

# Supplementary Materials

This supplementary materials lists and describes the various states and signals used in SDL diagrams. Each section is devoted to a specific process, providing the name of the state/signal and its description.

## States

### Pconfig\_Attr

State	Description
<i>Leg_Obtained</i>	National legislation has been loaded
<i>Highway_Attributes_Defined</i>	The attributes (national road laws according to the type of street) have been defined

### Pconv\_Map\_toNet

State	Description
<i>Map_Projected</i>	The map is projected
<i>Attribute_Received</i>	Attributes (national road laws according to the type of street) were received.

### PParking\_Areas

State	Description
<i>Parking_area_generated</i>	The parking area is generated
<i>Generating_PA</i>	The parking area is being generated

### PPoly\_Convert

State	Description
<i>OSM_Analysing</i>	The map OSM is being analyzed
<i>Map_Analysed</i>	the map was analyzed, polylines were created and sanded to destination.

### PPrep\_Map\_Osm

State	Description
<i>OSM_Obtained</i>	OSM file was received
<i>No_missed_data</i>	there are not missed data in the map
<i>Type_Streets_ok</i>	type streets in the map are equal to reality
<i>Speed_corrected</i>	the speed was corrected on the map
<i>TFL_corrected</i>	the positions of traffic lights have been corrected
<i>Lane_corrected</i>	the direction of travel (one way or two ways) has been set for that street
<i>Map_Detailed</i>	the map was detailed, and edge nodes were derived
<i>Prep_done</i>	the map was detailed and ready to be used in the other processes to derive and process information

#### Ppt\_flow

State	Description
<i>PT_Lines_Charged</i>	the reception of public transport lines and road network is confirmed
<i>PTFlows_SENT</i>	confirmation is given that public transport flows have been sent
<i>Simulating PT line</i>	the single line is being simulated
<i>Speed_corrected</i>	the speed was corrected on the map
<i>IDLE</i>	State that remains pending PT routes and flows signals

#### P\_Weight\_TAZ

State	Description
<i>Buildings_Uploaded</i>	Buildings and POIs (Points of interests) were uploaded
<i>Infrastructure_charged</i>	Bus stations and Street Network were uploaded
<i>TAZ_Weighted</i>	Traffic assignment zones were weighted according to their attractiveness

#### PAActivity\_Gen

State	Description
<i>TAZ_ok</i>	Traffic assignment zones uploaded with their weights
<i>Buildings_ok</i>	Buildings uploaded with their weights
<i>MATRIX_OD</i>	Matrix O/D uploaded
<i>pop_ok</i>	Population Data Uploaded
<i>First_TAZ</i>	First TAZ was named TAZ1 (selected the first TAZ)
<i>Activities_Done</i>	Activities were created and sent
<i>Analyze F</i>	The flow between TAZ1 and TAZ2 is analyzed
<i>Analyze Primary Loc</i>	It is analyzed where to locate the primary activity
<i>Analyze Secondary Loc</i>	It is analyzed where to locate secondary activities
<i>Circles_ok</i>	Circle for placement of secondary activities generated
<i>Ellipse_ok</i>	Ellipse for placement of secondary activities generated
<i>Chain_ok</i>	Sequence of activity generated for that individual
<i>Sec_Analysis</i>	It is being analyzed where to place the secondary activity
<i>Temp_Chain</i>	Spatially localized activities
<i>Pact_Time</i>	It is being localized the chain of activities over time

#### PBuilding

State	Description
<i>TAZ_Obtained</i>	TAZs uploaded with their weights
<i>Buildings_Received</i>	Buildings uploaded
<i>Building_Defined</i>	The weights of the single buildings is calculated
<i>WBuildings_DONE</i>	All buildings Analyzed with their weights

#### PDef\_TAZ

State	Description
<i>TAZ_Defined</i>	TAZs uploaded with their weights
<i>Net_Uploaded</i>	Buildings uploaded

<i>Building_Defined</i>	The weights of the single buildings is calculated
<i>WBuildings_DONE</i>	All buildings Analyzed with their weights

#### POD\_Matrix

<b>State</b>	<b>Description</b>
<i>TAZ_Uploaded</i>	TAZs uploaded with their weights
<i>Density_Uploaded</i>	Parameter related to population density loaded
<i>Weight_Uploaded</i>	The weights of the single TAZ are uploaded
<i>Second_TAZ</i>	All combinations between TAZs are being analyzed.

#### PComp\_Val

<b>State</b>	<b>Description</b>
<i>Pop_ok</i>	The initial population has been uploaded
<i>DataR_Captured</i>	Real data uploaded
<i>Sim_Captured</i>	Simulated traffic data uploaded
<i>Opt_Initialized</i>	Optimization initialized
<i>Checking_Sensor</i>	Real data are compared with synthetic data to change the parameters of the ABM block

#### PDef\_Tech

<b>State</b>	<b>Description</b>
<i>Ready</i>	Initial technologies were specified
<i>DataR_Captured</i>	Real data uploaded

