Human Factors in Automated Public Transportation

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Human Factors in Automated Public Transportation

- Communities are exploring how new technologies can help them achieve transportation, mobility & economic development goals

- New developments in public transit are likely to have a major impact on how people move

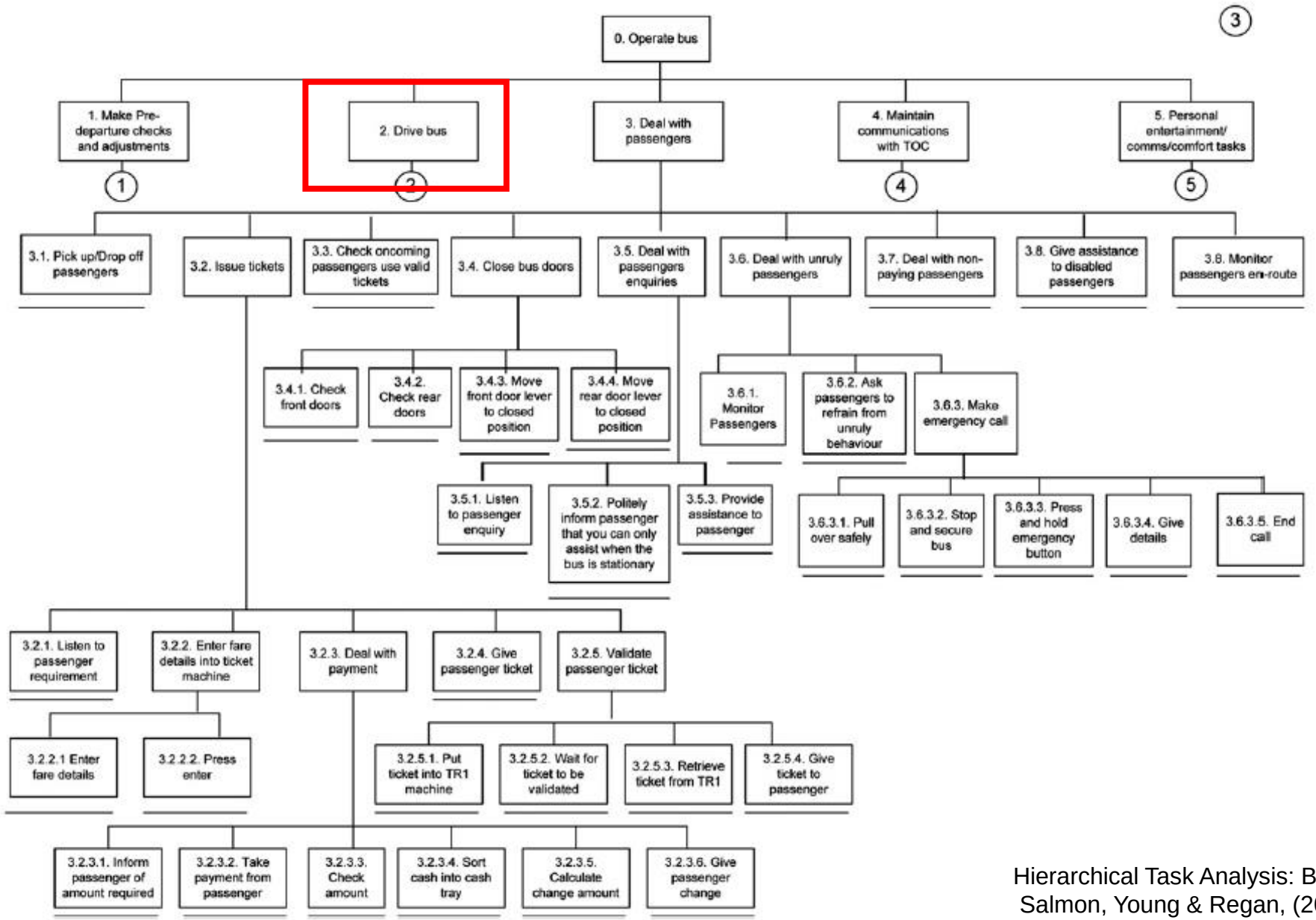
  - Provide service where there are gaps in current public transit
  - Replace inefficient modes (e.g. different vehicle types; scheduling)
  - Service communities that have had poor or no service
  - Provide transportation for groups of people without easy access to transportation (e.g. disabled community, elderly)
  - Environmental and cost benefits of electric vehicles

