safety critical" application, which implies the communication link has very low latency. That differentiation is along a time-to-collision axis, so if the driver is far in time from a potential conflict or crash, they receive an alert. At some point in the timeline, there is a transition to a safety critical warning. Though this is easy to understand in principle, there is a lack of industry consensus about the precise point at which the alert-warning transition occurs. The reasons for this include:

- The "alert," "warning," and "safety critical" vocabulary is not uniformly used by parties outside of ITS America, including human factors and Advanced Driver Assistance Systems (ADAS) specialists, government actors, academics, and service providers. Indeed, there is wide variation in the use of terminology in literature and reports that address V2X and safety.
- The alert-warning line, which indicates scenarios where networked V2X can be used and scenarios where direct communication should be applied, depends on many factors including use case requirements, human factors principles such as minimizing false and nuisance alarms, and coverage and quality of both direct communication links and network connections. Moreover, business-related issues are factors. They include baseline requirements on how well the application addresses safety and cost to deliver either direct or network communication. The requirements and other considerations might vary significantly among OEMs and IOOs. Finally, technologies, capabilities, and business offerings will evolve over time.

[2] https://itsa.org/wp-content/uploads/2025/02/ITSA-Beyond-5.9-2024-1.pdf

For the above reasons, this report continues using the "alert", "warning", and "safety critical" vocabulary of the previous report, both for the sake of continuity and to encourage convergence to consensus among stakeholders. Rather than pursuing the difficult goal of developing rules and boundaries between direct and networked communication for vehicle safety-related applications, we seek instead to provide example implementations of networked V2X communication and invite readers to consider the manifold case-by-case considerations that figure into broad networked and direct communication deployment on our streets and highways.

A note on deployment guidance:

Although this document follows and references deployment guidance used in the ITS America *Beyond 5.9 GHz Deployment Plan*, we acknowledge that real-world deployment decisions necessarily depend on human factors, technology capabilities, and local priorities. Rather than attempting to draw hard lines between networked and direct communication, this report encourages readers to consider the diverse set of tools available today and how they can be applied to meet agency-specific goals.

Use Cases

Wrong Way Driver

What: This application alerts offending and impacted drivers when a vehicle is detected traveling in the wrong direction on a specific roadway (e.g., highway ramp, one-way street), posing a serious and urgent risk.

Networked Solution: Roadside sensors (radar, camera) detect wrong way movement, or data from the wrong-way vehicle itself (if equipped) is used to detect the hazardous movement by comparing vehicle direction to the allowable direction on that road lane or segment. Once identified, the offending driver is alerted. In appropriate cases, an alert is also triggered within a network-connected back-end system, which then relays the warning to connected vehicles in harm's way, as identified by logic, including geofencing and direction of travel.

Related ARC-IT Services:
TM25: Wrong Way Vehicle Detection and Warning
VS03: Situational Awareness

Deployment Example(s): Applied Information, Bosch/BMW, Continental, HAAS Alert

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Intersection Collision Risk (ICR)

What: This application alerts drivers at risk of collision at intersections, often due to vehicles violating traffic signals, making unsafe maneuvers. ICR systems reduce the likelihood of collisions and improve traffic efficiency.

Networked Solution: Vehicle position, speed, trajectory, and traffic signal status (SPaT) as well as MAP[3] files are shared via connections to a service provider back-end located in the cloud. The back-end analyzes potential conflicts and sends timely alerts back to drivers on a collision course.

Related ARC-IT Service:
VS13: Intersection Safety Warning and Collision Avoidance

Deployment Example(s): HAAS Alert (R2R®), P3 (Direct)

[3] MAP messages are V2X messages that share intersection geometry – approaches, lane assignments, etc. MAP messages are sent by RSUs and used with SPaT messages to tell approaching vehicles about the intersection and their signal timings.

Work Zone Traveler Information

What: This application delivers work zone alerts to drivers with key information such as expected delay times, queue lengths, specific lane configuration details, or recommended alternate routes.

Networked Solution: Aggregates timely data from various sources (work zone status feeds, traffic data, probe vehicles collected and confirmed in traffic management centers) via connections to a cloud-based back-office platform. This platform directs the information via cellular network to in-vehicle systems or apps, depending on the vehicle relevance, based on geofence and direction of travel. The result is a road-user equipped to make more informed navigation decisions.

Related ARC-IT Service:
TI02: Personalized Traveler Information

Deployment Example(s): HAAS Alert, Wanco, Ver-Mac, SolarTech, Monotch

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Reduced Speed/Work Zone

What: This is a type of Work Zone alert focused explicitly on alerting drivers to a mandatory or advisory speed limit reduction within or approaching the work zone.

Networked Solution: Similar to Work Zone Traveler Information, but the alert specifically includes the required reduced speed. Data, such as required and temporary speed limits, is sent into connected vehicles by identifying, via geofence and direction of travel, the relevant vehicles. This information, sourced from digital speed limit signs, worker inputs, or agency data, is relayed via back-office system over cellular networks to vehicles and apps, giving drivers clear instruction to slow down for safety.

Related ARC-IT Service:
VS09: Reduced Speed Zone Warning / Lane Closure

Deployment Example(s): HAAS Alert, Talking Traffic (NL)

Emergency Vehicle Signal Preemption

What: Allows authorized emergency vehicles (police, fire, ambulance) approaching a signalized intersection to request a green light, clearing traffic and facilitating faster, safer passage.

Networked Solution: An emergency vehicle's location and status (e.g., lights/sirens active) are shared with a preemption service provider, either by on-board equipment and a network connection, or by connection between the service provider and the vehicle's back-office AVL (Automatic Vehicle Location) system. The emergency vehicle's status and location are used by the service provider to request preemption, whereupon the system authenticates the request and communicates securely (via backhaul or cellular) with the relevant traffic signal controller to grant priority, either in the cloud or the signal controller.

Related ARC-IT Service:
PS03: Emergency Vehicle Preemption

Deployment Example(s): Applied Information, HAAS Alert, LYT, Miovision, Monotch, P3, ThruGreen, Verizon

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Approaching Emergency Vehicle

What: This is a timely alert precisely targeted at informing drivers when an alerting emergency vehicle (like police, fire, or ambulance, operating with lights and/or sirens) is approaching their position or projected path, reducing the risk of collision and improving response times through advance traffic preemption.

Networked Solution: A device within the actively responding emergency vehicle shares its location and status via the cellular network to a dedicated cloud service. This service then pushes alerts over networks to connected vehicles and driver apps within a defined geographical proximity or along the emergency vehicle's projected path.

Related ARC-IT Service:
VS04: Special Vehicle Alert

Deployment Example(s): HAAS Alert (R2V), Monotch (EVA)

Forward Collision Risk (Enhanced via V2X)

What: While direct V2X Forward Collision Warning uses onboard sensors, V2X enhances this by providing warnings about hazards outside the field-of-view of vehicle sensors, such as a disabled vehicle around a blind curve or over a hill.

Networked Solution: A disabled vehicle can transmit its status and precise location via cellular to a cloud-based solution. This platform relays the information over cellular networks to approaching vehicles, giving drivers advanced notice of the hazard well before it might be visible or detectable by onboard radar/cameras.

Related ARC-IT Service:
VS02: V2V Basic Safety

Deployment Example(s): HAAS Alert

Pedestrian Crossing Information

What: Provides drivers with information about upcoming pedestrian crossings (marked or unmarked) and can alert them when a crossing is actively being used, enhancing awareness especially at non-signalized locations.

Networked Solution: Roadside sensors or pedestrian personal devices detect pedestrian presence or intent to cross. This information is sent via cellular to a service provider, which then pushes alerts over cellular network to drivers approaching that crossing location.

Related ARC-IT Service:
VS12: Vulnerable Road User Safety

Deployment Example(s): Commsignia (Pedestrian Push Button), Monotch, Verizon

Pedestrian in Signalized Crosswalk (PISC)

What: Specifically alerts drivers to pedestrians detected within a signalized crosswalk, particularly if the vehicle has a green light or is permitted to turn, reducing the risk of pedestrian-vehicle conflict.

Networked Solution: Roadside infrastructure (like smart traffic signals equipped with cameras, lidar, or thermal sensors) detects a pedestrian in the crosswalk. This presence is relayed to a service provider backend, which creates and sends a targeted alert over cellular network to relevant approaching drivers based on their direction of travel and position relative to that crosswalk.

Related ARC-IT Service:
VS12: Vulnerable Road User Safety

Deployment Example(s): Applied Information, City of Chattanooga (w/ suppliers), Monotch, Verizon

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Curve Speed Alert

What: Alerts drivers to potentially unexpected curves ahead or to warn a driver when their speed is above that of an upcoming curve's posted suggested safe speed.

Networked Solution: Combines digital map data (suggested safe speed, posted limits) with timely inputs (e.g. vehicle speed, icy conditions detected from sensors or other vehicles). A service provider analyzes vehicle speed and location relative to the curve data, sending advisory speed alerts via the cellular network to the driver's connected system or app to alert to a hazard.

Related ARC-IT Service
VS05: Curve Speed Warning

Deployment Example(s): Drivewyze, Monotch, PennDOT (Information Data Exchange), Verizon

Emergency Communications and Evacuation Information

What: Delivers emergency messages, instructions, or tailored evacuation routing information to drivers during large-scale emergencies like natural disasters, chemical spills, or major security incidents.

Networked Solution: Authorized emergency management agencies push official alerts and routing guidance through established channels (like WEA/IPAWS infrastructure or dedicated platforms) that leverage cellular networks. Cloud services disseminate this information broadly or targeted geographically via cellular to connected vehicles and mobile devices.

Related ARC-IT Service:
PS14: Disaster Traveler Information

Deployment Example(s): HAAS Alert, Texas Trust Project (V2X Accelerator, Hurricane Evacuation)

Highway/Railroad Collision Alert

What: Alerts drivers approaching a railroad crossing about the presence or imminent arrival of a train, or potential hazards at the crossing itself.

Networked Solution: Data from the railway signaling system (e.g., crossing gate activation status, train detection circuits) or dedicated trackside sensors is transmitted to a service provider. The service provider then sends timely alerts via cellular to connected vehicles approaching the crossing.

Related ARC-IT Service:
TM14: Advanced Railroad Grade Crossing

Deployment Example(s): HAAS Alert, Verizon

Signal Priority (Transit/Freight)

What: Allows public transit vehicles (buses, snowplows) or freight trucks to request priority treatment at signalized intersections (e.g., extending a green light) to improve schedule adherence, fuel efficiency, and traffic flow.