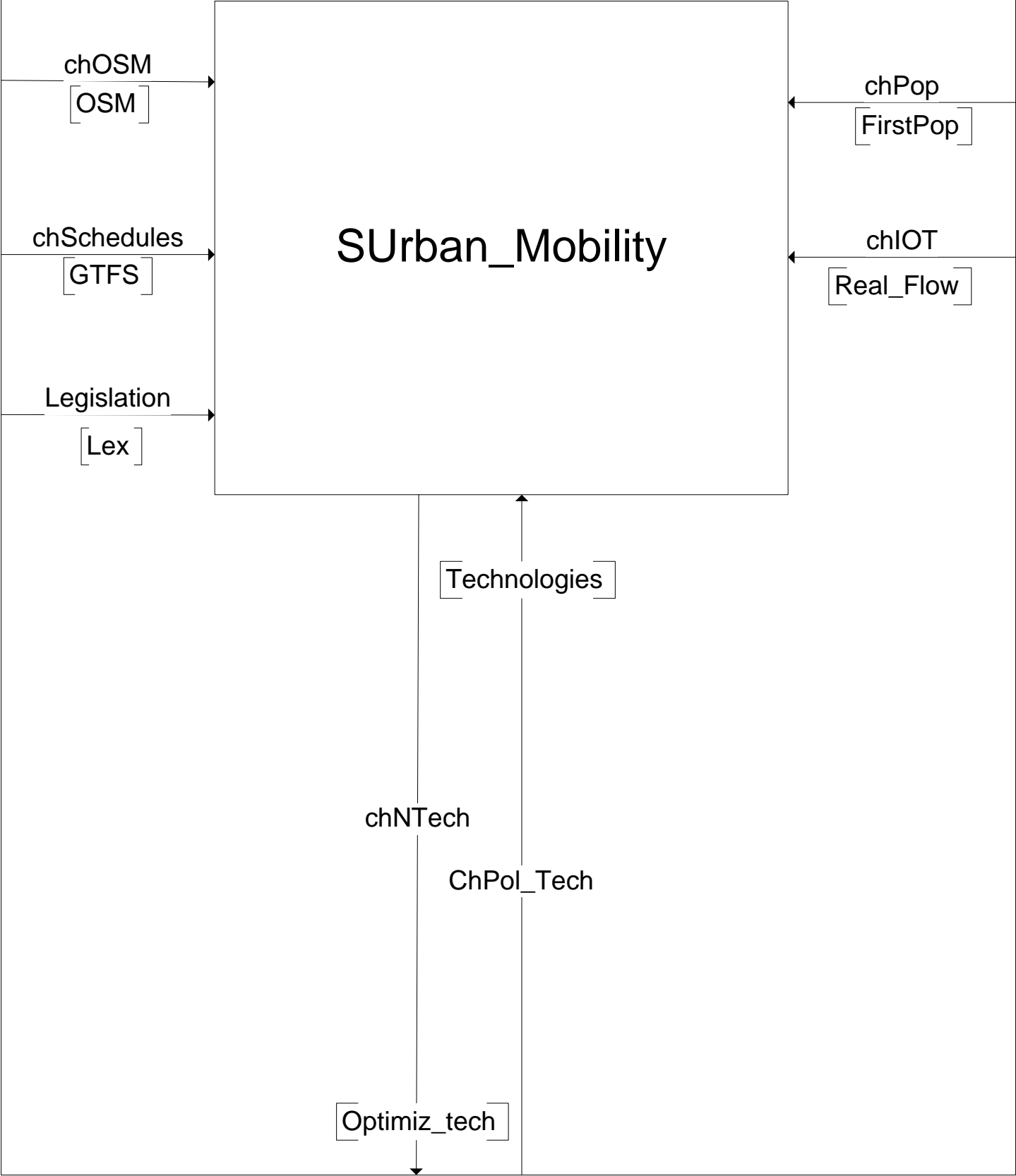
#### PResults

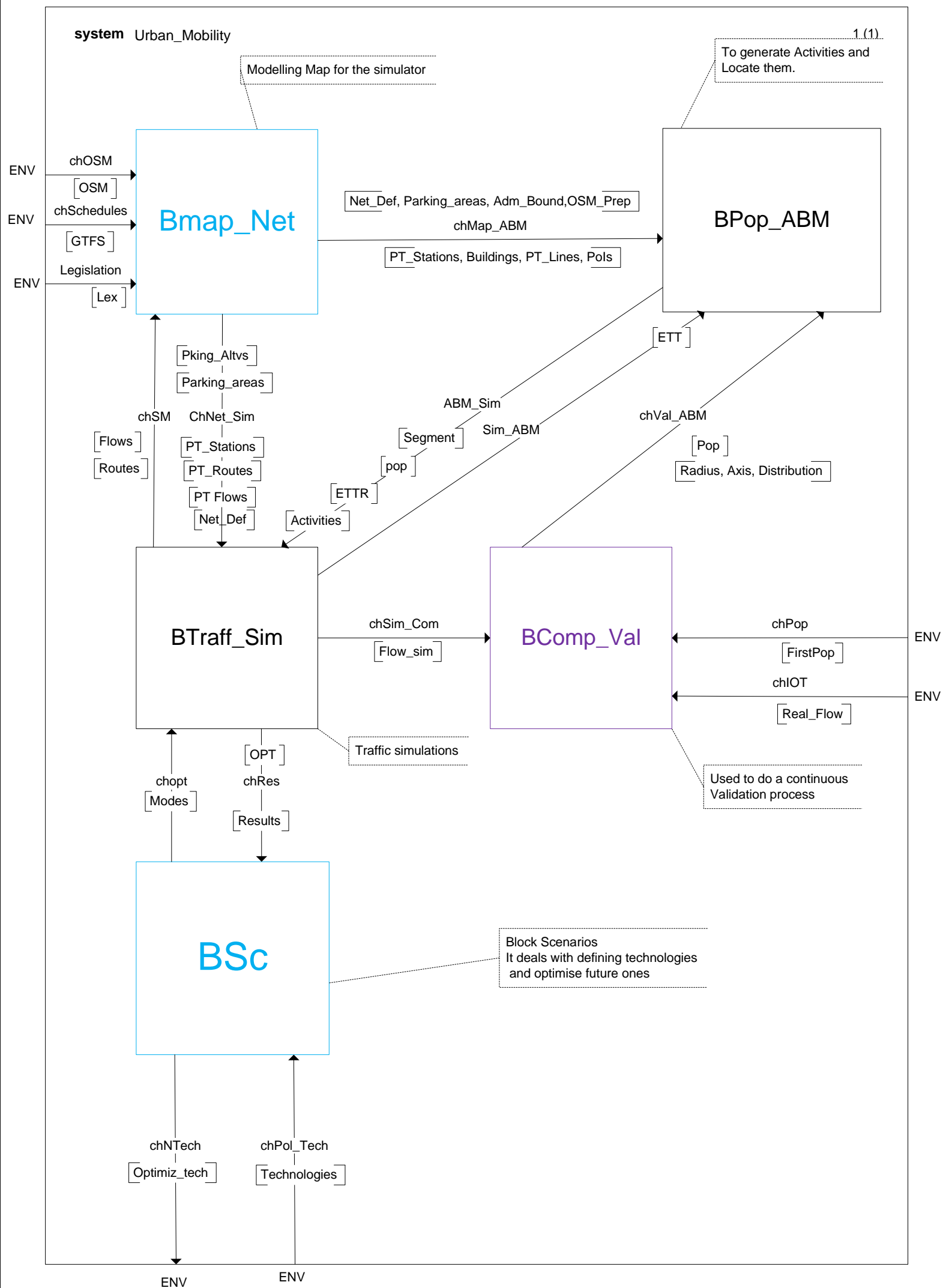
<b>State</b>	<b>Description</b>
<i>Tech_Received</i>	The technologies of the scenario to be studied have been received and the relevant modalities have been determined
<i>FO_Done</i>	The objective function is ready to be used
<i>ANA_TECH</i>	Analysis of individual technology to assess whether it should be optimized or not

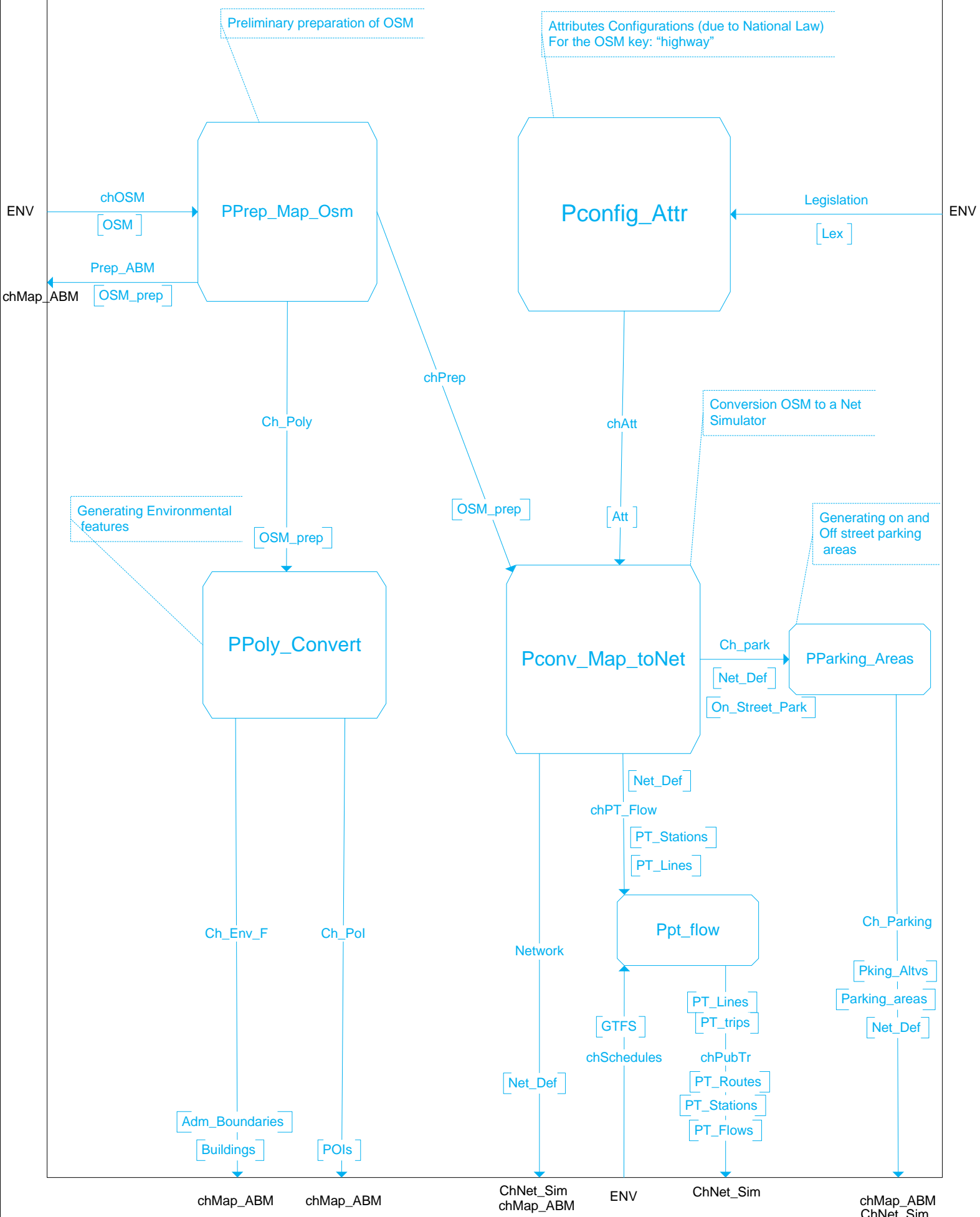
## Signals

Signal	Description
<i>Axis</i>	Axes of the ellipse that are used as a parameter to generate the position of the secondary activities in the ABM block
<i>Activate</i>	Activation auxiliary message used to trigger operations within processes
<i>Activities</i>	Activities carried out by the people who make up the synthetic population (locate in time, space)
<i>Acbuildings</i>	Activities carried out in the buildings
<i>Adm_Boundaries</i>	Administrative boundaries of the city
<i>Analyze</i>	Auxiliary signal used to build the map and activate operations
<i>ANA_TECH</i>	Analysis of individual technology to assess whether it should be optimized or not
<i>Arch</i>	Arc of road you want to analyze within the block for creating maps
<i>Att</i>	attributes configured for map generation, used to impose speed limits, and build road infrastructure when it has not been specified on the map
<i>Buildings</i>	Buildings located in the city, from OSM
<i>Bus_Stations</i>	Positions of bus stations
<i>Car access</i>	The more car access point closest to the residence
<i>Dens_pop</i>	Population density
<i>Distribution</i>	Distribution used to calculate the time chain of activities
<i>ETT</i>	Estimated Travel Time
<i>ETTR</i>	Temporary Estimated Travel Time used to calculate the real ETT
<i>FirstPop</i>	First population parameters that will later be improved in the ABM block
<i>Flow_sim</i>	Traffic flow simulated
<i>Flows</i>	PT flows generated for the simulations
<i>GTFS</i>	Data on public transport timetables and routes made by the public transport company operating in the city
<i>LANE</i>	Auxiliary signal to analyze the different lanes
