!Standard Mode: off

!List Exceptions:

{SOFTWARE_EXCEPTION::GovernmentComputerUnavailable},

{SOFTWARE_EXCEPTION::OperatorTerminalFailure},

{SOFTWARE_EXCEPTION::RWAntennaFailure},

{HARDWARE_EXCEPTION::DetectorFailure},

{HARDWARE_EXCEPTION::LocatorAntennaFailure},

{HARDWARE_EXCEPTION::LightFailure},

{HARDWARE_EXCEPTION::CameraFailure},

{HARDWARE_EXCEPTION::LaserScannerFailure},

{SOFTWARE_EXCEPTION::CreditCardCompanyUnavailable},

{ENVIRONMENT_EXCEPTION::InsufficientCredit},

{ENVIRONMENT_EXCEPTION::BouncedCheck},

{SOFTWARE_EXCEPTION::TransponderUsed}

Use Case: UseHighway

Scope: ETR_System

Level: SUMMARY

Intention: "The intention of the Driver is to use the 407 ETR highway on a regular basis."

Multiplicity: "One Driver can only drive one vehicle at a time on the highway. However, different Drivers can

use the highway simultaneously."

Primary Actor: HUMAN::Driver

Secondary Actor: PHYSICAL_ENTITY::GovernmentComputer

Main Success Scenario:

1. "Driver registers vehicle in the System."

"Step 2-4 are repeated once a month as long as the vehicle is registered."

"Step 2 can be repeated any number of times per month."

2. "Driver takes the System highway."

3. "At the end of the month, System sends bill to Driver."

4. "Driver pays System generated bill."

5. "Driver cancels System registration."

use case ends in: SUCCESS

extensions:

alternative for 1:

1a. "Driver uses System highway without registering vehicle."

use case continues at step: 2

alternative for 4:

4a. "Driver does not pay System generated bill for 3 consecutive months."

4a.1. "System informs GovernmentComputer of refusal to pay the bill."

Use case continues at step: 2

Use Case: RegisterVehicle

Scope: ETR_System

Level: USER_GOAL

Intention: "The goal of the Driver is to register a vehicle with the system, which involves opening an account and linking a transponder to it."

Multiplicity: "A driver registers his vehicles one at a time. However, the system should be able to handle multiple simultaneous registrations done by different drivers."

Primary Actor: HUMAN::Driver

Secondary Actor: PHYSICAL_ENTITY::OperatorTerminal, PHYSICAL_ENTITY::GovernmentComputer, PHYSICAL_ENTITY::PostalService

Main Success Scenario:

"The Driver interacts with the System by calling an Operator."

1. "Driver provides System with personal data and vehicle information."

2. "System acknowledges opening of a new account for the Driver."

3. "System sends vehicle information to GovernmentComputer for verification."

4. "GovernmentComputer notifies System that vehicle information is correct."

5. "System assigns a new transponder to the vehicle, and informs Postal Service to deliver the transponder to

the Driver."

6. "Driver installs and tests transponder sent by System."

7. "Driver notifies the System of successful installation of the transponder."

use case ends in: SUCCESS

Extensions:

alternative for 2:

2a. "Driver already has an account with the system."

Use case continues at step: 3

exception for 4:

4a. {SOFTWARE_EXCEPTION::GovernmentComputerUnavailable} #Government Computer cannot proccess

the information#

Use case ends in: FAILURE

alternative for 6:

6a. "Transponder installation and testing fails. Driver notifies System of the problem."

Use case continues at step: 5

alternative for 7:

7a. "Driver forgets to acknowledge installation to System and simply starts using the transponder on the highway."

Use case ends in: SUCCESS

Use Case: TakeHighway

Scope: ETR_System

Level: USER_GOAL

Intention: "The intention of the Driver is to drive a vehicle from one location to another by taking

the 407 ETR highway."

Multiplicity: "One Driver can only drive one vehicle at a time on the highway. However, different Drivers can

take the highway simultaneously."