Networked Solution: Similar to emergency vehicle preemption, the privileged vehicle location is known to a signal priority service provider, and a priority request is made. These events are handled via cellular network or cloud connection, or both. Traffic signal controllers and/or cloud systems grant priority based on rules pre-defined by the local road agency policy.

Related ARC-IT Service:
CVO06: Freight Signal Priority
PT09: Transit Signal Priority

Deployment Example(s): Drivewyze, Kimley-Horn, Miovision, Monotch (Talking Traffic), P3, Verizon

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Advanced Traveler Information System (ATIS)

What: A comprehensive system delivering a wide range of roadway data to drivers, including traffic speeds, congestion levels, incident locations, travel time estimates, weather conditions, parking availability, and more.

Networked Solution: Aggregated data from numerous sources (road sensors, connected vehicles providing probe data, traffic cameras, agency feeds, weather services, parking operators) is available to a service provider platform. This information is then processed and delivered dynamically via cellular networks to drivers through navigation apps, websites, and in-vehicle infotainment systems based on timely geofencing criteria.

Related ARC-IT Service:
TI02: Personalized Traveler Information

Deployment Example(s): Monotch, TriHydro, Verizon

Queue Alert

What: Alerts drivers to slowing or stopped traffic ahead, particularly unexpected "end-of-queue" situations that can lead to rear-end collisions, often occurring beyond the driver's line of sight.

Networked Solution: Detected through aggregated and timely speed data from probe vehicles, roadside traffic sensors, or sudden vehicle deceleration or stopped status. This queue information is sent via cellular to a service provider, which pushes alerts over cellular networks to vehicles approaching the back of the queue.

Related ARC-IT Service:
VS08: Queue Warning

Deployment Example(s): Drivewyze, Verizon, Waze/Google

Spot Weather Impact Alert

What: Provides highly localized alerts about hazardous road weather conditions impacting a segment of roadway, such as black ice, heavy fog, standing water (hydroplaning risk), or high crosswinds.

Networked Solution: Data from Road Weather Information Systems (RWIS), connected vehicles reporting conditions (e.g., ESP/ABS activation, wiper usage, temperature readings), or localized meteorological forecasts are sent via cellular networks to a cloud platform. Solutions in this space fuse this data with precise location information and disseminate targeted alerts via cellular to vehicles entering the affected area.

Related ARC-IT Service:
WX03: Spot Weather Impact Warning

Deployment Example(s): HAAS Alert, Monotch, TriHydro, Verizon

How to Get Started

Deploying networked V2X technology involves several key steps to ensure a successful implementation. First, it is essential to conduct a thorough assessment of your current infrastructure and identify areas where V2X technology can provide the most significant benefits. This includes evaluating existing communication networks, roadside units (RSUs), and vehicle fleets to determine their readiness for V2X integration.

Next, develop a comprehensive deployment plan that outlines the specific V2X applications you intend to implement, such as wrong-way driver detection, emergency vehicle preemption, and pedestrian safety alerts. This plan should include a detailed timeline, budget, and resource allocation to ensure that all aspects of the deployment are adequately addressed. Engaging with key stakeholders, including local government agencies, transportation departments, and technology providers, is crucial to gain support and ensure a coordinated effort.

Securing funding is another critical step in the deployment process. Explore various funding sources, including federal grants, state and local funding, and public-private partnerships, to support your V2X initiatives. Additionally, consider leveraging existing resources and collaborating with other agencies or organizations that have successfully deployed V2X technology to learn from their experiences and best practices.

Finally, it is essential to provide training and education for all personnel involved in the deployment and operation of V2X systems. This includes technical training for installation and maintenance, as well as awareness programs for drivers and the general public to ensure they understand the benefits and proper use of V2X technology. This helps in gaining public support and ensuring that users understand how to interact with the new systems.

Initial Deployment Checklist

1. Assess Current Infrastructure

- Evaluate existing communication networks, RSUs, and vehicle fleets.
- Identify areas where V2X technology can provide the most significant benefits.

2. Develop a Deployment Plan

- Outline specific V2X applications to implement.
- Create a detailed timeline, budget, and resource allocation plan.
- Engage with key stakeholders for support and coordination.

3. Secure Funding

- Explore various funding sources (federal grants, state and local funding, public-private partnerships).
- Leverage existing resources and collaborate with other agencies or organizations.

4. Provide Training and Education

- Offer technical training for installation and maintenance.
- Implement awareness programs for drivers and the public.

Other Considerations for Successful Deployment

Interoperability and Standards Compliance: Ensure that the V2X systems and devices comply with national and international standards to guarantee interoperability with other systems and future-proof the deployment. This includes aligning with the Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT) services.

Data Privacy and Security: Implement robust data privacy and security measures to protect sensitive information transmitted through V2X systems. This includes securing communication channels and ensuring that data is encrypted and access-controlled.

Scalability and Flexibility: Design the V2X deployment to be scalable and flexible to accommodate future expansions and technological advancements. This involves considering the potential for integrating new applications and services as they become available.

Stakeholder Engagement and Collaboration: Engage with a wide range of stakeholders, including local communities, government agencies, technology providers, and end-users, to ensure that the deployment meets the needs of all parties involved. Collaboration can also help in sharing best practices and lessons learned.

Pilot Testing and Iterative Deployment: Conduct pilot tests and iterative deployments to identify and address any issues before full-scale implementation. This approach allows for adjustments based on real-world feedback and ensures a smoother rollout.

Regulatory Compliance: Ensure that the deployment complies with all relevant regulations and guidelines set by federal, state, and local authorities. This includes obtaining necessary permits and approvals.

Technical Assistance and Support: Utilize technical assistance programs and support services offered by organizations such as the USDOT to ensure that the deployment is successful. These programs can provide valuable resources and expertise to help navigate the complexities of V2X deployment.

Appendix I: ARC-IT Networked V2X Use Case Mappings

The networked vehicle-to-everything (V2X) use cases are mapped in this Appendix to the Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT)[4] to provide insight into considerations for networked V2X environment. Each networked V2X use case was mapped to the ARC-IT services that best matched their functional scope as illustrated in Table 1 and as noted in each networked V2X use case description. The diagrams in this Appendix represented tailored diagrams to specifically illustrate networked V2X in each service context. Some ARC-IT services include Wide Area Wireless (WAW) implementations to which networked V2X maps well. In all cases, the ARC-IT services define the environment within which the networked V2X approach would operate.

Table 1 Networked V2X Use Case Mappings to ARC-IT Services

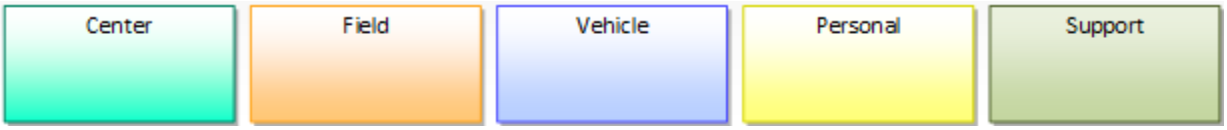
ARC-IT SERVICES	Freight Signal Priority	Emergency Vehicle Preemption	Disaster Traveler Information	Transit Signal Priority	Personalized Traveler Information	Advanced Railroad Grade Crossing	Wrong Way Vehicle Detection and Warning	V2V Basic Safety	Situational Awareness	Special Vehicle Alert	Curve Speed Warning	Queue Warning	Reduced Speed Zone Warning / Lane Closure	Vulnerable Road User Safety	Intersection Safety Warning and Collision Avoidance	Spot Weather Impact Warning
Use Case	**CVO06**	**PS03**	**PS14**	**PT09**	**TI02**	**TM14**	**TM25**	**VS02**	**VS03**	**VS04**	**VS05**	**VS08**	**VS09**	**VS12**	**VS13**	**WX03**
Wrong Way Driver							■		■							
Intersection Collision Risk															■	
Reduced Speed/Work Zone													■			
Work Zone Traveler Information					■											
Emergency Vehicle Signal Preemption		■														
Approaching Emergency Vehicle										■						
Forward Collision Risk (Enhanced via V2X)								■								
Pedestrian in Signalized Crosswalk (PICS)														■		
Curve Speed Alert											■					
Emergency Communications and Evacuation Information			■													
Pedestrian Crossing Information														■		
Highway/Railroad Collision Alert						■										
Signal Priority (Transit/Freight)	■			■												
Advanced Traveler Information System (ATIS)					■											
Queue Alert												■				
Spot Weather Impact Alert																■

The ARC-IT services tailored for the networked V2X use cases are presented in this Appendix to inform use case definition discussions and considerations. In most of the service tailoring, original ARC-IT service information exchanges are retained for option consideration and/or context for the environment in which networked V2X will be operating.

[4] https://www.arc-it.org/

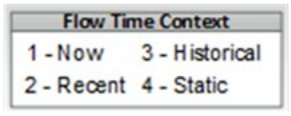
The tailored service diagrams contain detail explained as follows:

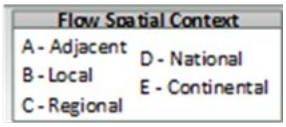
- The colored blocks in each diagram represent Physical Objects corresponding to systems and devices in the ITS environment, such as operational centers, field equipment, vehicle on-board equipment, personal devices, or support systems. The color-coding is illustrated as follows:



- The white blocks within each Physical Object represent Functional Objects. They define the functionality that is required for each Physical Object to support the service.