<i>Lex</i>	Current national road legislation containing information on limits, how to generate intersections based on the type of road (main road, urban, etc.)

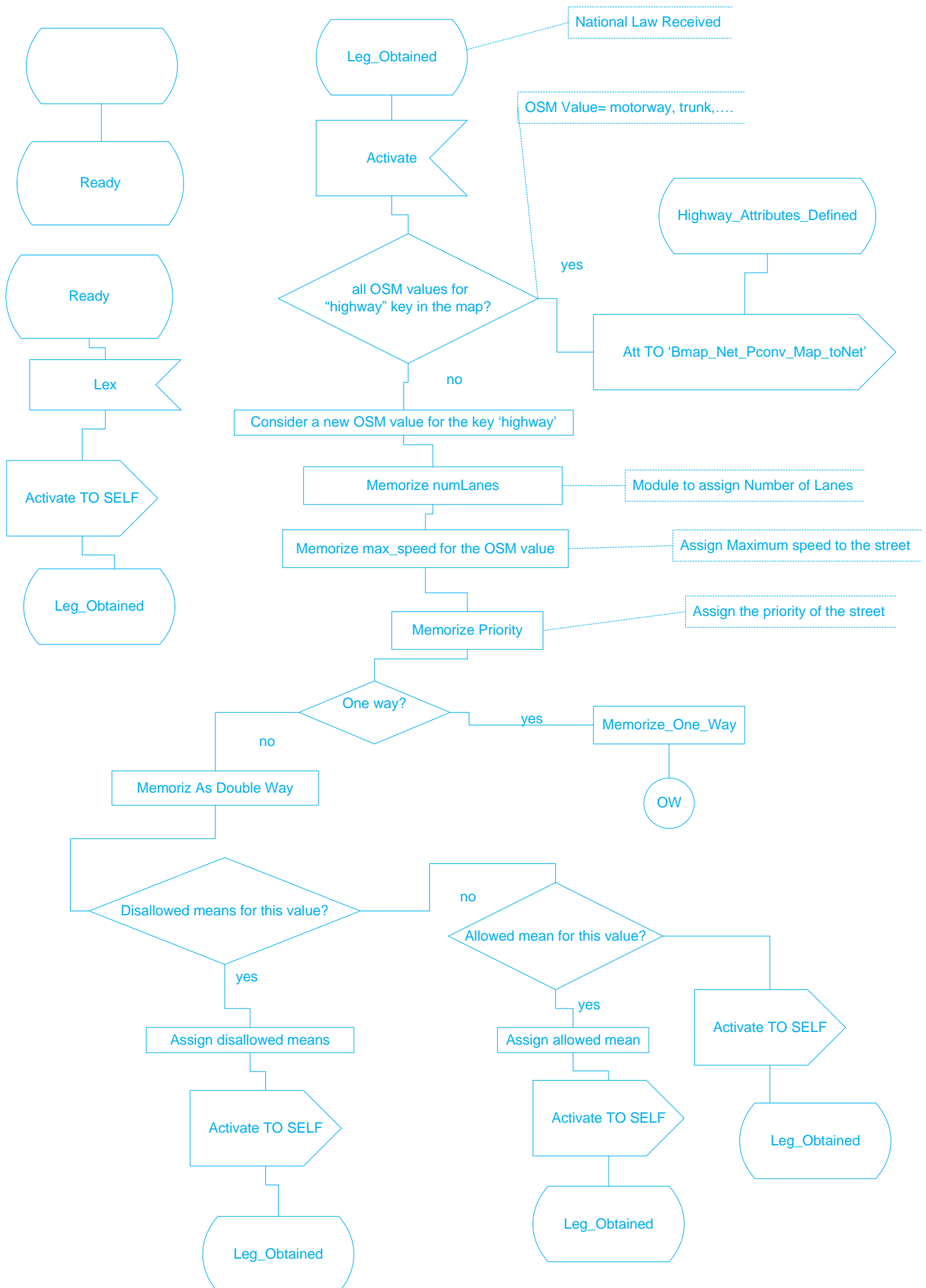
<b>Signal</b>	<b>Description</b>
<i>Modes</i>	The modes of transportation derived from the different technologies
<i>Net_Def</i>	Definition of the road and public transport network containing information on speed limits, signs to be observed
<i>O/D</i>	OD Matrix
<i>OPT</i>	Temporary signal used to optimize technologies that need to be optimized
<i>OW</i>	Signal used to build a One way street
<i>OSM</i>	File from open street map
<i>OSM_prep</i>	Map ready to be used to run simulations
<i>On_street_Park</i>	Parking lots along the road taken from the OSM file
<i>Park</i>	Auxiliary signal used in the Parking Area process
<i>Pedestrian access</i>	The more pedestrian access point closest to the residence
<i>Pking_Altvs</i>	Alternative parking areas are chosen for each parking area in case they are full
<i>POIs</i>	Set of points of interest derived from the OSM map
<i>Pop</i>	Social behavioral and population registry information
<i>PT</i>	Auxiliary signal used to build PT flows
<i>PT_Flows</i>	Flows (sequence of transportation means) evaluated through the simulation process
<i>PT_Lines</i>	Signal that contains the information about public transport lines
<i>PT_Routes</i>	outes of the Public Transport
<i>PT_Stations</i>	Contains information on the Public Transport Stations
<i>PT_trips</i>	Trips of PT classified according to the PT mean
<i>Radius</i>	Radius parameter used to locate secondary activities
<i>Real_flow</i>	Real flow from sensors
<i>Result</i>	Simulation results used to optimize different technologies
<i>Routes</i>	Routes calculated as a result of solving a routing problem
<i>Segment</i>	Segment of road under analysis
<i>TAZ</i>	Traffic assignment zone: division of the city into multiple zones
<i>TAZW</i>	TAZ with the different weights for each TAZ
<i>Technologies</i>	Technologies that make up the mobility scenario
<i>TFL</i>	Auxiliary signal used to correct traffic light