Primary Actor: HUMAN::Driver

Secondary Actor: PHYSICAL_ENTITY::RWAntenna, PHYSICAL_ENTITY::GovernmentComputer, PHYSICAL_ENTITY::OperatorTerminal

Main Success Scenario:

1. "Driver enters System highway, passing through gantry."

2. "Driver exits System highway, passing through gantry."

3. "System retrieves the Driver's vehicle record based on trip information*."

4. "System determines the amount owed based on the trip information and adds the transaction to the Driver

vehicle's records."

5. "System informs Driver by sending a signal to the RWAntenna of successful completion of transaction."

use case ends in: SUCCESS

extensions:

alternative for 1:

1a. "Driver can not enter System highway."

use case ends in: FAILURE

alternative for 2:

2a. "Driver cannot exit at desired System exit."

2a.1. "Driver follows highway to next System exit."

use case continues at step: 3

alternative for 3:

3a. "Driver vehicle is unregistered in System and does not have a record yet."

3a.1. "System sends licence plate information to GovernmentComputer."

3a.2. "GovernmentComputer sends vehicle information and owner's address to System."

3a.3. "System creates a new vehicle record for the Driver."

Use case continues at step: 4

exception for 3:

3b. {SOFTWARE_EXCEPTION::GovernmentComputerUnavailable} #Government Computer cannot proccess

the information#

use case ends in: FAILURE

alternative for 3:

3c. "Driver's vehicle is unregistered and licence plate is unrecognizeable to System."

3c.1. "System displays pictures on OperatorTerminal."

3c.2. "OperatorTerminal sends licence plate information to System."

Use case continues at step: 3

exception for 3:

3d. {SOFTWARE_EXCEPTION::OperatorTerminalFailure}#Operator terminal unavaiable

for alternate 3 scenrio#

use case ends in: FAILURE

alternative for 5:

5a. "Driver vehicle is not registered in System."

use case ends in: SUCCESS

exception for 5:

5b. {SOFTWARE_EXCEPTION::RWAntennaFailure} #Antenna cannot complete it's action and the Driver

is unable to be charged#

use case ends in: SUCCESS

Use Case: PassThroughGantry

Scope: ETR_System

Level: SUB_FUNCTION

Intention: "The Driver passes through a entry or exit gantry as part of his trip."

Multiplicity: "One Driver can only drive one vehicle at a time through a gantry. However, different Drivers can pass through the same or different gantries simultaneously."

Primary Actor: HUMAN::Driver

Secondary Actor: SENSOR::VehicleDetector

Main Success Scenario:

1. "VehicleDetector informs System that vehicle is approaching entry gantry.

Steps 2 and 3 are performed in any order or in parallel."

2. "System processes Driver's registered or unregistered vehicle."

3. "System classifies the Driver's vehicle."

4. "System records entry time and vehicle information of the Driver for the trip."

use case ends in: SUCCESS

Extensions:

exception for 1:

1a. {HARDWARE_EXCEPTION::DetectorFailure}#Sensor down and unable to inform System#

Use case ends in: SUCCESS

alternative for 2:

2a. "System processing Driver's vechicle was unsuccessful."

Use case continues at step: 3

alternative for 3:

3a. "Classification of Driver vechicle by System was unsuccessful."

"Vechicle type will default to preset option"

use case continues at step: 4

Use Case: ProcessRegisteredVehicle

Scope: ETR_System

Level: SUB_FUNCTION

Intention: "The System communicates with the transponder to identify the approaching vehicle."

Multiplicity: "The System must be able to process multiple registered vehicles simultaneously."

Primary Actor: N/A

Secondary Actor: READER::LocatorAntenna, PHYSICAL_ENTITY::RWAntenna, HUMAN::Driver

Main Success Scenario:

1. "LocatorAntenna notifies System that it detected an approaching vehicle with transponder."

2. "System asks RWAntenna to obtain account information from transponder."

3. "RWAntenna informs System of account information."

4. "System records account information for the Driver's trip."

use case ends in: SUCCESS

Extensions:

alternative for 1:

1a. "The approaching Driver's vehicle does not have a transponder for the System."