- The lines in the diagrams are Information Flows that exchange the information indicated by the Information Flow name between the Physical Objects. The Information Flows have direction or flow indicated by arrows. The color coding of the Information Flows reflects Flow Security. The alphanumeric characters at the beginning of each Information Flow name in parentheses represent temporal context with the number and spatial context with the letter. Each of these characteristics are explained in the following legends:





Wrong Way Driver Use Case

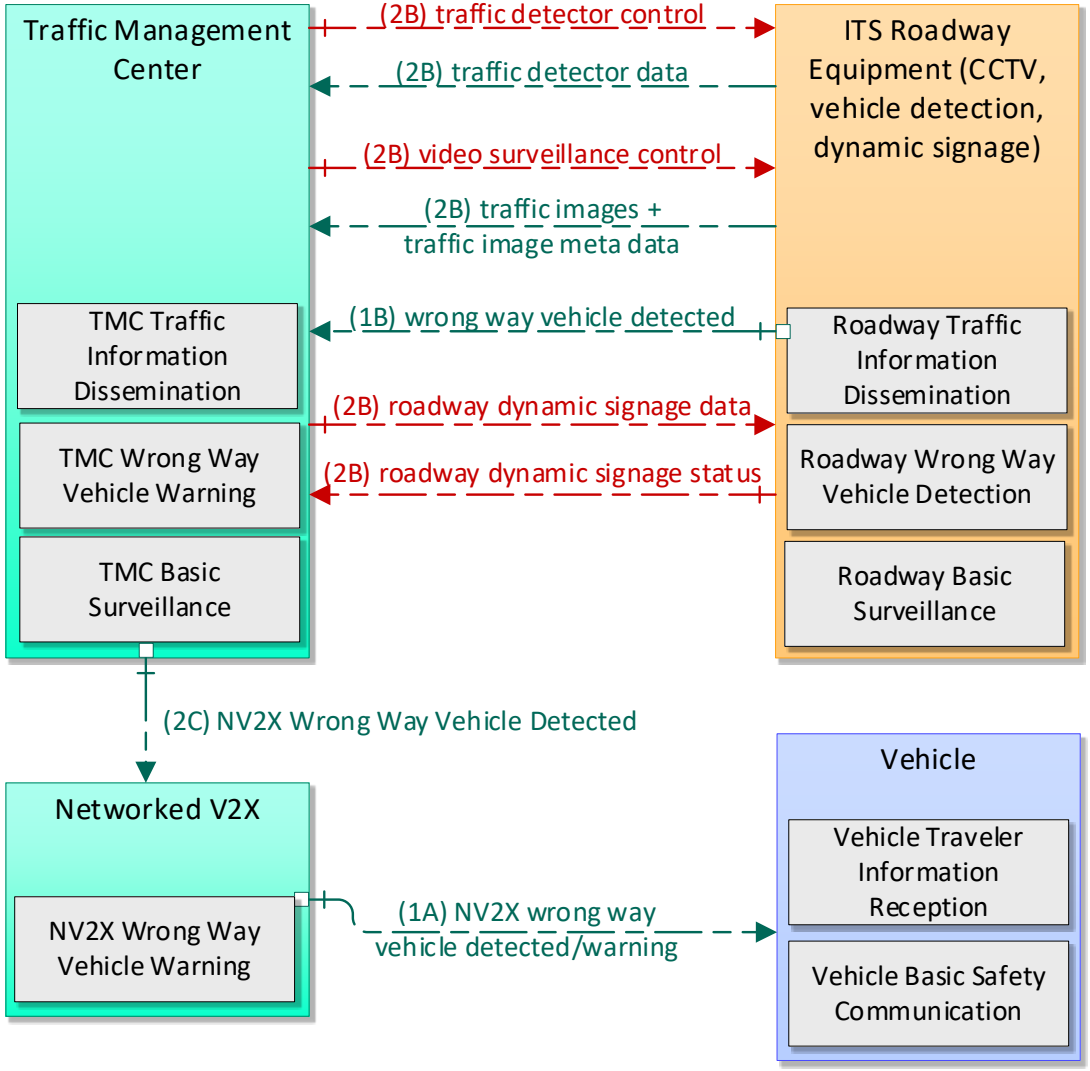


Figure 1 Wrong Way Driver Use Case (ARC-IT TM25 and VS03)

Intersection Collision Risk Use Case

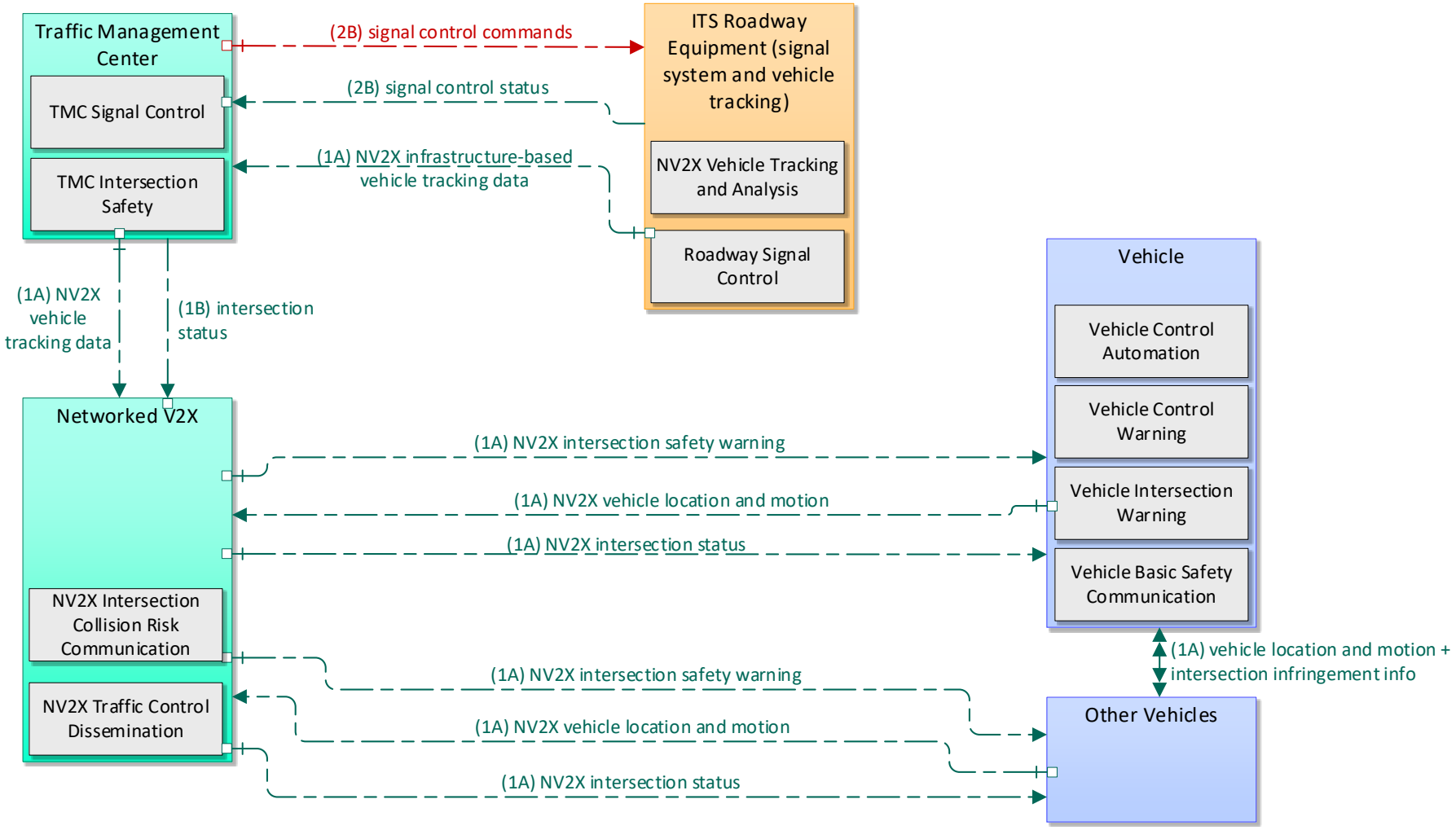


Figure 2 Intersection Collision Risk Use Case (ARC-IT VS13)

Reduced Speed/Work Zone Use Case

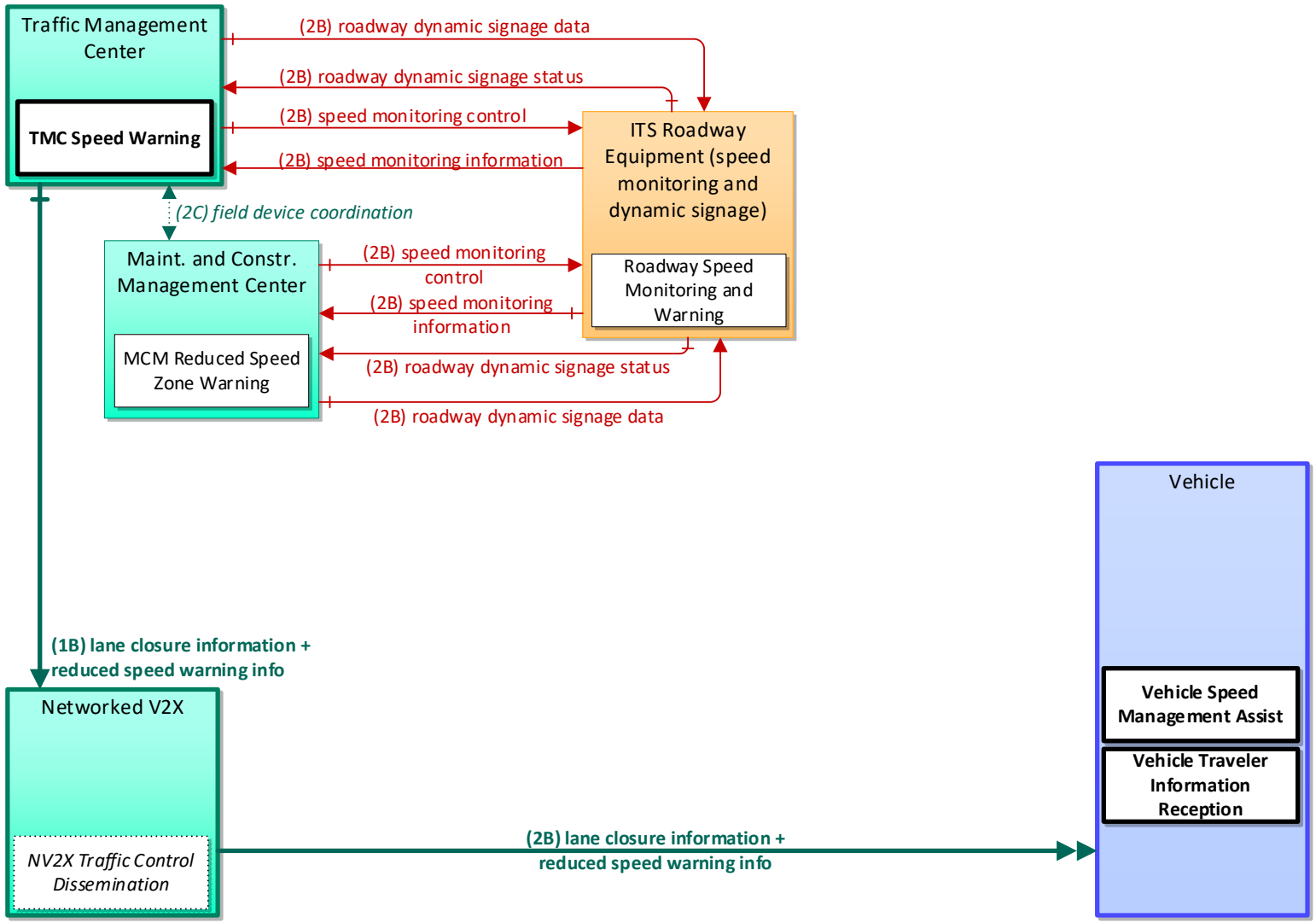


Figure 3 Reduced Speed/Work Zone Use Case (ARC-IT VS09)