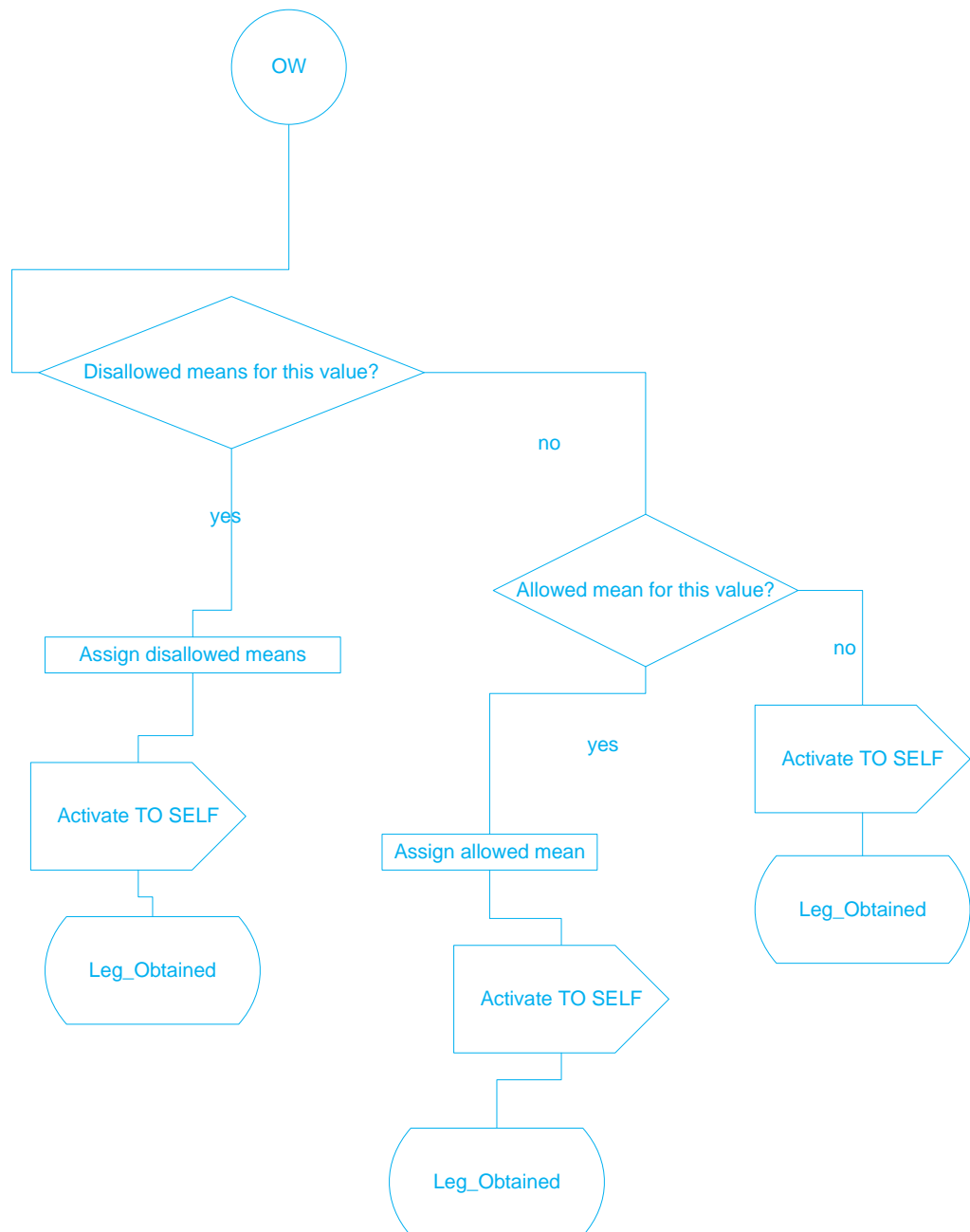








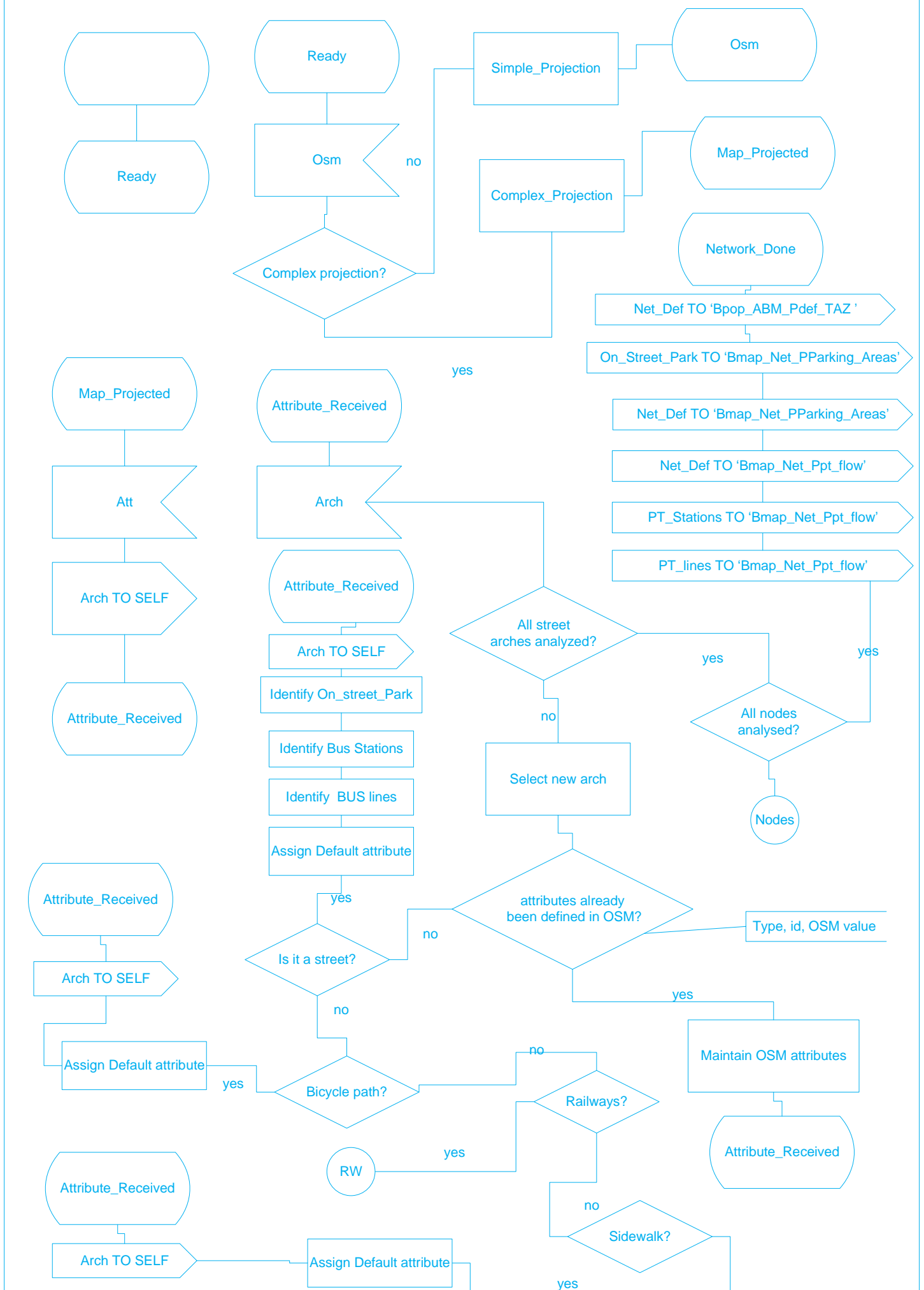


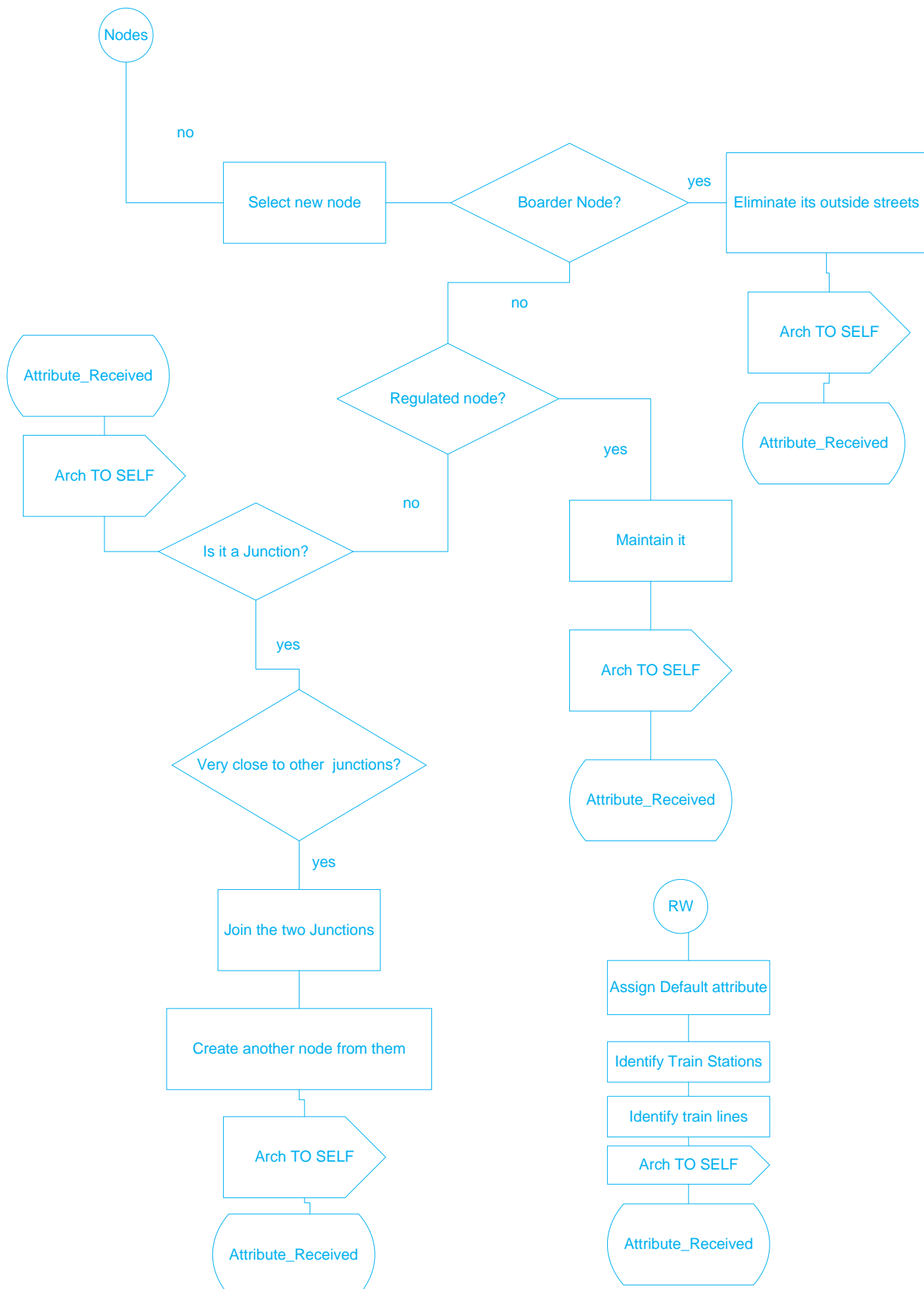


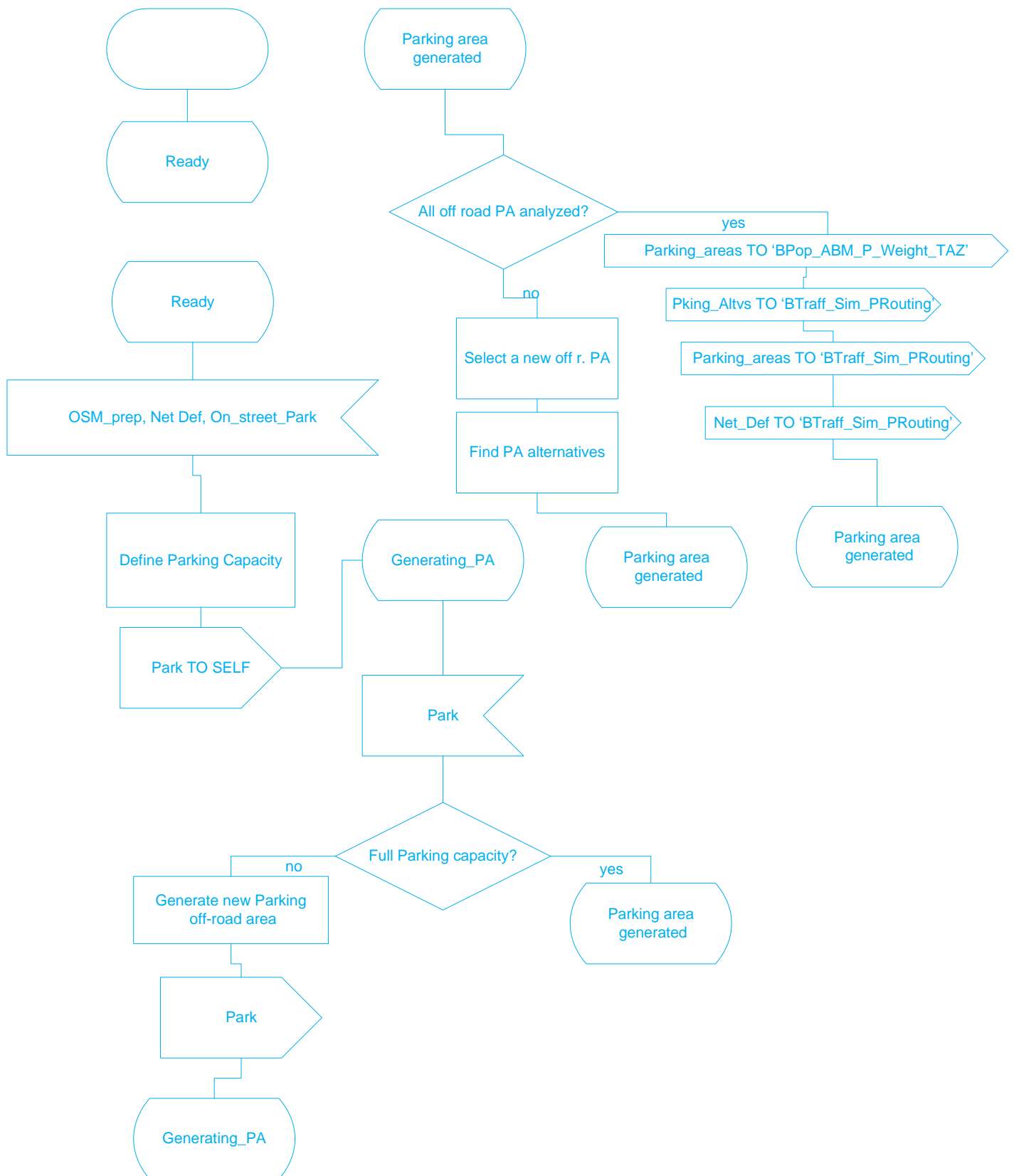
