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Personal mobility devices and other devices facilitating sustainable and inclusive mobility

Submitted by Urban Robotics Foundation

This document contains a speech given by the Executive Director of Urban Robotics Foundation (Canada) on ISO/4448 — a draft ISO technical standard for governing robotic passenger and goods vehicles and devices in public, pedestrianized spaces.

ISO 4448: Governing robotic passenger and goods vehicles and devices in public, pedestrianized spaces

2022 03 08

Bern Grush
Executive Director, Urban Robotics Foundation

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Thank you for inviting me to speak today.

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We are likely all familiar with massive factory and warehouse operations that use automated mobile robots orchestrated to move and stack parts and products for assembly or delivery.

And most of us are aware that mobile robots have been used on **farms and in mines** for many years.

These robots have expanded beyond these controlled, industrial environments to enter **public pedestrianized spaces in hospitals and airports** for maintenance, delivery, and surveillance.

More recently, robots have entered **less-structured municipal footways and bikeways** to deliver packages and food, sweep streets, plough snow, pick up litter, and write parking tickets.

Robot innovation naturally moves from structured to unstructured spaces, from industrial spaces to urban living spaces.

But, on our footways, they are effectively just learning to crawl.

Scaled for footways and bikeways, and initially radio-operated like large toy cars, mobile robots are now being equipped with the cameras, LIDARs, communication and intelligent software developed for the automated vehicle.

Some are claiming Level 3 and Level 4 driving automation capabilities, but there is far less government oversight for the confirmation of these capabilities compared to that for passenger vehicles.

Their variation, versatility and capabilities are expanding rapidly. They are evolving in parallel with IoT technologies.

We are teaching them to walk, climb stairs, open doors and communicate with humans.

Robot innovation for public-space applications is only in its infancy.

Within our cities, we can appreciate that small electric devices may have a valuable role to play.

A 25 kg electric device making a 5 kg delivery is an improvement over a 1400 kg car making that same delivery.

A small electric device that can remove litter or spread salt on walkways while we sleep could maintain cleaner and safer pedestrian spaces.

The advantages of this technology are remarkable and many.

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But there is something more complex that we need to consider here.

Most robot applications are deployed within controlled work-spaces where nearby humans have been trained to collaborate with these robots.

Now these mechanized and motorized devices are entering spaces that have been previously reserved for pedestrians and their pets, baby carriages, and wheelchairs.

And they are entering bike lanes designed for through-traffic from other vulnerable road users.

Many of these footways and bikeways are poorly designed — spaces that are frequently narrow or cluttered.

Footways, especially, have fire hydrants, trees, newspaper boxes, garbage bins, and retailer's signs and goods.

These spaces are organized for strolling, for window shopping, for waiting for the bus, for some of us to sit, beg or sleep, and for others to watch street performances.

Many restaurants have moved dining tables into these spaces.

Helper robots clearly bring enormous advantages, but they also bring new complexities regarding rights to this space.

What rights should retailers and restaurant operators have to use robots to deliver goods or groceries on these footways and bikeways?

What about residents who wish to receive deliveries or need improved walkway maintenance?

And pedestrians who have mobility, sight, or hearing losses?

What about footways that are already inadequate for existing traffic in their dimensions or conditions?

How should these devices interact with pedestrians at intersections, already the location of a majority of pedestrian fatalities?

In 2019, the ISO approved a project to draft a new standard for managing the realtime queueing and governance of loading and unloading of robotic vehicles for passengers and goods at the kerbside.

In 2020, this was expanded to include robots on the footway or sidewalk — the domain of the pedestrian.

This meant consideration of robot behaviour.

How should robots give way to pedestrians?

How should they communicate their intentions to blind or deaf pedestrians?

And how should they use crosswalks?

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By 2021, the scope had further expanded to include how robots enter and leave bike lanes.

How should they behave while passing busy bus stops?

How could their numbers be limited within a single block face or during peak hours?

In 2022, we are adding elements for safety and location-readiness certification.

But even considering all this, there is still a deeply profound issue for these robots in our cities.

Innovators and entrepreneurs are introducing small, motorized machines that are able to flow in and out of our footways, bikeways, and road shoulders — traversing any infrastructure they are permitted to use.

Within a decade, these devices will become far more spatially capable than active transportation devices — as well as cleaner, smaller, and quieter than our current motor vehicles.

Shortly thereafter they will become more spatially nimble than most pedestrians.

We probably want all of these advantages, but as with everything we invent, there are unintended consequences.

Consider a time in five or ten years in which:

- a large variety of robots,
- that are multiply-purposed,
- that are each independently operated,
- by multiple independent operators,
- performing maintenance, delivery, and monitoring activities,
- each on independent and asynchronous schedules,
- all competing within a common public space with each other and with us humans.

We have an impending traffic management problem at least an order of magnitude more complex than our current urban traffic management problems already exacerbated by the pandemic.

The easy way out is to ban these devices.

At least three cities have already done that. Most recently Toronto and Ottawa in Canada.

San Francisco banned delivery robots in 2017 but has since reversed that ruling.

There are too many advantages to ban these devices, and there are too many risks to leave them ungoverned.

Neither our cities nor the robotics and last-mile logistics industries can operate without standards.

Such standards must include matters for safety, data, governance, machine behavior, and traffic orchestration.

In my opinion, they should include standards for monetization, as well.

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Ideally, international standards should inform national model codes.

Such national codes would inform jurisdictional legislation which in turn would inform municipal bylaws.

So far, this is not how things are rolling out. In approximately 20 US states, an uncoordinated mix of simplistic legislation has been passed and this has prodded a number of U.S. municipalities to instigate pilots and trials.

These will most likely result in bylaws local to those municipalities.

This will make things more complex for each municipality and for each logistics and maintenance operator.

Over the next few years, robot operators will have a growing multiplicity of processes in many jurisdictions.

To address this gap in harmonization, the Urban Robotics Foundation consults with accessibility, logistics, municipal, planning, and robotics experts to draft international standards, guidelines, and certification methods to ensure that robotic passenger and goods systems are safe, managed, and contribute to improved livability for cities and their people.

As project leader for draft technical standard ISO 4448, *Ground-based automated mobility*, we are currently drafting 16 parts under the guidance of ISO technical committee TC204, working group WG19.

We consult with entities and experts in Europe, the United States, and Canada.

Please contact us, if this work is important to you.

www.urbanroboticsfoundation.org