Work Zone Traveler Information Use Case

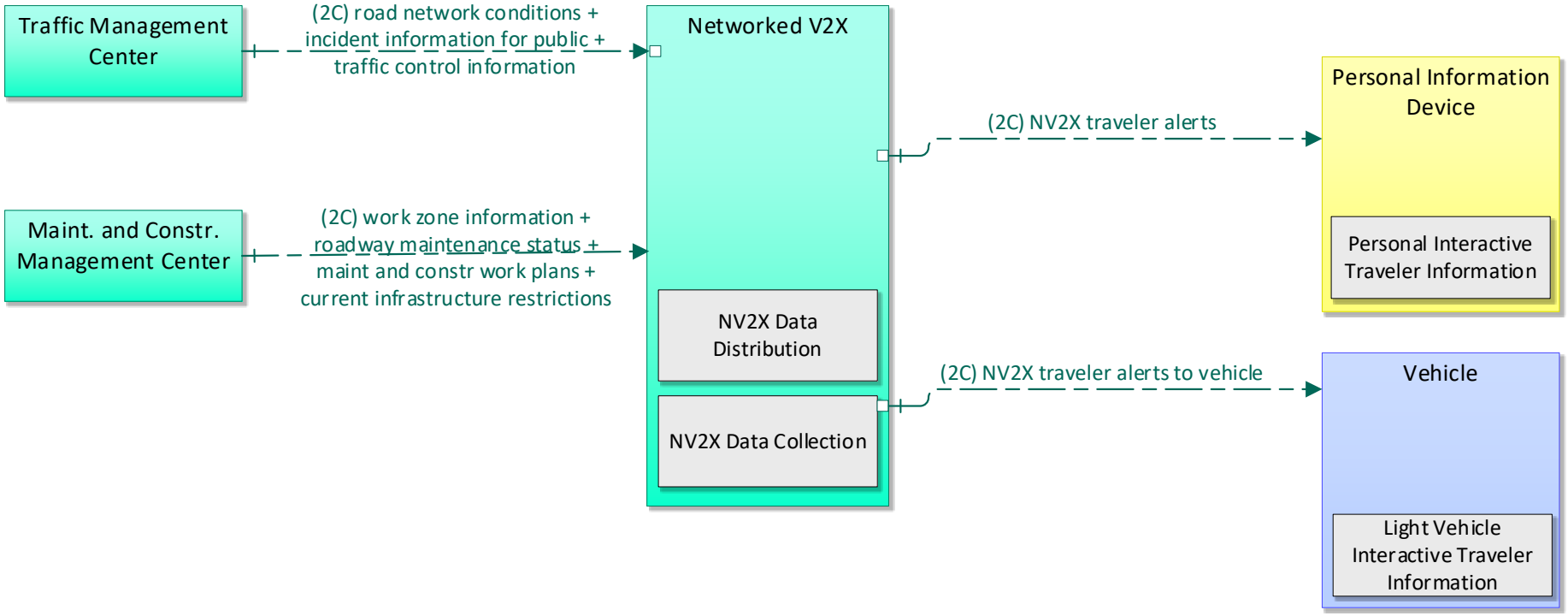


Figure 4 Work Zone Traveler Information Use Case (ARC-IT TI02)

Emergency Vehicle Signal Preemption Use Case

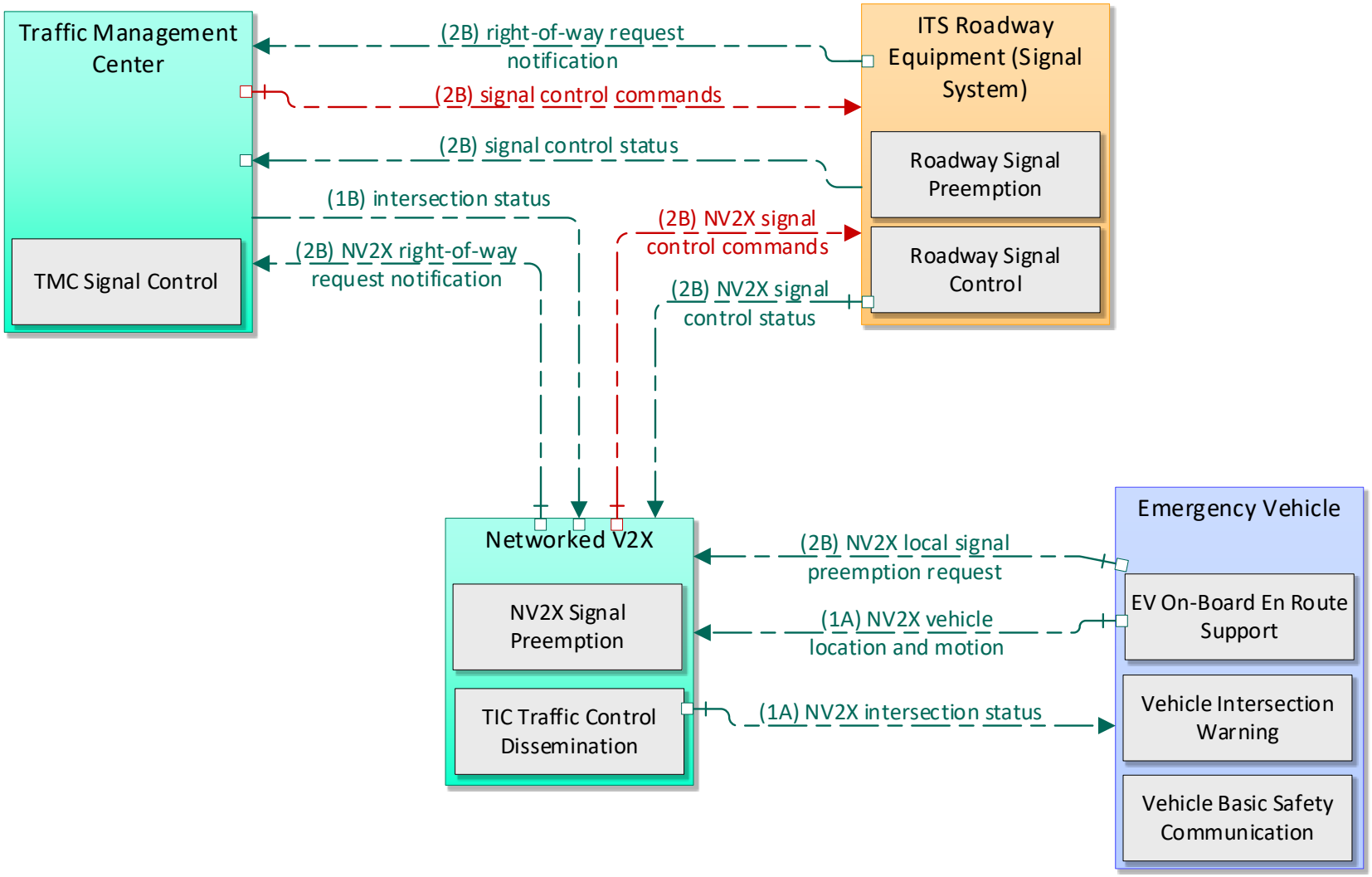


Figure 5 Emergency Vehicle Signal Preemption Use Case (ARC-IT PS03)

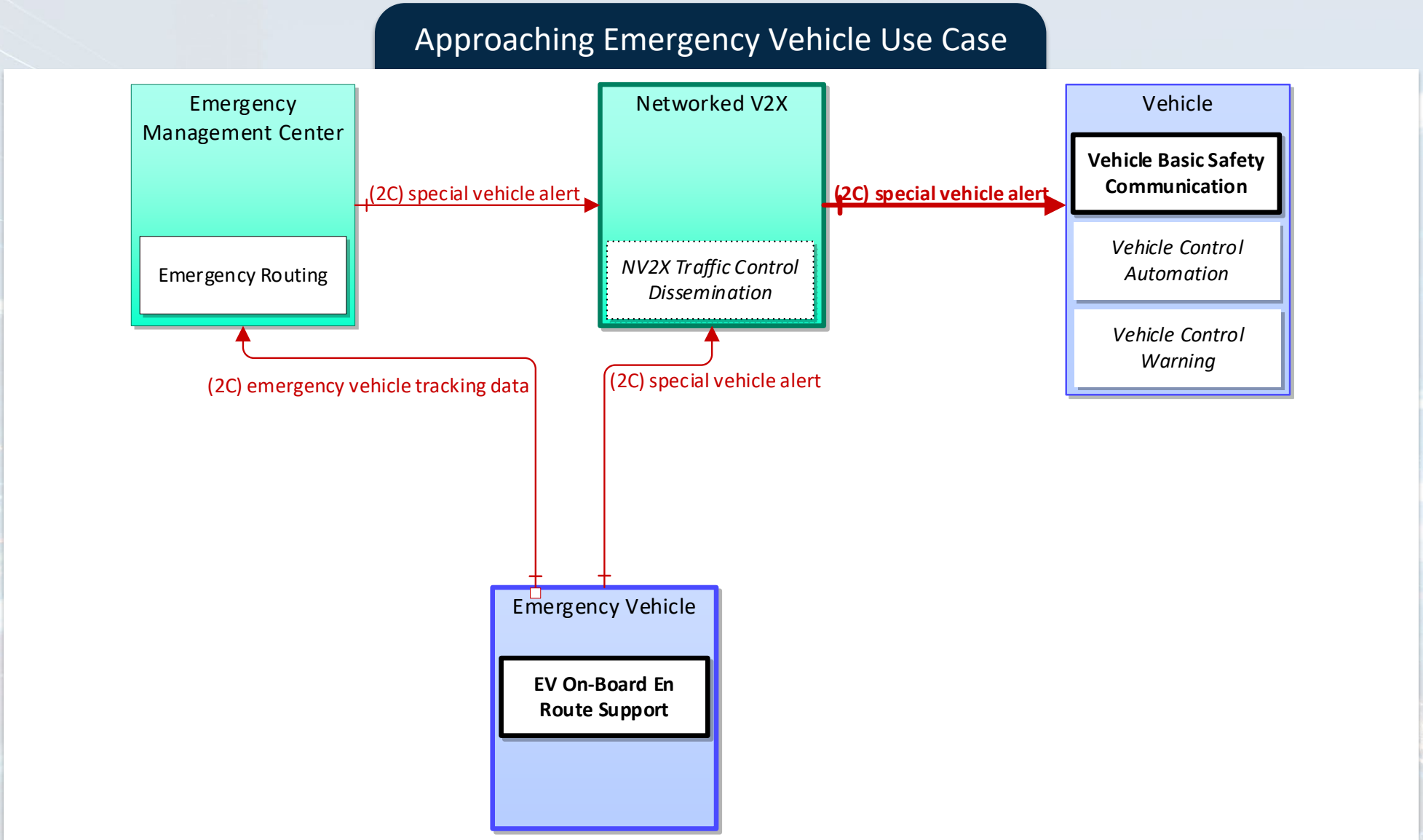


Figure 6 Approaching Emergency Vehicle Use Case (ARC-IT VS04)