process

Pconv\_Map\_toNet

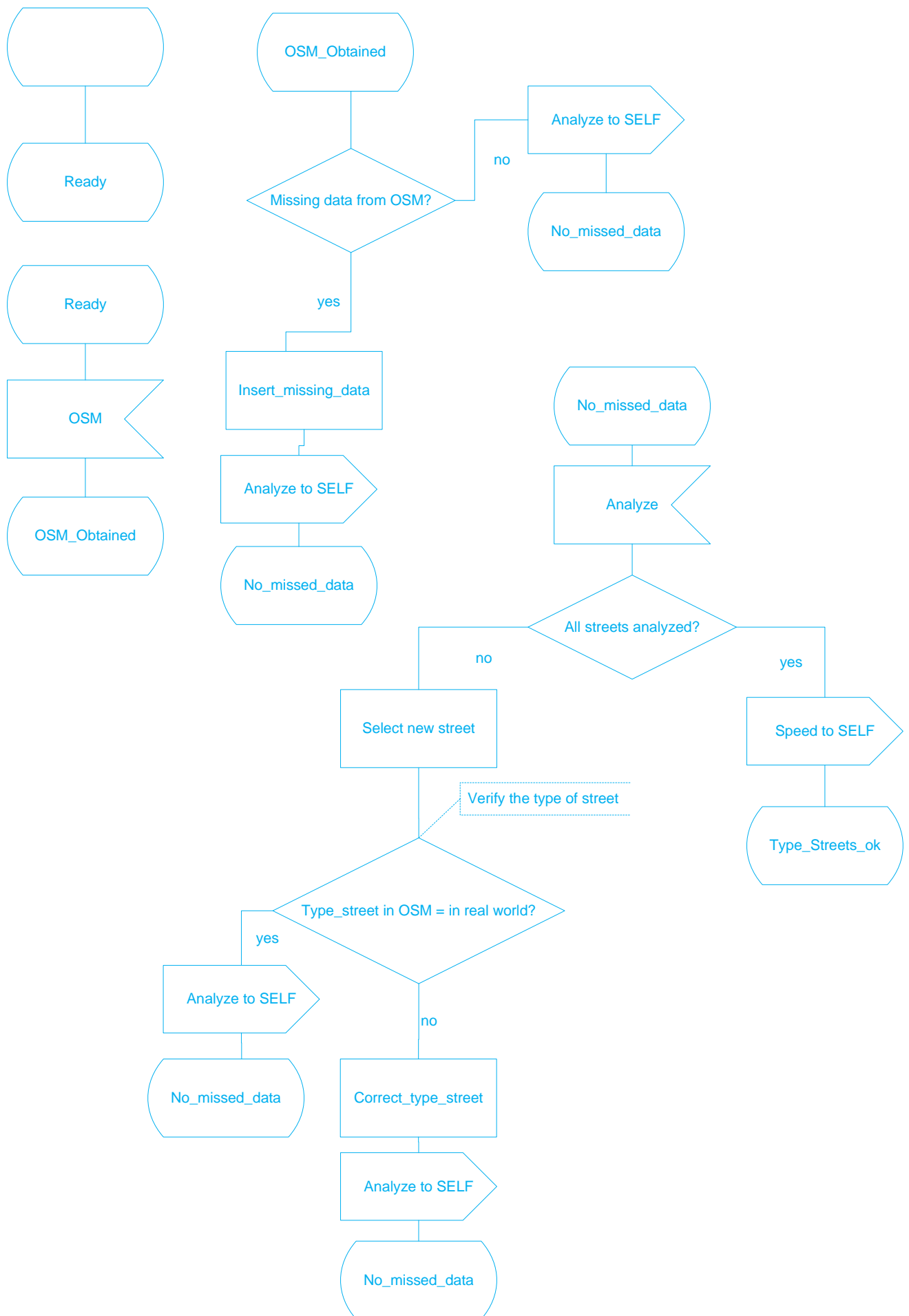
Street\_Arches

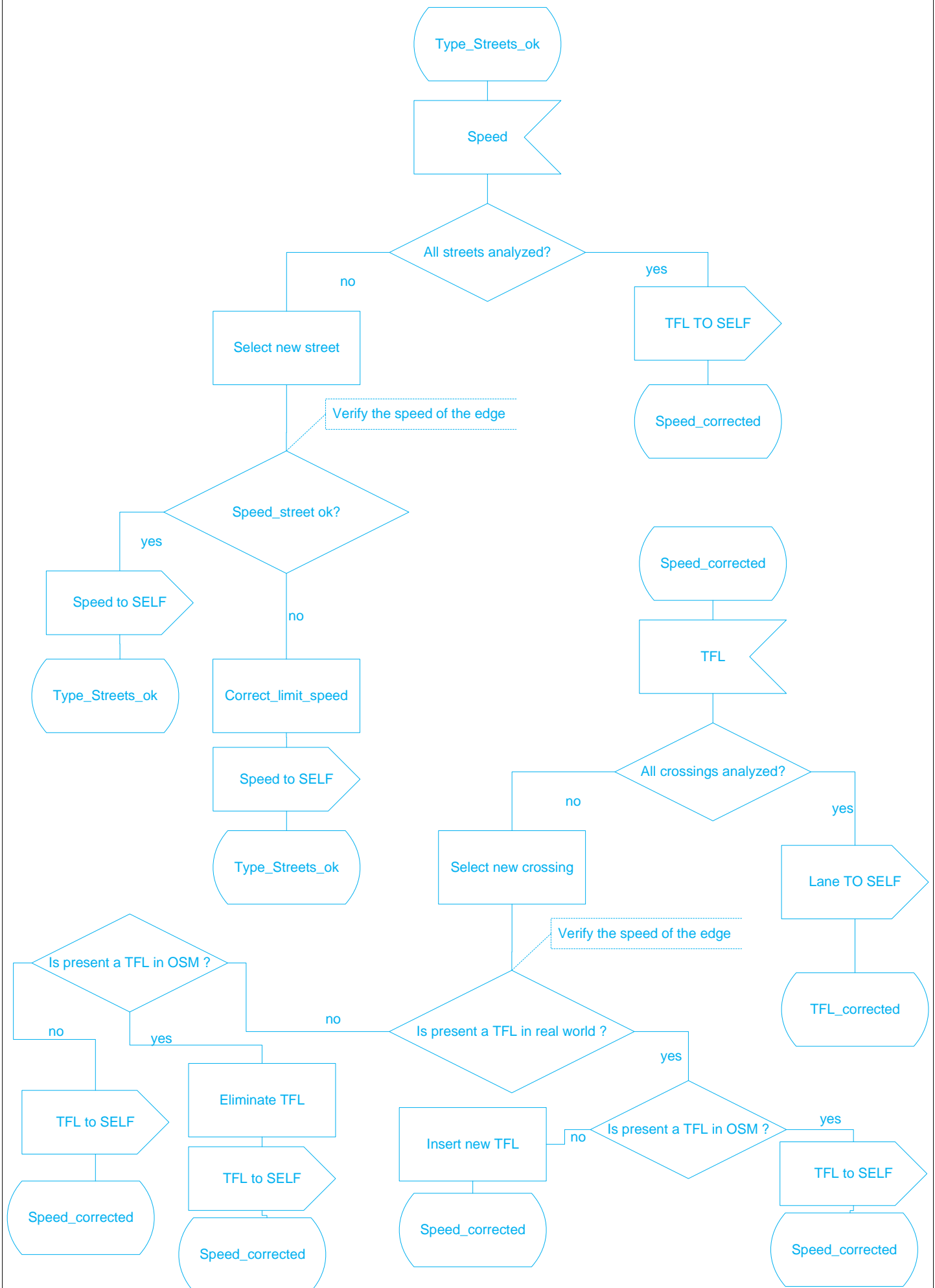




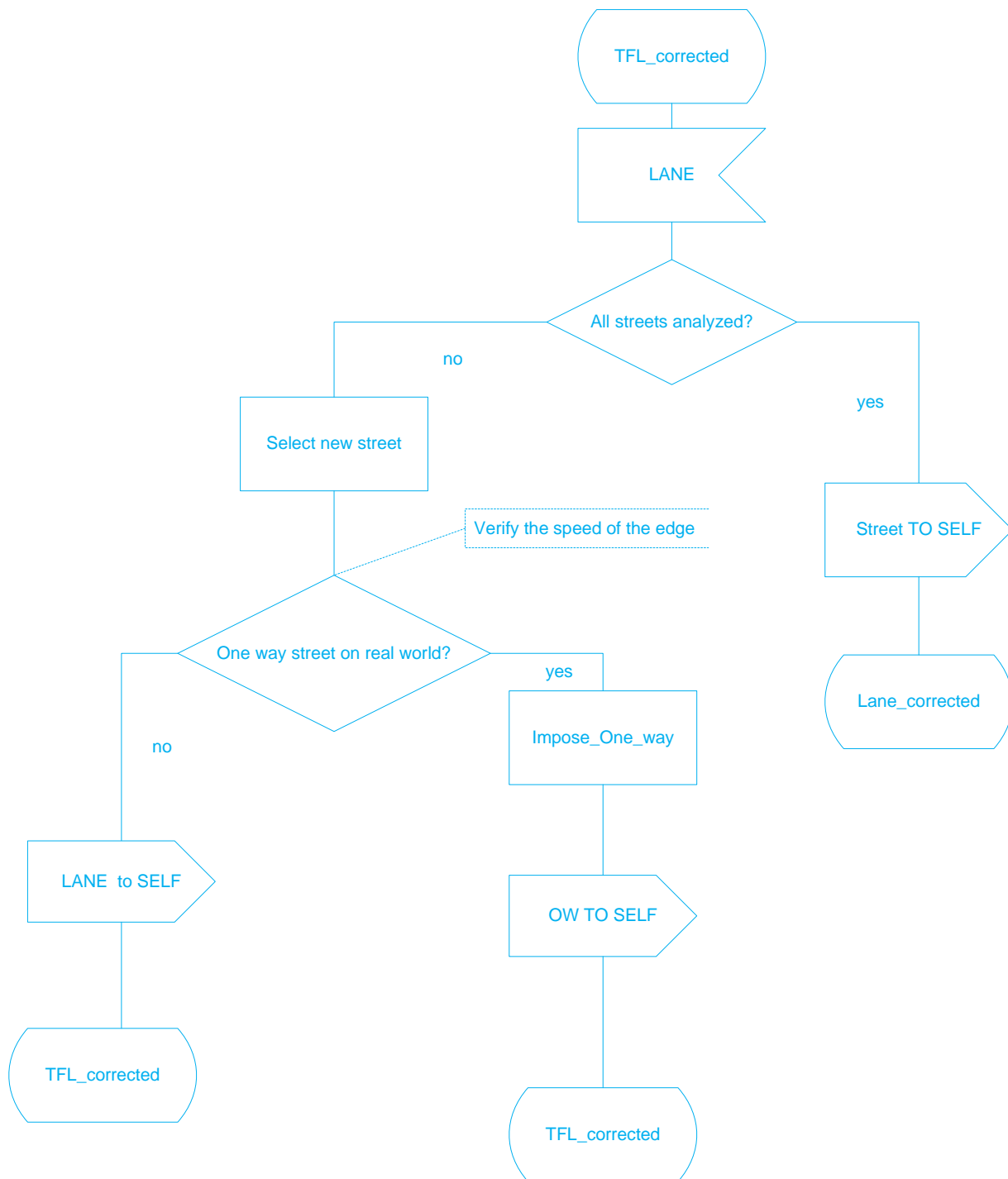