Low Speed Automated Shuttle Service Models

	CIRCULATOR	FIXED ROUTE	FIRST / LAST MILE	ON-DEMAND / PARATRANSIT
OPERATING ENVIRONMENT	Specific neighborhood	Dedicated lanes; Mixed Traffic	Connect to transit; Short distance trips	Varies; due to point to point service
ROUTE	Closed Loop; Fixed	Specific Route; Fixed	Specific route; may be flexible	Varies
WAYPOINTS / STOPS	Fixed; Makes all Stops	Fixed; Stops on Request	Fixed; may operate at certain times	User Requests pick up & drop off Pre-booked or provided on demand

National Academies of Sciences, Engineering & Medicine (2021)

Passenger Interactions with Transit Drivers



Hierarchical Task Analysis: Bus Drivers
Salmon, Young & Regan, (2011)

Passengers: Information, Assistance & Safety

Assistance & Information

- Pick up/drop off passengers safely
  - Check doors, different abilities, time required, assistance
- Passenger information enquiries
- Communications external & internal to vehicle for passengers
- Monitor passengers – for safety & behaviour; interior cleanliness, loose cargo
  - Unruly behaviour; passengers beyond load limit

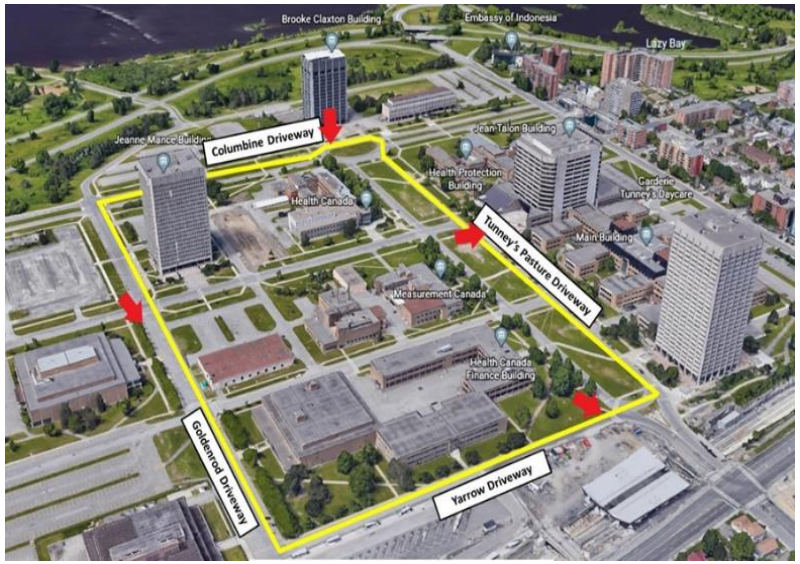
Vehicle Operation & Safety

- Maneuver around objects/ & vehicles in the environment
- Equipment malfunction & breakdown
- Emergency: passenger medical; crash
  - Emergency communication with dispatch & emergency crew
  - Pull over safely; stop & secure vehicle
  - Guide emergency egress