Forward Collision Risk (Enhanced via V2X) Use Case

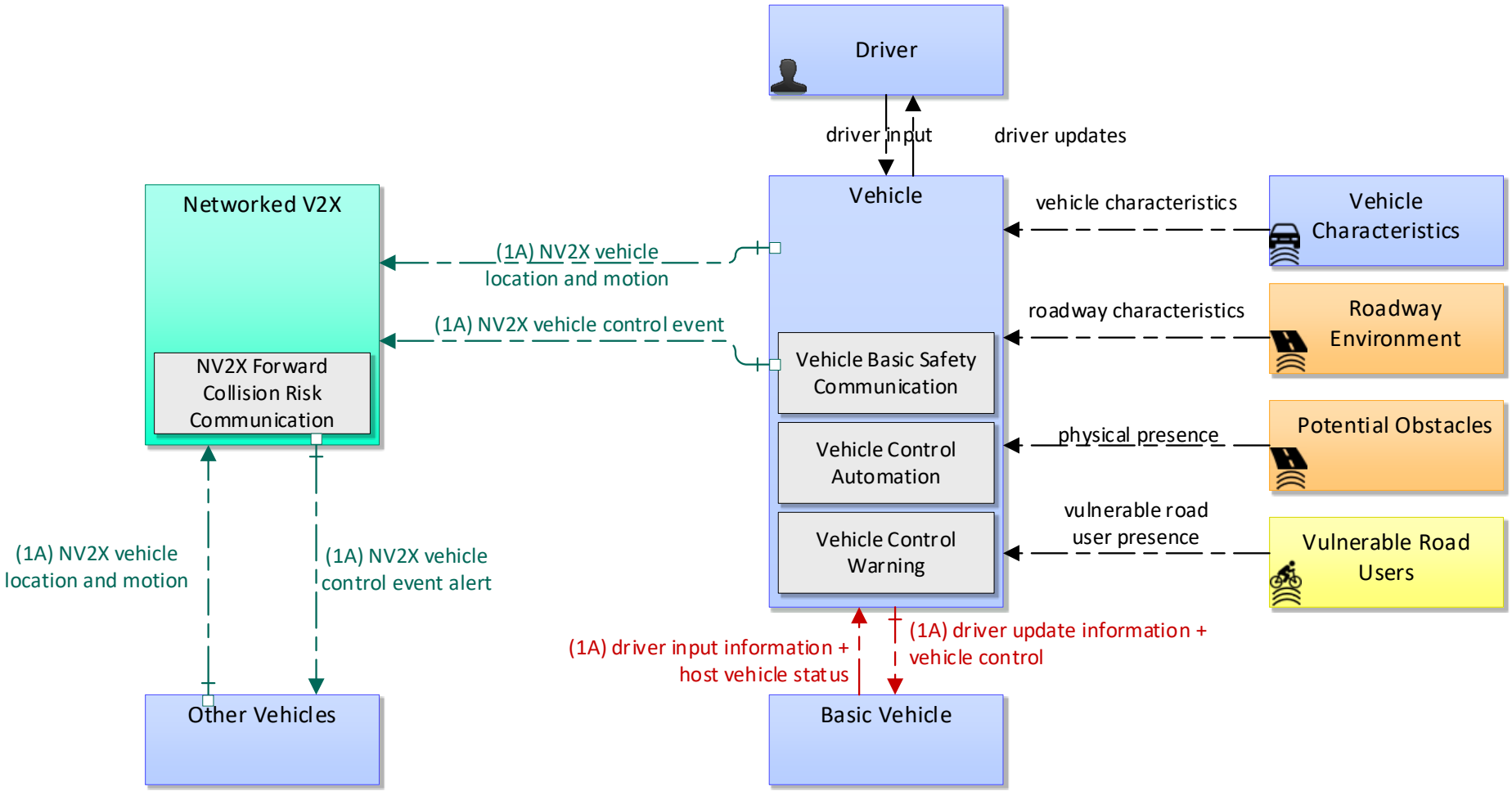


Figure 7 Forward Collision Risk (Enhanced via V2X) (ARC-IT VS02)

Pedestrian in Signalized Crosswalk (PISC) Use Case

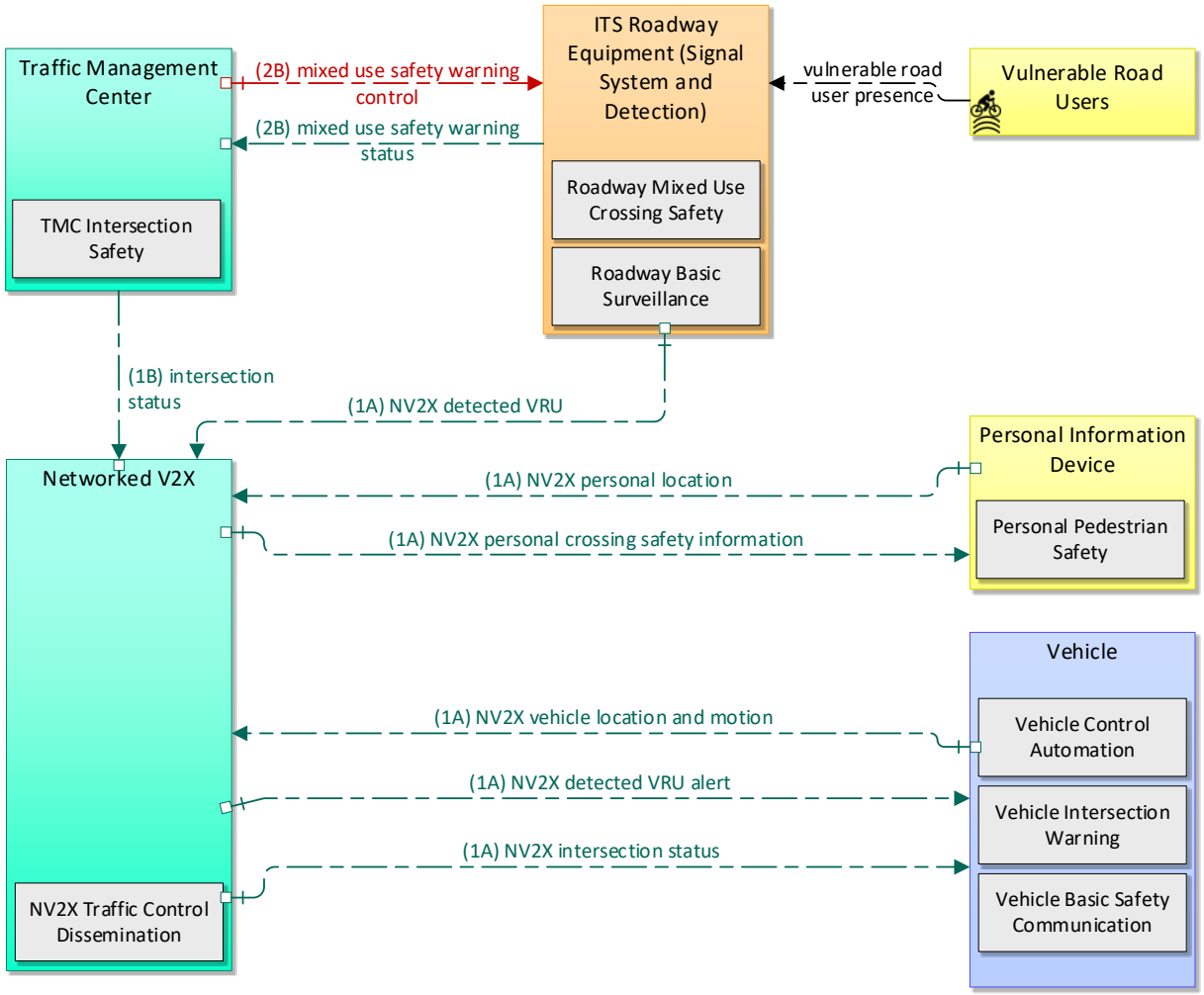


Figure 8 Pedestrian in Signalized Crosswalk (PICS) Use Case (ARC-IT VS12)