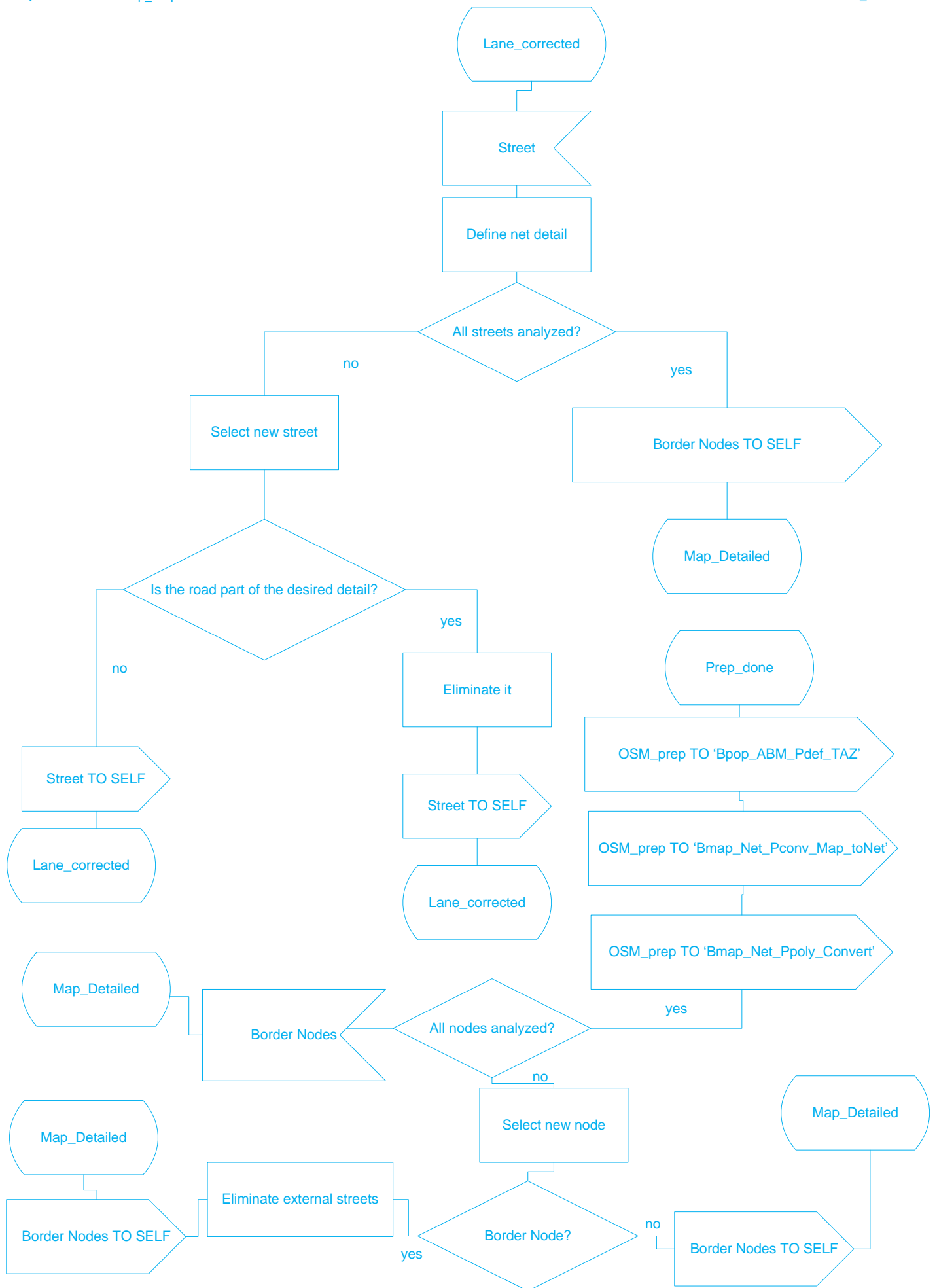


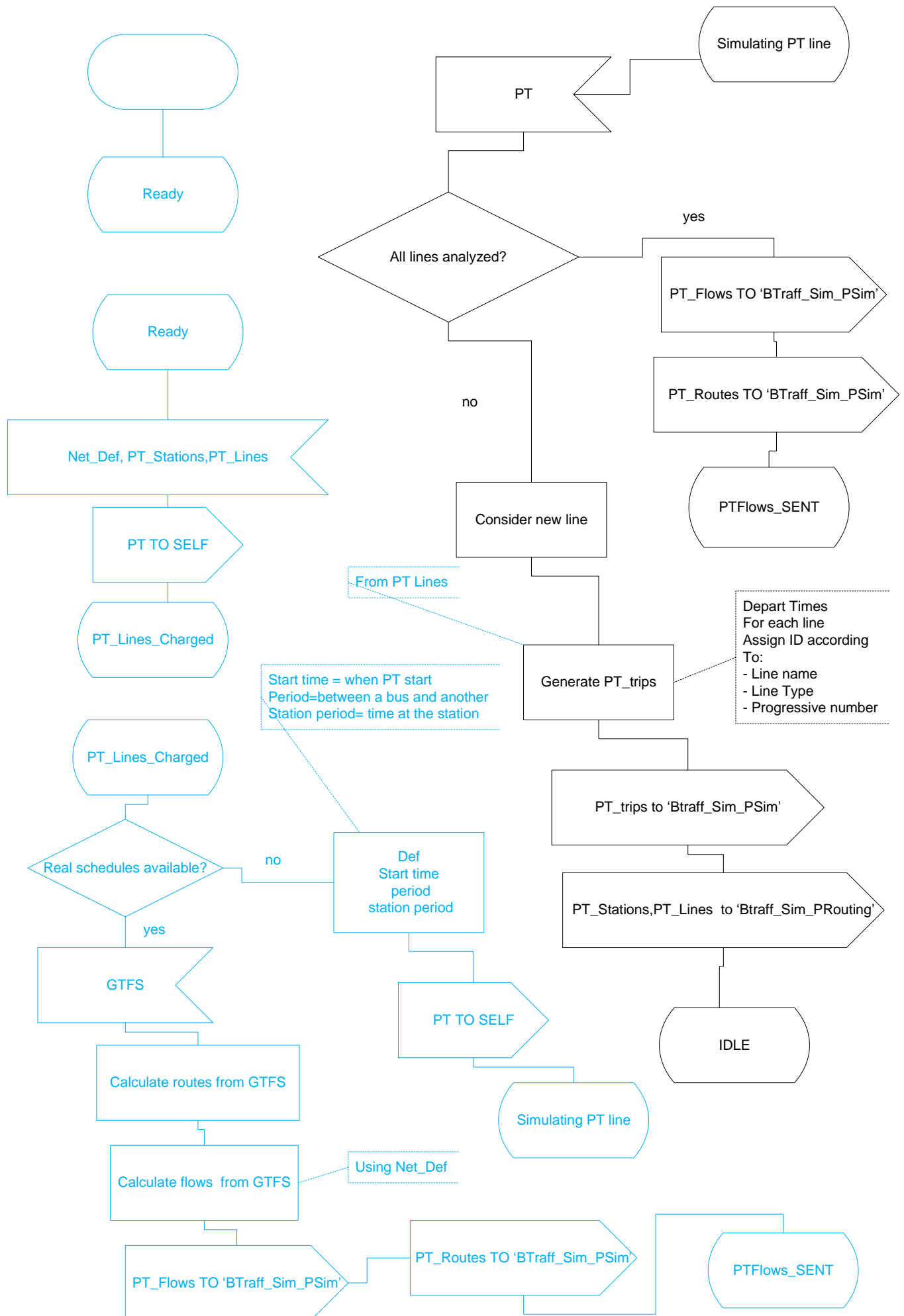


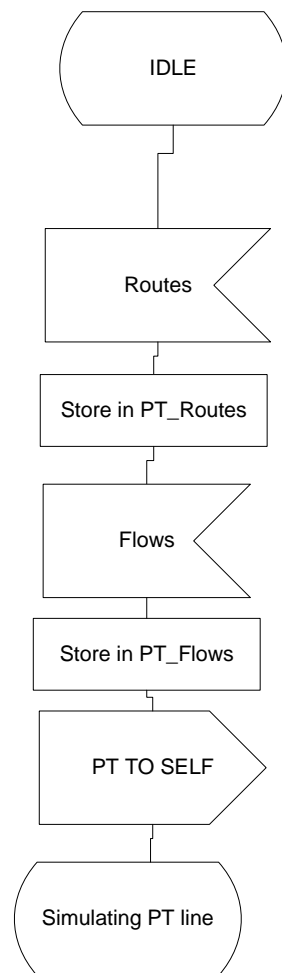






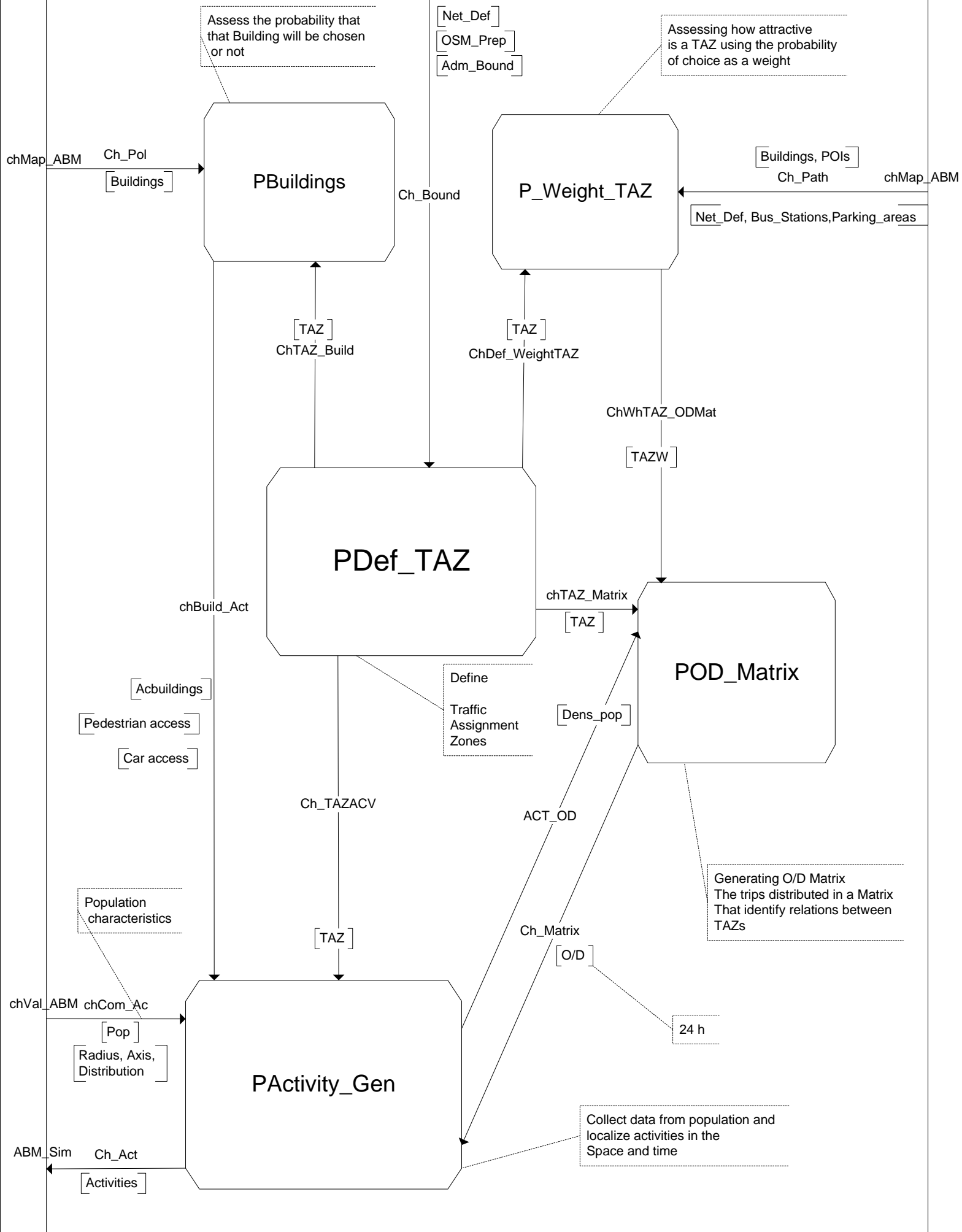