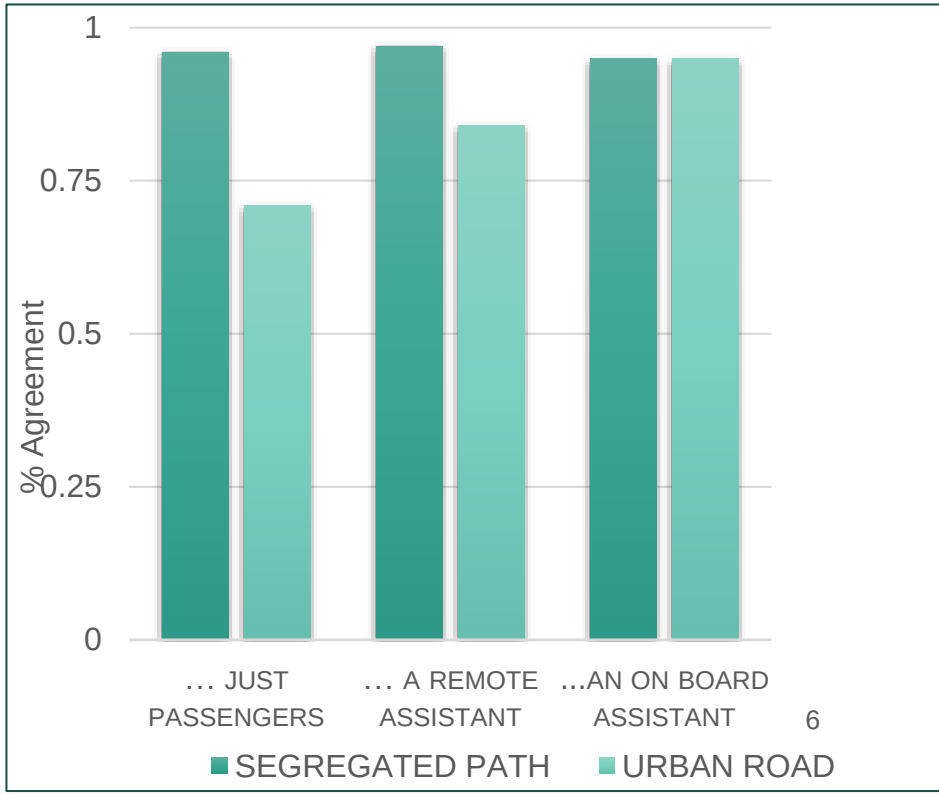
Low Speed Automated Shuttle Trial

Information, Assistance & Safety

Visual Display Current position on map Next Stop Auditory Announcements Information app on phone Status for delays/ incidents …….	On-Board Human Assistant Communication method to get assistance Information Display Screen Emergency Stop Button Tool to break window to exit Seatbelts ……



"Would you feel safe riding in a shuttle with…."



Lau, Harbluk & Burns (2021)

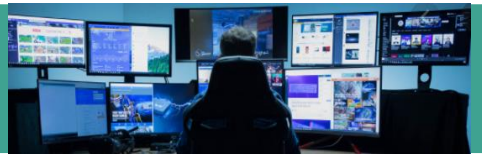
Overview of ADS Remote Support Applications

Remote Dispatcher	Remote Monitor	Remote Assistant	Remote Driver	
			Direct line-of-sight	**Beyond line-of-sight**
• Direct vehicle to a location • Plan & select routes	• On-board monitoring for passenger safety & security • Communication with passengers to answer questions or concerns • Provide support or summon emergency responders	• Assist with manoeuvre planning • Provide information and advice to vehicle to aid navigation through an intersection or around an obstruction	• Perform some or all aspects of DDT from onboard (e.g. low speed shuttle) or from a nearby location overlooking the vehicle • Temporary or prolonged period of time	• Perform some or all aspects of the DDT without a direct view of the vehicle and its environment

Source: Guidelines for Testing Automated Driving Systems in Canada Version 2.0. (2021). www.Canada.ca/automatedvehicles (Modified from Table 3)

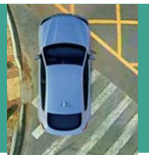
Considerations For Assistance & Operation