Curve Speed Alert Use Case

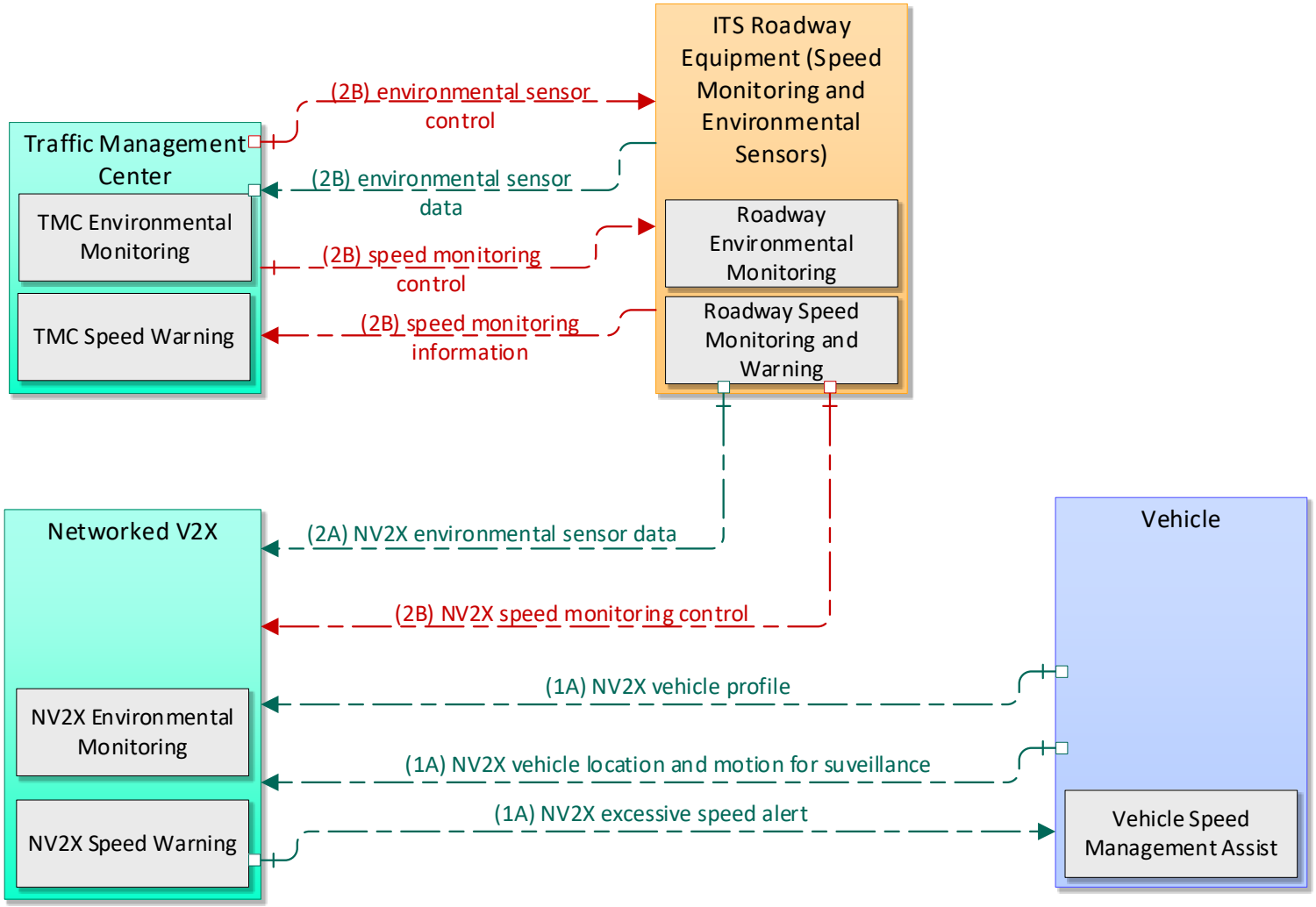


Figure 9 Curve Speed Alert Use Case (ARC-IT VS05)

Emergency Communications and Evacuation Information Use Case

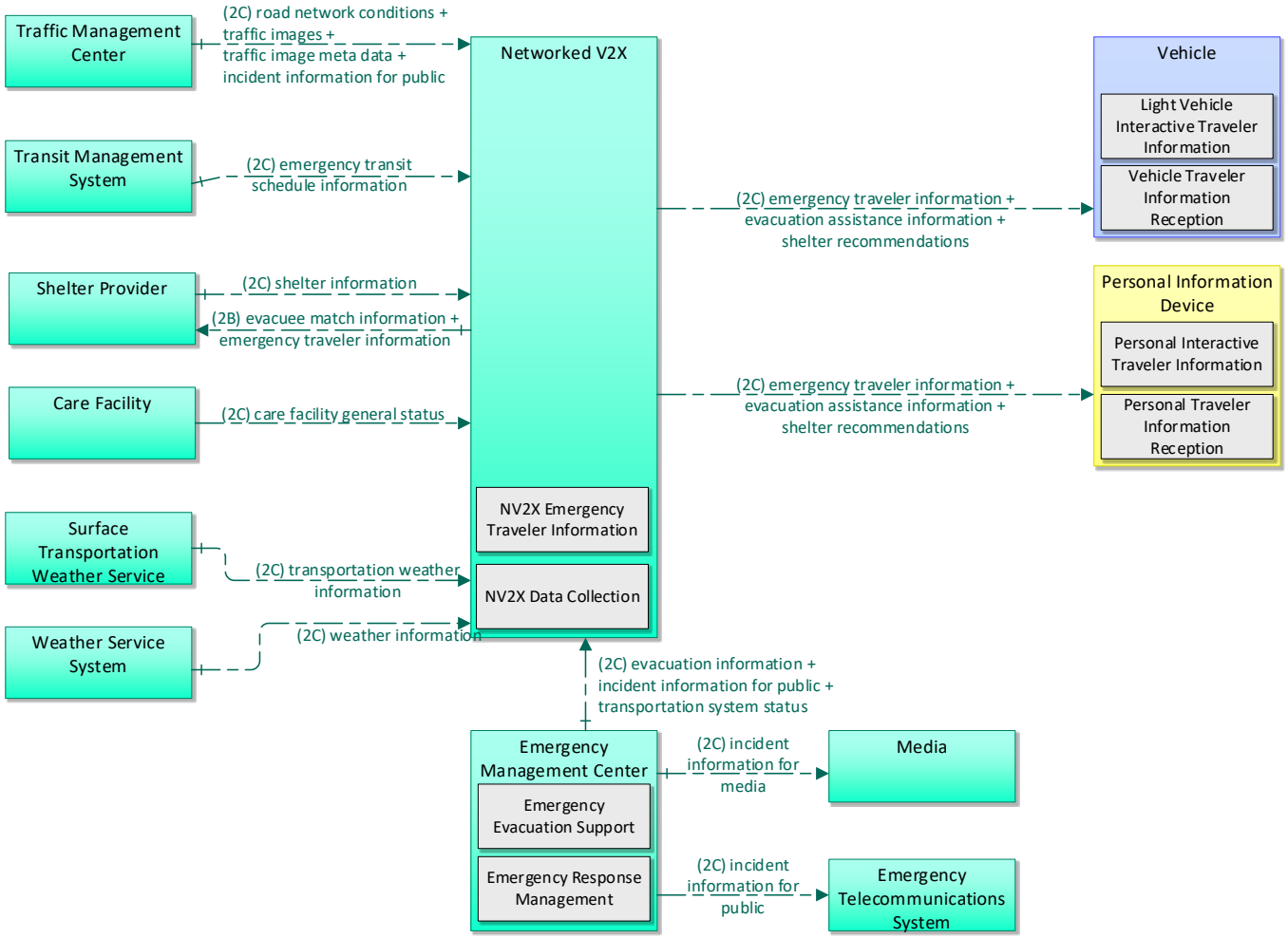


Figure 10 Emergency Communications and Evacuation Information Use Case (ARC-IT PS14)

Pedestrian Crossing Information Use Case

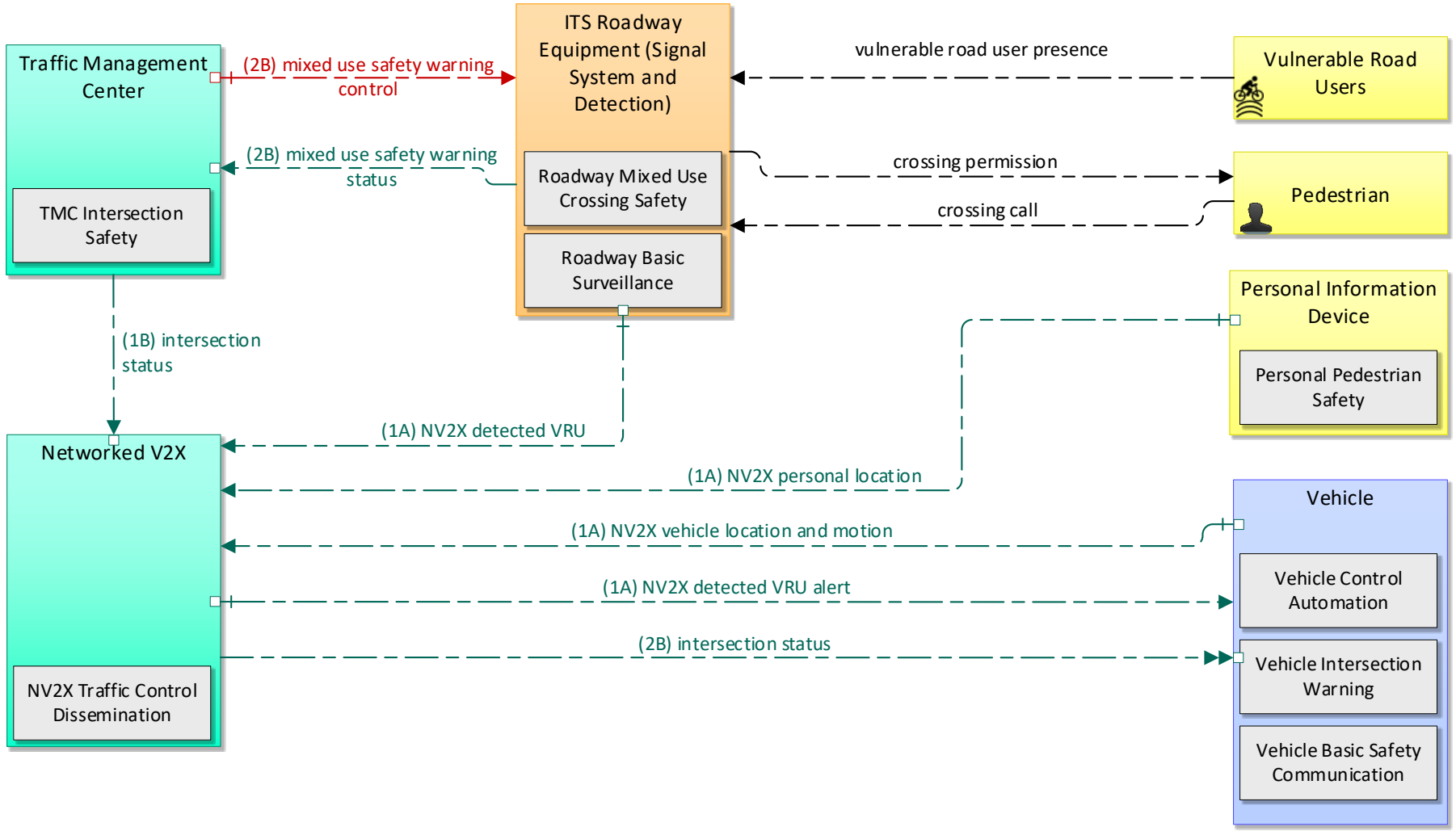


Figure 11 Pedestrian Crossing Information Use Case (ARC-IT VS12)