Use case ends in: FAILURE

exception for 1:

1b. {HARDWARE_EXCEPTION::LocatorAntennaFailure} #Locator Antenna down#

use case ends in: FAILURE

exception for (2-3):

(2-3)a. {SOFTWARE_EXCEPTION::RWAntennaFailure} #RW Antenna down#

use case ends in: FAILURE

alternative for 3:

3a. "RWAntenna is unable to obtain account information for the System."

Use case ends in: FAILURE

Use Case: ProcessUnregisteredVehicle

Scope: ETR_System

Level: SUB_FUNCTION

Intention: "The System wants to identify the approaching vehicle using the licence plate information."

Multiplicity: "The System must be able to process multiple unregistered vehicles simultaneously."

Primary Actor: N/A

Secondary Actor: READER::Cameras, PHYSICAL_ENTITY::Lights

Main Success Scenario:

1. "System turns on the Lights."

2. "System triggers the Cameras."

3. "Cameras send images to System."

use case ends in: SUCCESS

Extensions:

exception for 2:

2a.{HARDWARE_EXCEPTION::LightFailure} #Lights won't engage#

Use case continues at step: 3

exception for 3:

3a.{HARDWARE_EXCEPTION::CameraFailure} ##

Use case ends in: FAILURE

Use Case: ClassifyVehicle

Scope: ETR_System

Level: SUB_FUNCTION

Intention: "The System wants to classify the approaching vehicle as light vehicle, heavy single unit vehicle, or heavy multiple unit vehicle."

Multiplicity: "The System must be able to classify multiple vehicles simultaneously."

Primary Actor: N/A

Secondary Actor: SENSOR::LaserScanner, HUMAN::Driver

Main Success Scenario:

1. "System activates LaserScanner."

2. "LaserScanner sends vehicle dimensions to System."

3. "System classifies Driver's vehicle and records classification in trip information."

use case ends in: SUCCESS

Extensions:

exception for 2:

2a. {HARDWARE_EXCEPTION::LaserScannerFailure} #System records classification failure in trip information.#

Use case ends in: FAILURE

Use Case: PayByCreditCard

Scope: ETR_System

Level: USER_GOAL

Intention: "The goal of the Driver is pay for his trip by credit card."

Multiplicity: "Every driver pays for his trips once a month. The system must support concurrent payments of

different drivers, be it by credit card or by check."

Primary Actor: HUMAN::Driver

Secondary Actor: PHYSICAL_ENTITY::OperatorTerminal, SOFTWARE::CreditCardCompany

Main Success Scenario:

"Driver interacts with System by calling an Operator."

1. "OperatorTerminal provides System with credit card information."

2. "System contacts CreditCardCompany to validate credit."

3. "CreditCardCompany notifies System of successful validation."

4. "System notifies OperatorTerminal of success."

use case ends in: SUCCESS

Extensions:

exception for 2:

2a. {SOFTWARE_EXCEPTION::CreditCardCompanyUnavailable} #System notifies Operator.#

Use case ends in: FAILURE

exception for 3:

3a. {ENVIRONMENT_EXCEPTION::InsufficientCredit} #System notifies Operator.#

Use case ends in: FAILURE

Use Case: PayByCheck

Scope: ETR_System

Level: USER_GOAL

Intention: "The goal of the Driver is pay for his trip by check."

Multiplicity: "Every driver pays for his trips once a month. The system must support concurrent payments of

different drivers, be it by credit card or by check."

Primary Actor: HUMAN::Driver

Secondary Actor: PHYSICAL_ENTITY::OperatorTerminal

Main Success Scenario:

"Driver sends check to Operator."

1. "OperatorTerminal notifies System that check has been received."

"Operator cashes check with Bank."

2. "Bank notifies System that Driver's check has been cleared."

use case ends in: SUCCESS

Extensions:

exception for 2:

2a. {ENVIRONMENT_EXCEPTION::BouncedCheck} #System notifies Driver.#

Use case ends in: FAILURE

Use Case: CancelRegistration

Scope: ETR_System

Level: USER_GOAL

Intention: "The goal of the Driver is to unregister a vehicle and potentially cancel his account with the 407 ETR system."