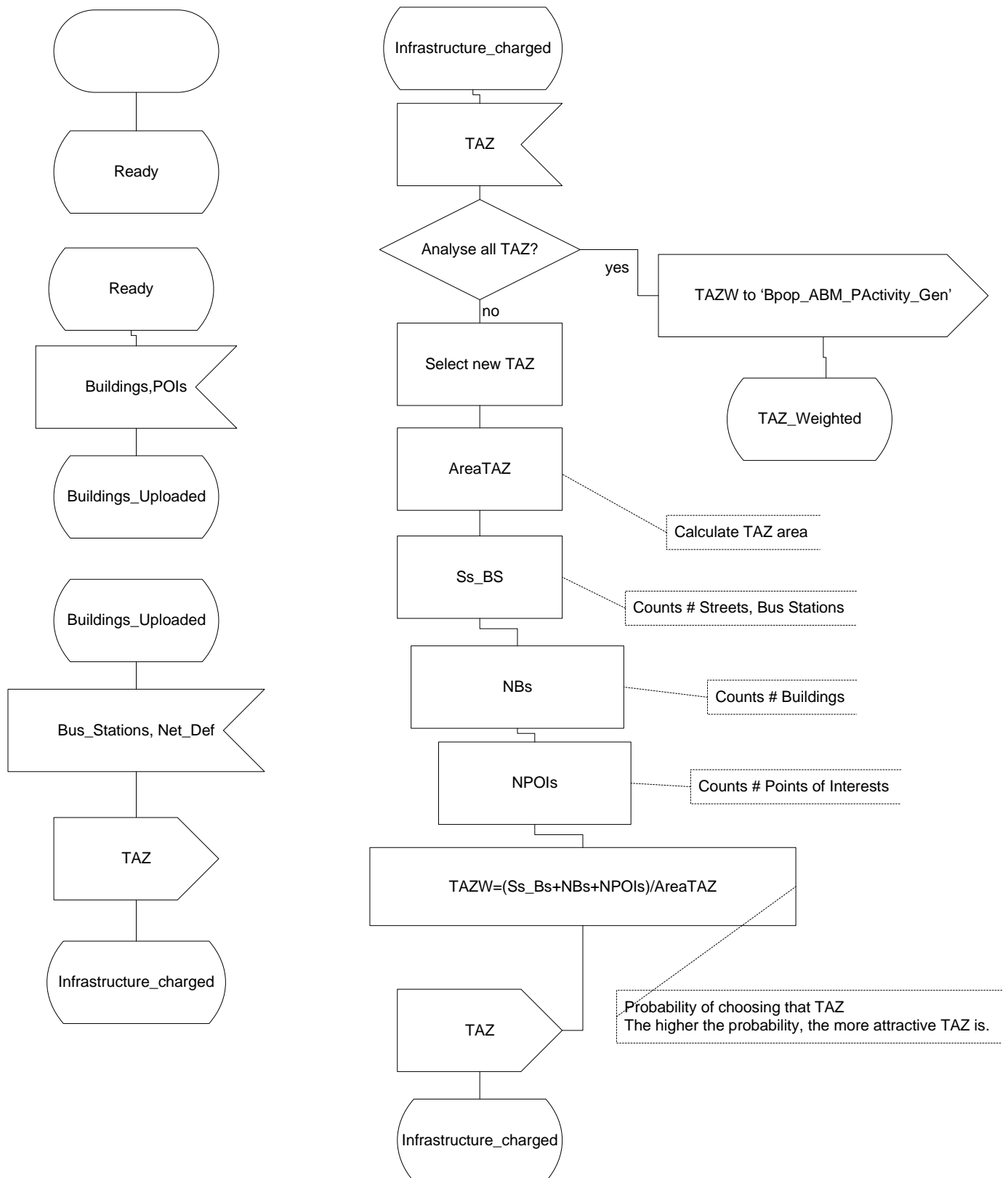


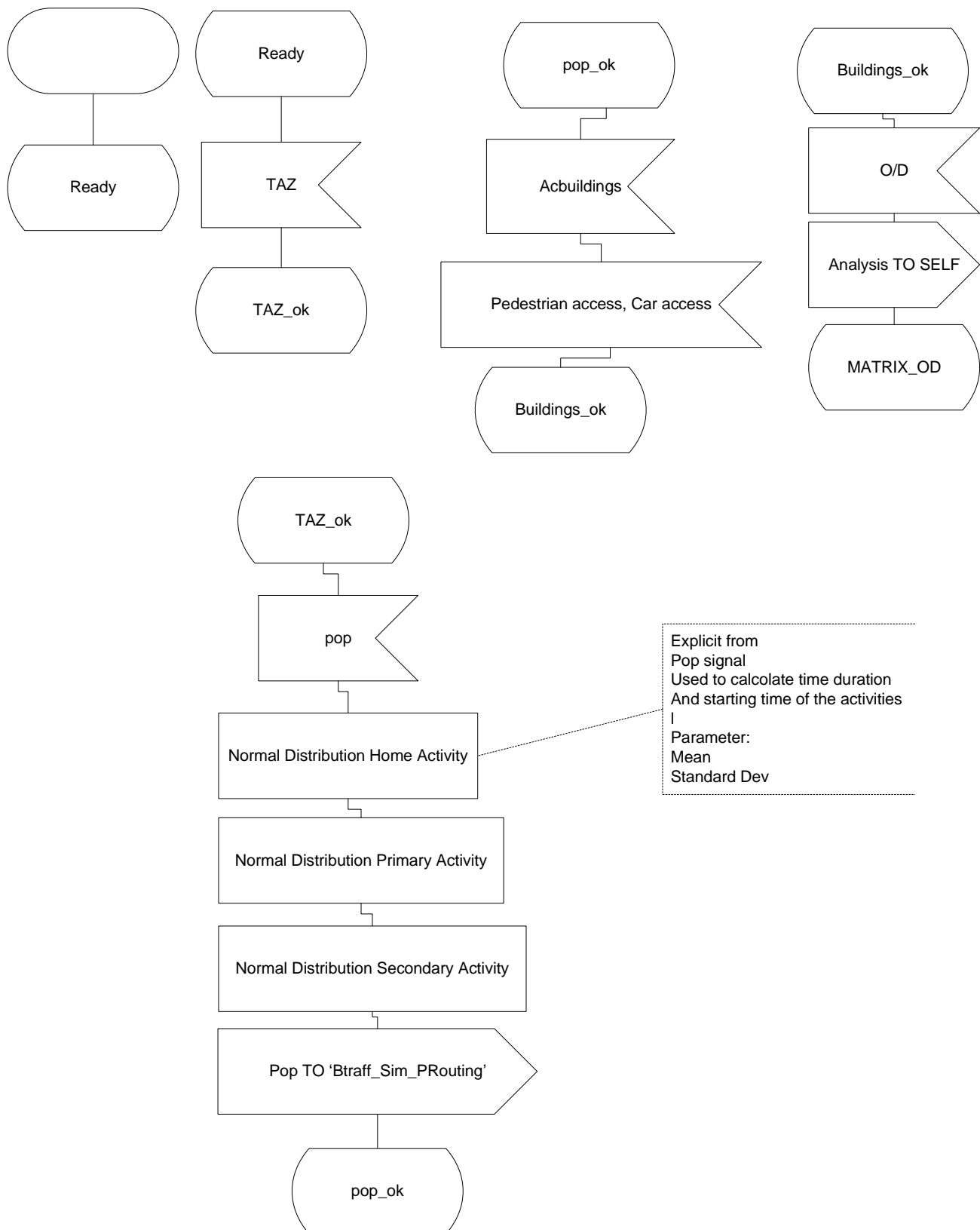


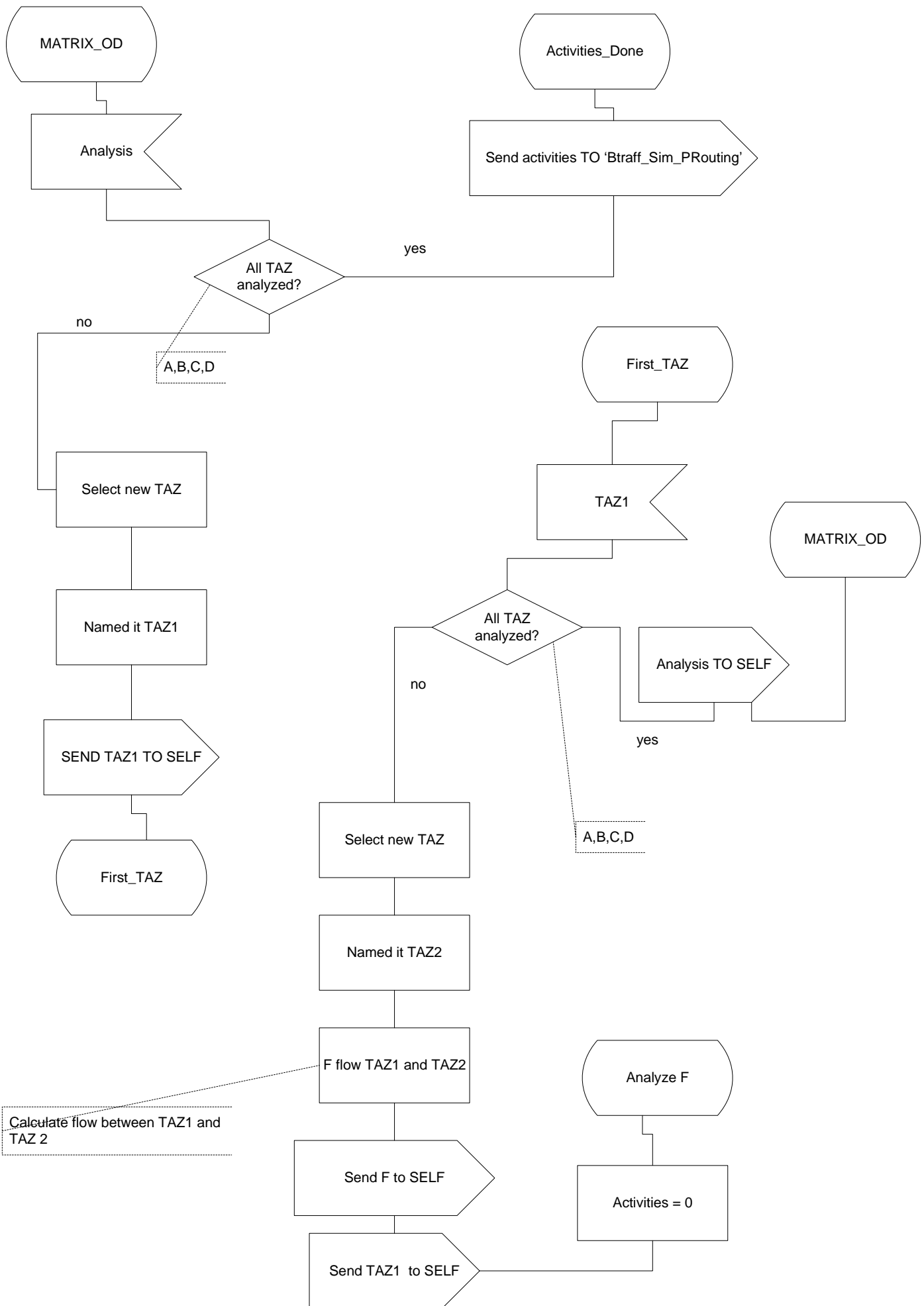
block BPop\_ABM

1 (1)