Highway/Railroad Collision Alert Use Case

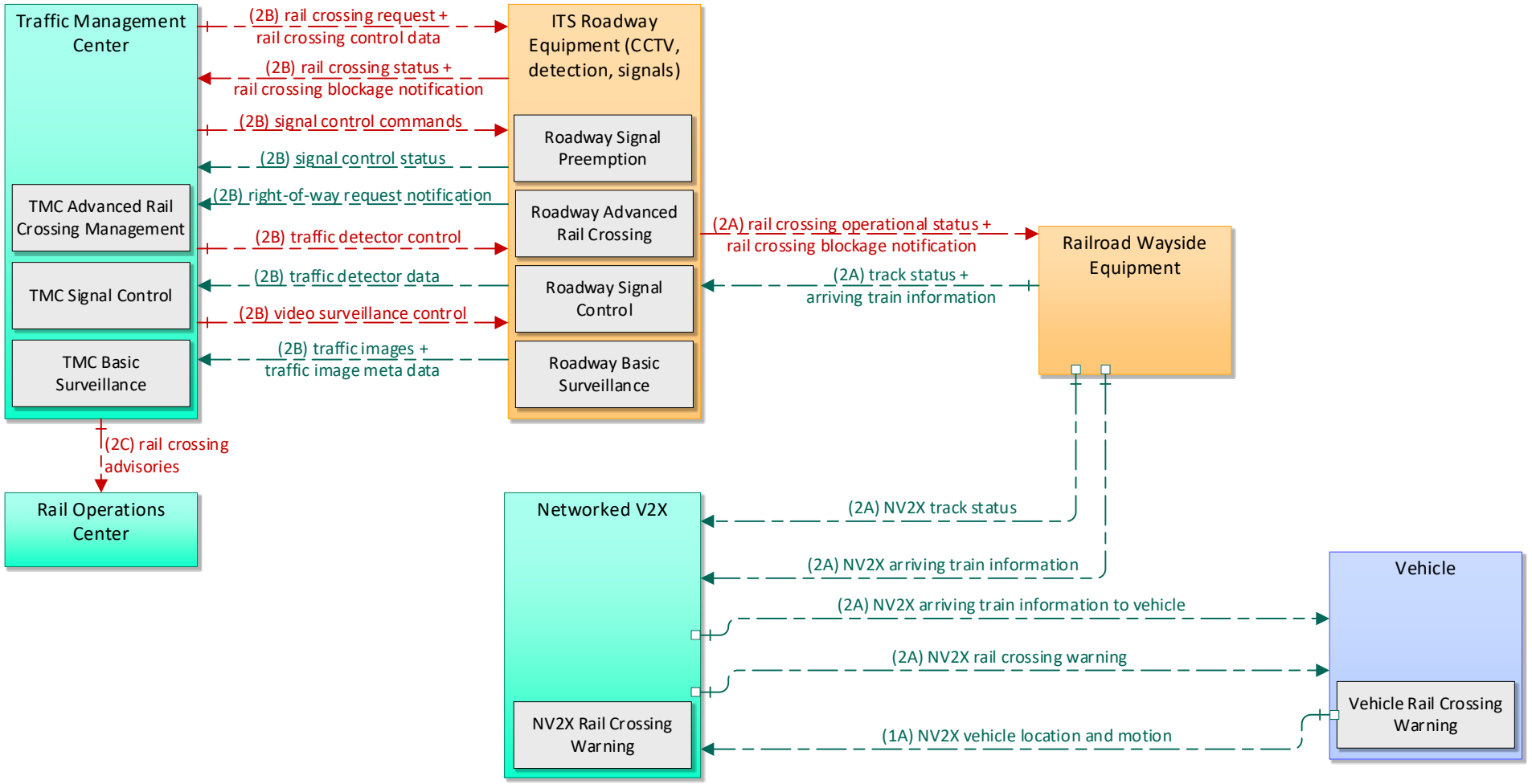


Figure 12 Highway/Railroad Collision Alert Use Case (ARC-IT TM14)

Signal Priority (Transit/Freight) Use Case

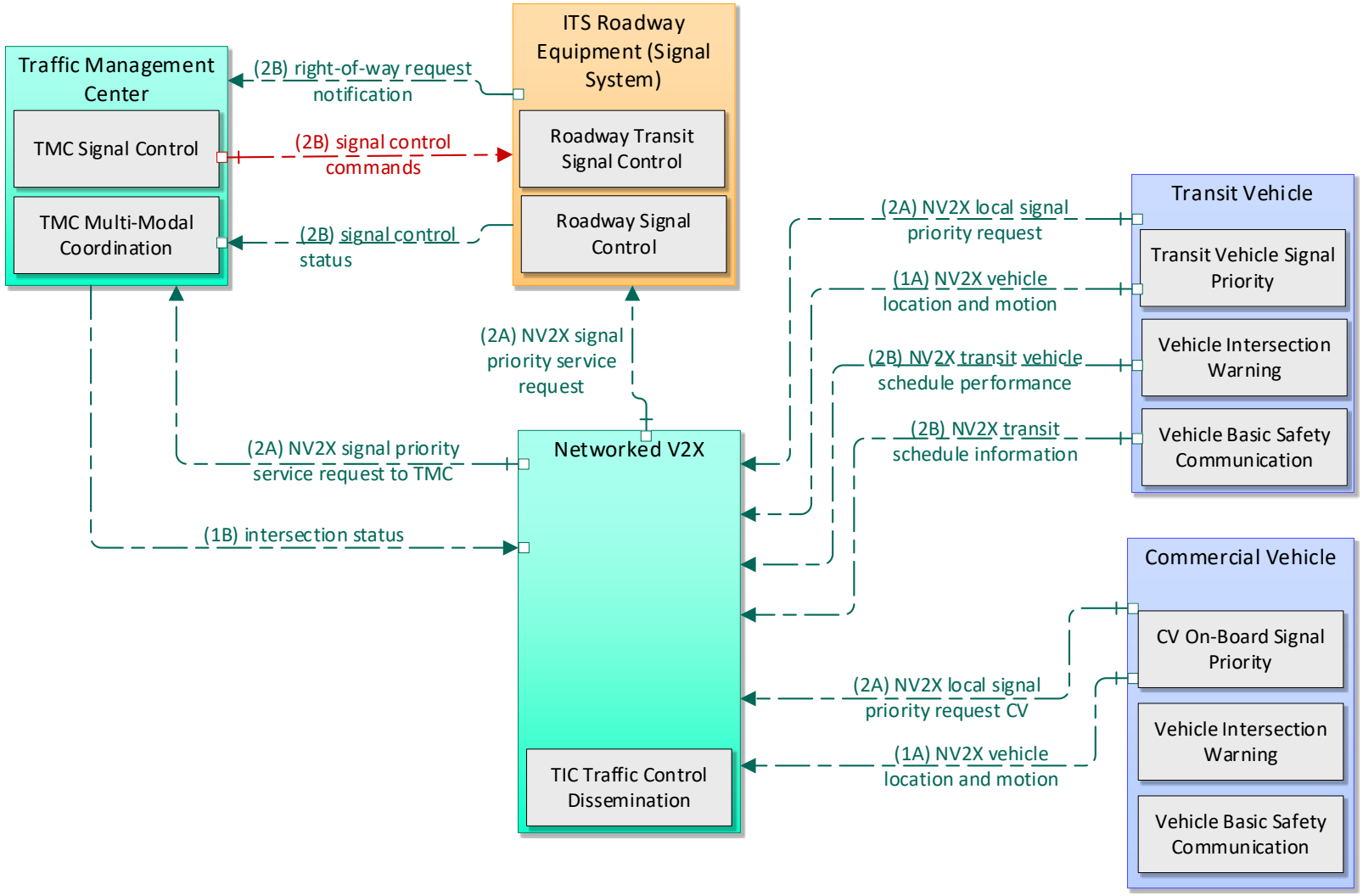


Figure 13 Signal Priority (Transit/Freight) Use Case (ARC-IT PT09 and CVO06)