Multiplicity: "A driver unregisters a vehicle one at a time. The system should be able to handle multiple concurrent unregistrations of different drivers."

Primary Actor: HUMAN::Driver

Secondary Actor: PHYSICAL_ENTITY::OperatorTerminal

Main Success Scenario:

"Driver interacts with System by calling an Operator."

1. "Operator notifies System that Driver wants to cancel his registration for a vehicle."

2. "System marks vehicle registration as suspended and does not charge monthly fees anymore. Driver sends transponder to Operator."

3. "OperatorTerminal notifies System that transponder has been received."

4. "System cancels vehicle registration for Driver."

5. "If Driver has no vehicles registered with the system anymore, System cancels driver account."

use case ends in: SUCCESS

Extensions:

exception for 3:

3a. {SOFTWARE_EXCEPTION::TransponderUsed} #System reactivates registration.#

Use case ends in: FAILURE

Handler use case: ServiceLights

scope: ETR_System

level: SUB_FUNCTION

intention: "System intends too repair/replace non-working lights"

primary actor: None

secondary actor: PHYSICAL_ENTITY::Lights, HUMAN::ServicePerson

contexts and exceptions: ProcessUnregisteredVehicle{HARDWARE_EXCEPTION::LightFailure}

main success scenario:

1. "System requests ServicePerson to repair/replace lights"
2. "ServicePerson repairs/replaces System lights"
3. "System Lights operational"

use case ends in: SUCCESS

Handler Use Case: ServiceOperatorTerminal

Scope: ETR_System

Level: SUB_FUNCTION

Intention: "The system intends to repair/replace the non-working OperatorTerminal."

Primary Actor: None

Secondary Actor: PHYSICAL_ENTITY::OperatorTerminal, HUMAN::ServicePerson

Contexts and Exceptions:

TakeHighway{SOFTWARE_EXCEPTION::OperatorTerminalFailure},

PayByCreditCard{SOFTWARE_EXCEPTION::CreditCardCompanyUnavailable},

PayByCheck{ENVIRONMENT_EXCEPTION::BouncedCheck}

Main Success Scenario:

1. "System requests ServicePerson to repair/replace the OperatorTerminal."
2. "ServicePerson repairs/replaces the System OperatorTerminal."
3. "OperatorTerminal operational and System can resume normal function."

Use case ends in: SUCCESS

Handler Use Case: ServiceRWAntenna

Scope: ETR_System

Level: SUB_FUNCTION

Intention: "The system intends to repair/replace the non-working RWAntenna."

Primary Actor: None

Secondary Actor: PHYSICAL_ENTITY::RWAntenna, HUMAN::ServicePerson

Contexts and Exceptions:

TakeHighway{SOFTWARE_EXCEPTION::RWAntennaFailure},

ProcessRegisteredVehicle{SOFTWARE_EXCEPTION::RWAntennaFailure}

Main Success Scenario:

1. "System requests ServicePerson to repair/replace the RWAntenna."
2. "ServicePerson repairs/replaces the System RWAntenna."
3. "RWAntenna operational and System can resume normal function."

Use case ends in: SUCCESS

Handler Use Case: ServiceVehicleDetector

Scope: ETR_System

Level: SUB_FUNCTION

Intention: "The system intends to repair/replace the non-working VehicleDetector."

Primary Actor: None

Secondary Actor: SENSOR::VehicleDetector, HUMAN::ServicePerson

Contexts and Exceptions: PassThroughGantry{HARDWARE_EXCEPTION::DetectorFailure}

Main Success Scenario:

1. "System requests ServicePerson to repair/replace the VehicleDetector."
2. "ServicePerson repairs/replaces the System VehicleDetector."
3. "VehicleDetector operational and System can resume normal function."

Use case ends in: SUCCESS

Handler Use Case: ServiceLocatorAntenna

Scope: ETR_System

Level: SUB_FUNCTION

Intention: "The system intends to repair/replace the non-working LocatorAntenna."