- Remote Environment



- Personnel & Training

- Controls & Displays

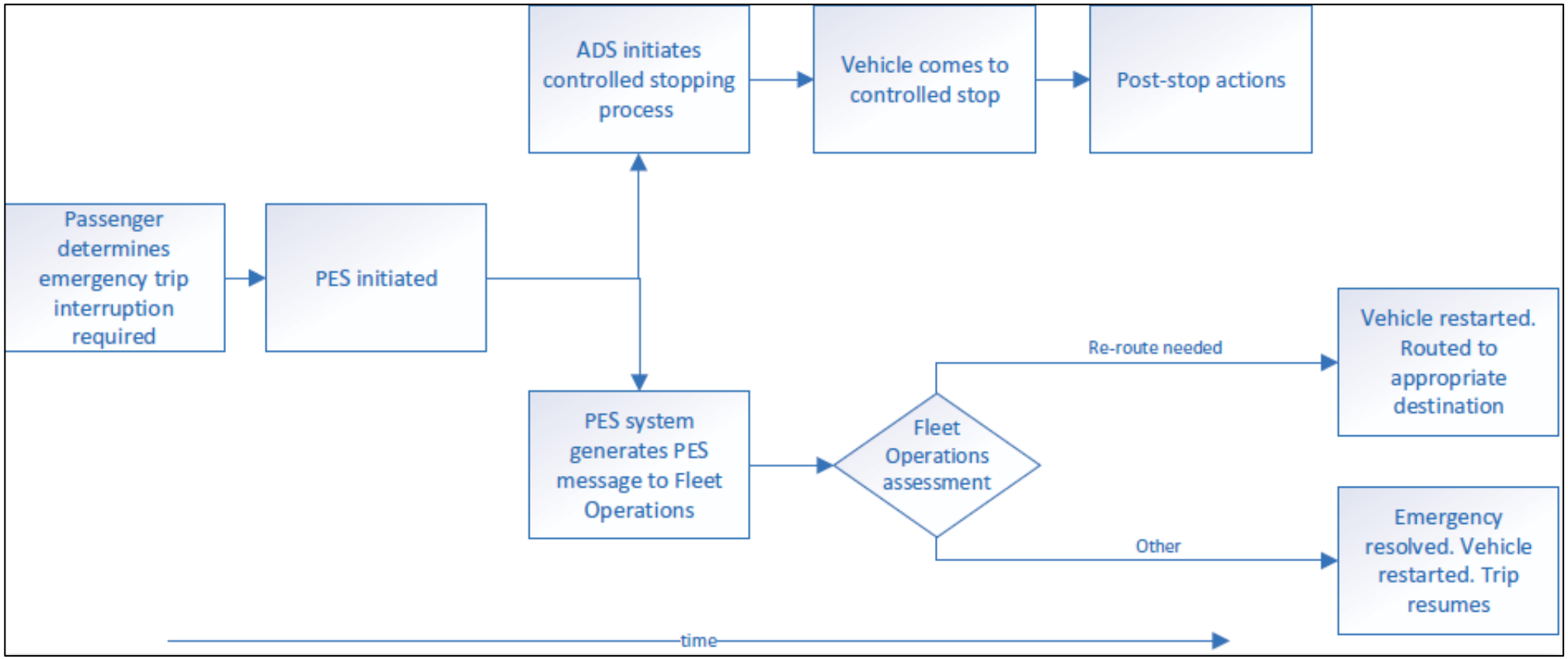


- Communication Channels

- Passenger Needs and Requirements

- Service Design

Example: Passenger Initiated Emergency Stop (PES)



Closing Comments…

Automated Public Transit

Well-known Human Factors considerations and also some new ones

- Different requirements for various transit service models
- Passenger needs on transit where there is no on-board operator
- Design of work environment, tasks and coordination for Remote Monitor, Assistant and Operator to carry out their functions and ensure safety of those on-board
- Complex environment
- There is a need to understand and organize the various use cases and address safety considerations
- Importance of public acceptance of new mobility technologies





Thank you for your attention.

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www.Canada.ca/automatedvehicles
www.tc.gc.ca/eng/motorvehiclesafety/menu.htm