Advanced Traveler Information System (ATIS) Use Case

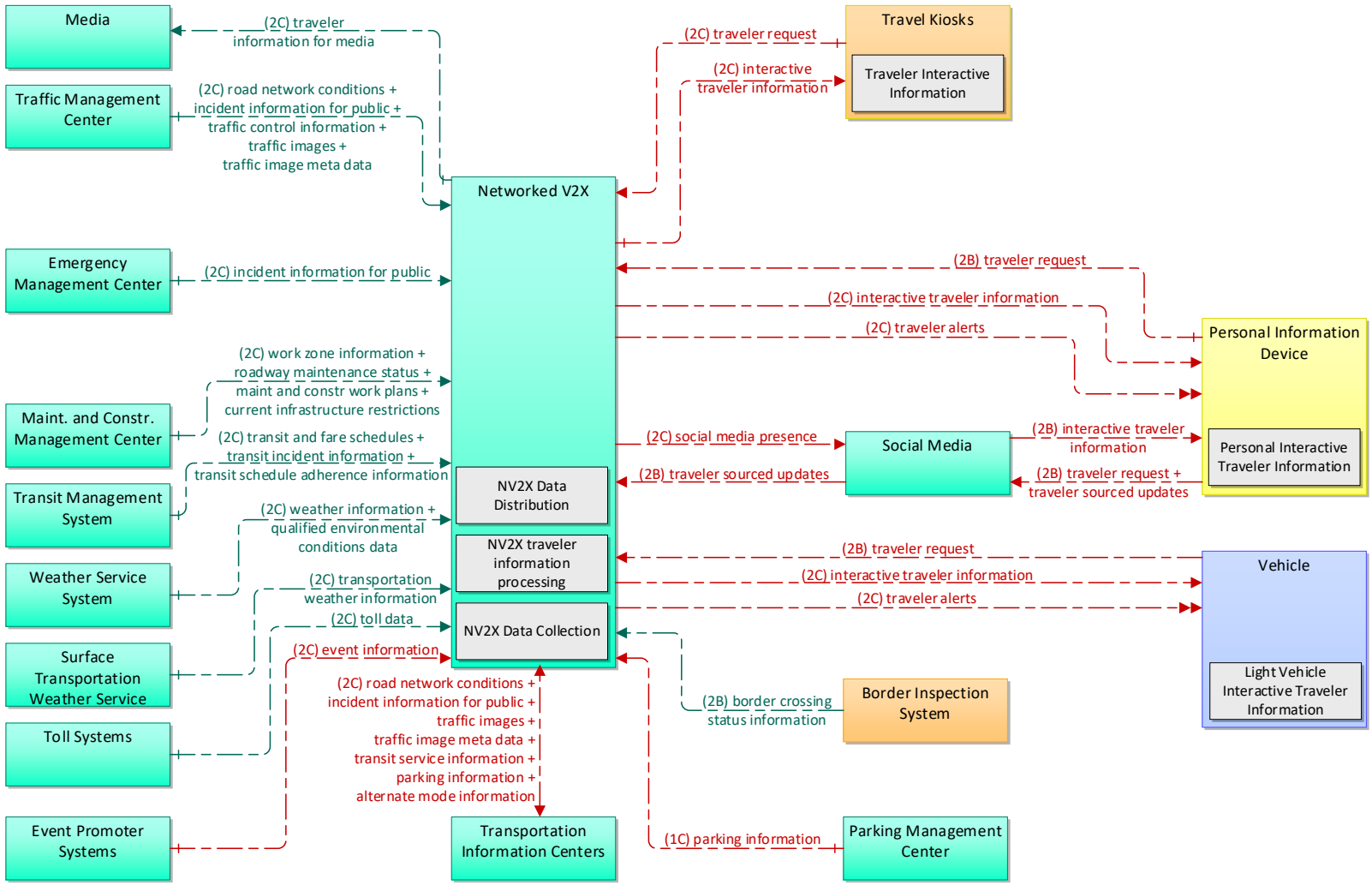


*Figure 14 Advanced Traveler Information **System** (ATIS) Use Case (ARC-IT TI02)*

Queue Alert Use Case

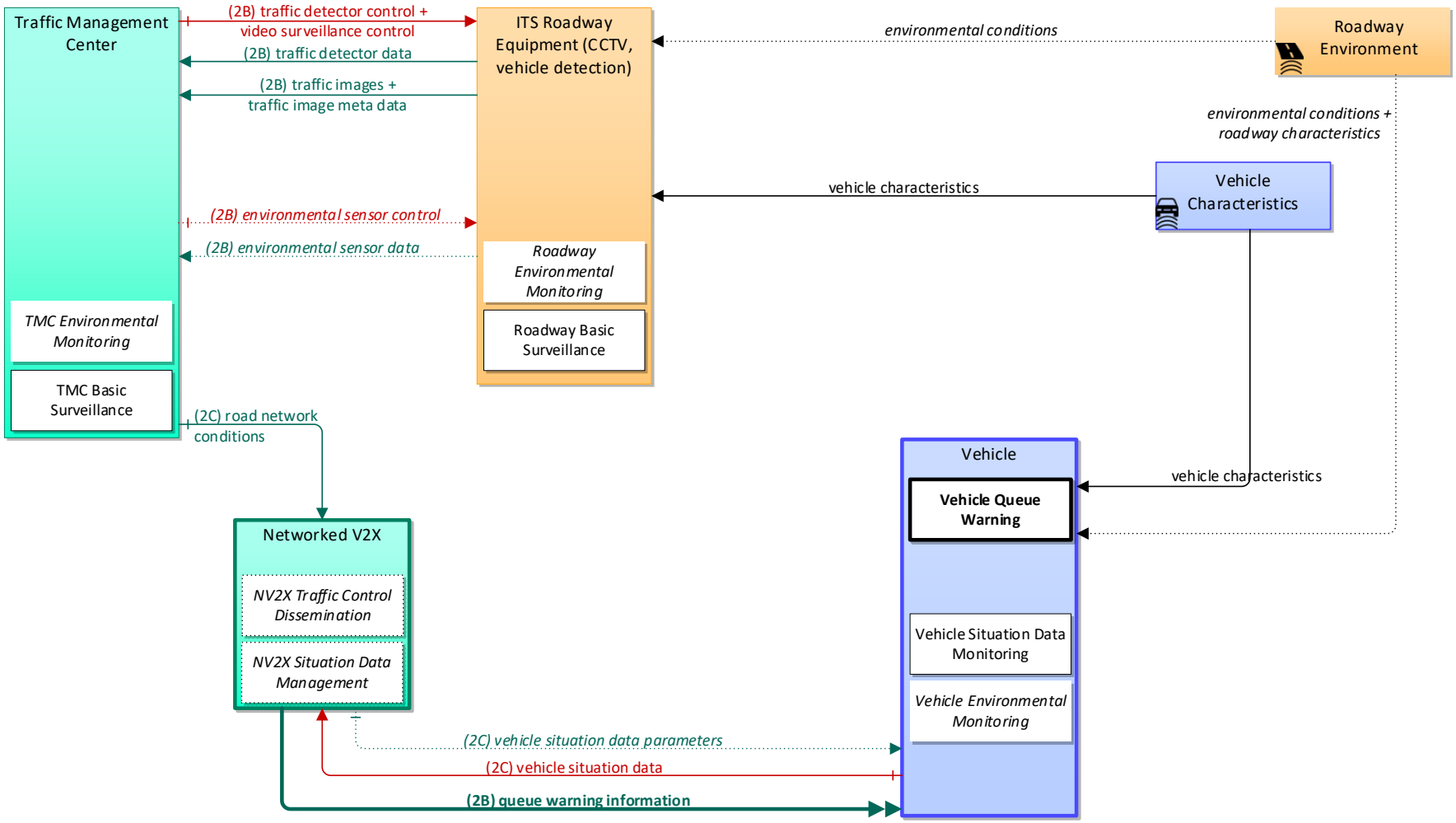


Figure 15 Queue Alert Use Case (ARC-IT VS08.2)

Spot Weather Impact Alert Use Case

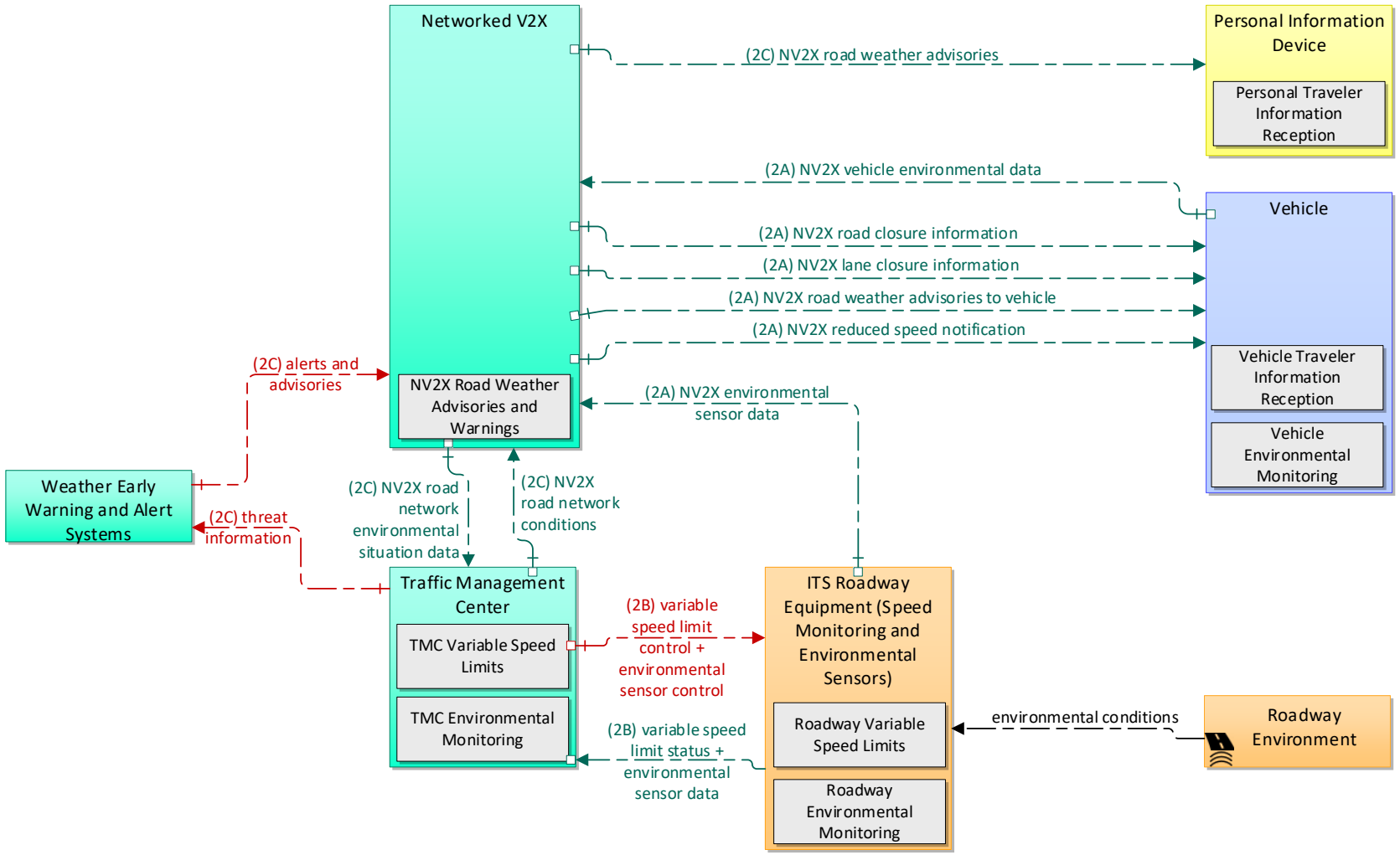


Figure 16 Spot Weather Impact Alert Use Case (ARC-IT WX03

Appendix II: Additional V2X Resources

ITS America V2X Resources

- A Blueprint for Transportation Technology
- ITS America Connected Vehicle Privacy Brief
- Beyond 5.9 V2X Deployment Plan
- Future of V2X in 5.9 GHz Report
- ITS America National V2X Deployment Plan

Industry V2X Resources

- ITS Deployment Evaluation Spotlight on Vehicle to Everything (V2X) Deployments
- ITS JPO Vehicle-to-Everything (V2X) Communications
- ITS Deployment Evaluation's ITS Benefits and Costs Map
- ARC-IT Architecture and Standards Use