Primary Actor: None

Secondary Actor: READER::LocatorAntenna, HUMAN::ServicePerson

Contexts and Exceptions: ProcessRegisteredVehicle{HARDWARE_EXCEPTION::LocatorAntennaFailure}

Main Success Scenario:

1. "System requests ServicePerson to repair/replace the LocatorAntenna."
2. "ServicePerson repairs/replaces the System LocatorAntenna."
3. "LocatorAntenna operational and System can resume normal function."

Use case ends in: SUCCESS

Handler Use Case: ServiceCamera

Scope: ETR_System

Level: SUB_FUNCTION

Intention: "The system intends to repair/replace the non-working Camera."

Primary Actor: None

Secondary Actor: READER::Cameras, HUMAN::ServicePerson

Contexts and Exceptions: ProcessUnregisteredVehicle{HARDWARE_EXCEPTION::CameraFailure}

Main Success Scenario:

1. "System requests ServicePerson to repair/replace the Camera."
2. "ServicePerson repairs/replaces the System Camera."
3. "Cameras operational and System can resume normal function."

Use case ends in: SUCCESS

Handler Use Case: ServiceLaserScanner

Scope: ETR_System

Level: SUB_FUNCTION

Intention: "The system intends to repair/replace the non-working LaserScanner."

Primary Actor: None

Secondary Actor: SENSOR::LaserScanner, HUMAN::ServicePerson

Contexts and Exceptions: ClassifyVehicle{HARDWARE_EXCEPTION::LaserScannerFailure}

Main Success Scenario:

1. "System requests ServicePerson to repair/replace the LaserScanner."
2. "ServicePerson repairs/replaces the System LaserScanner."
3. "LaserScanner operational and System can resume normal function."

Use case ends in: SUCCESS

Handler Use Case: HandleGovernmentComputerUnavailable

Scope: ETR_System

Level: SUB_FUNCTION

Intention: "The system notifies relevant parties when the GovernmentComputer is unavailable."

Primary Actor: None

Secondary Actor: PHYSICAL_ENTITY::GovernmentComputer, HUMAN::Operator

Contexts and Exceptions:

RegisterVehicle{SOFTWARE_EXCEPTION::GovernmentComputerUnavailable},

TakeHighway{SOFTWARE_EXCEPTION::GovernmentComputerUnavailable}

Main Success Scenario:

1. "System detects GovernmentComputer is unavailable."
2. "System notifies Operator of the unavailability."
3. "Operator contacts Government authorities to resolve the issue so System can resume normal function."

Use case ends in: SUCCESS

Handler Use Case: HandleInsufficientCredit

Scope: ETR_System

Level: SUB_FUNCTION

Intention: "The system notifies the Driver of insufficient credit."

Primary Actor: None

Secondary Actor: HUMAN::Driver, SOFTWARE::CreditCardCompany

Contexts and Exceptions: PayByCreditCard{ENVIRONMENT_EXCEPTION::InsufficientCredit}

Main Success Scenario:

1. "System detects insufficient credit from Driver."
2. "System notifies the Driver of insufficient credit."

Use case ends in: SUCCESS

Handler Use Case: HandleBouncedCheck

Scope: ETR_System

Level: SUB_FUNCTION

Intention: "The system notifies the Driver of a bounced check."

Primary Actor: None

Secondary Actor: HUMAN::Driver

Contexts and Exceptions: PayByCheck{ENVIRONMENT_EXCEPTION::BouncedCheck}

Main Success Scenario:

1. "System detects a bounced check from Driver."
2. "System notifies the Driver of the bounced check."

Use case ends in: SUCCESS

Handler Use Case: HandleTransponderUsed

Scope: ETR_System

Level: SUB_FUNCTION

Intention: "The system reactivates the registration if a transponder is used after cancellation."

Primary Actor: None

Secondary Actor: PHYSICAL_ENTITY::RWAntenna

Contexts and Exceptions: CancelRegistration{SOFTWARE_EXCEPTION::TransponderUsed}

Main Success Scenario:

1. "RWAntenna detects transponder use after cancellation in System."
2. "System reactivates the vehicle registration and RWAntenna processes the car like normal."

Use case ends in: SUCCESS