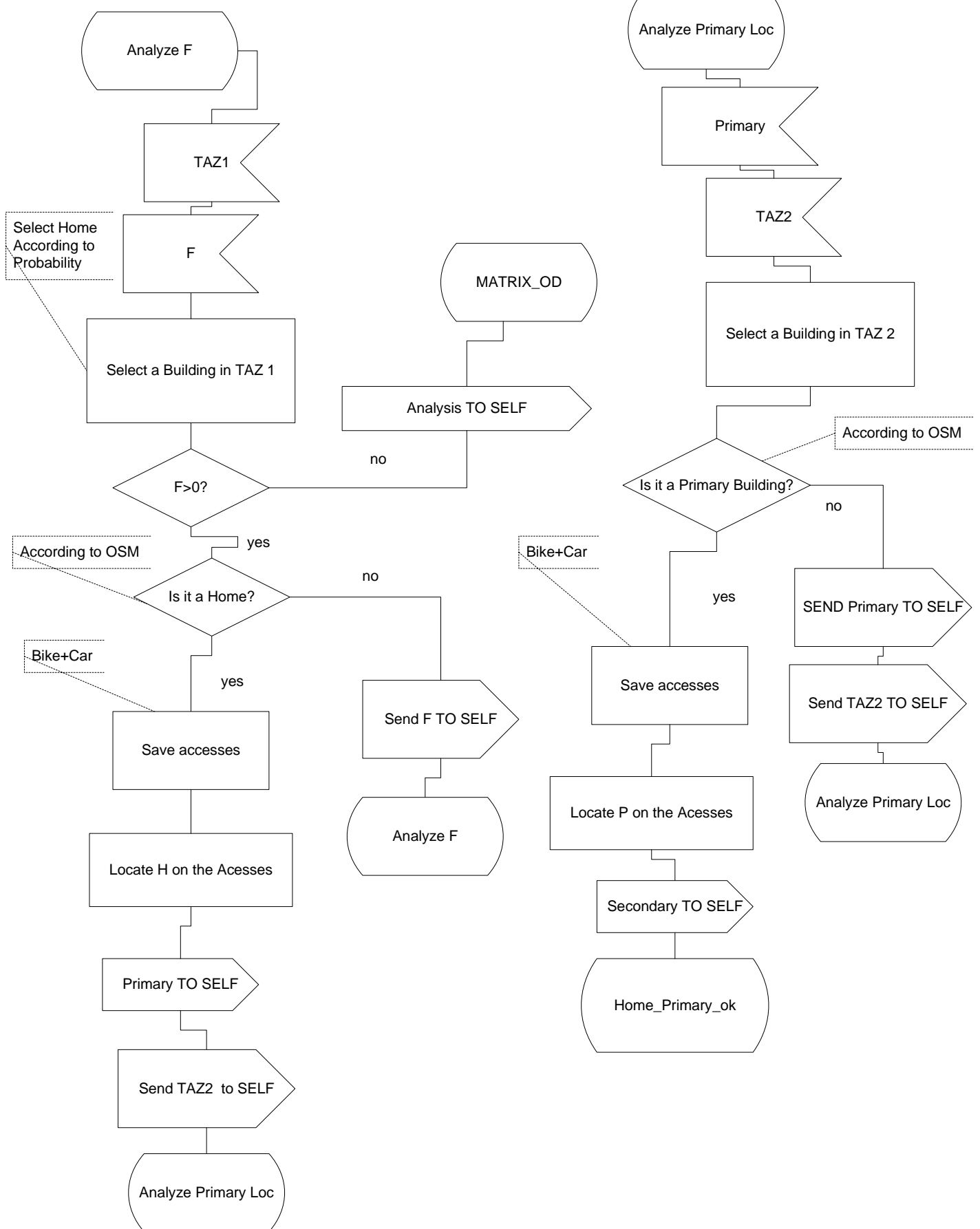


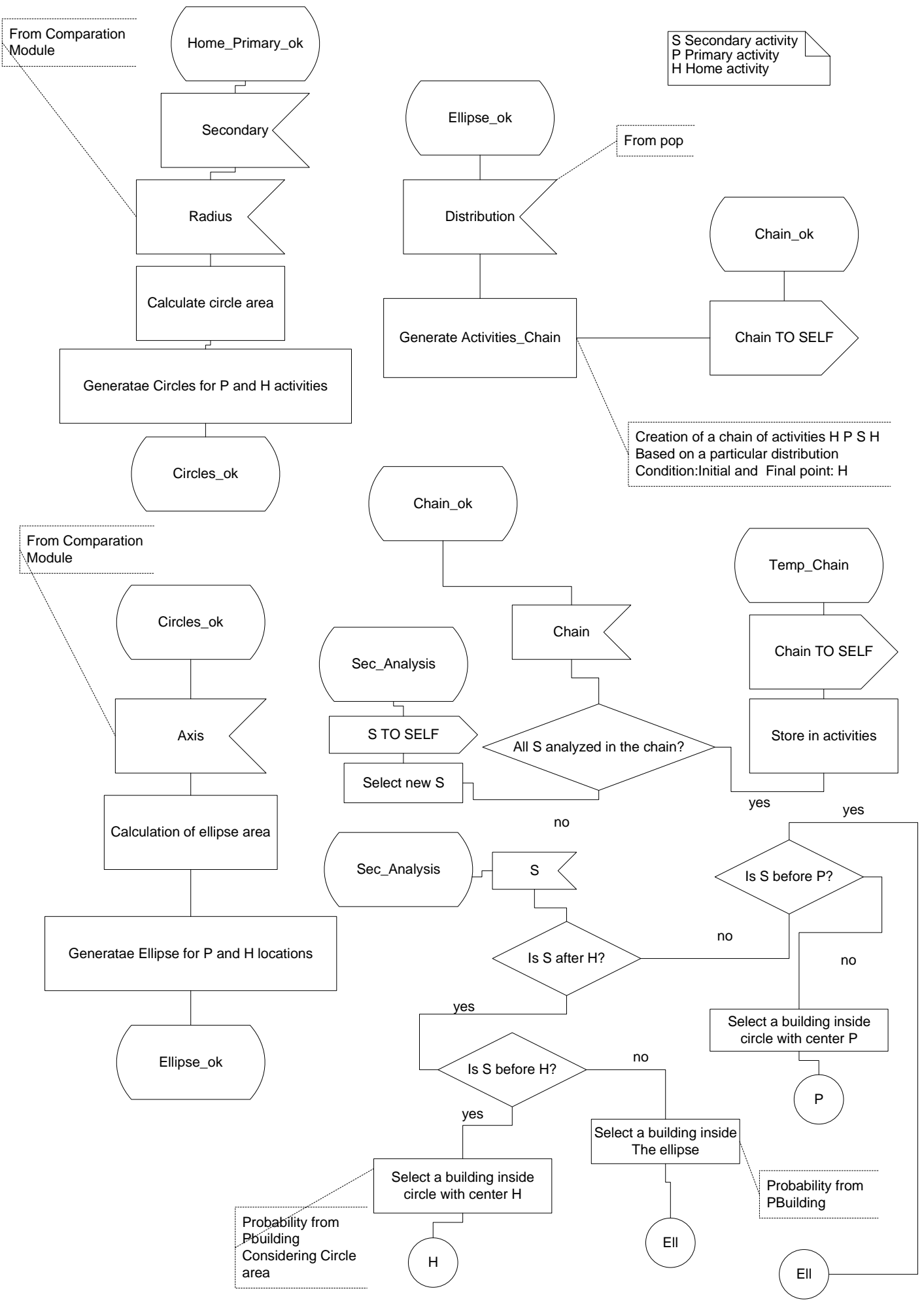


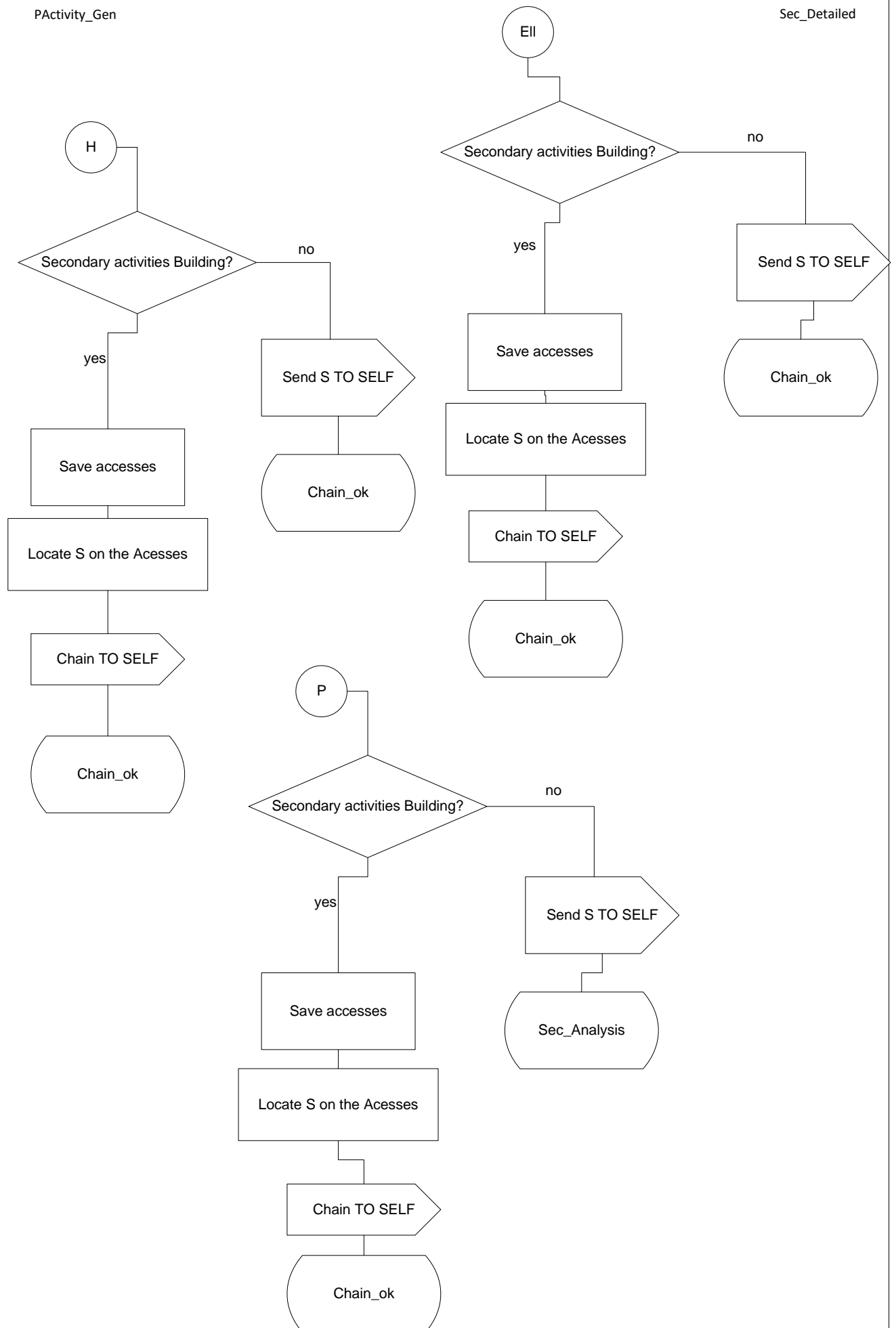


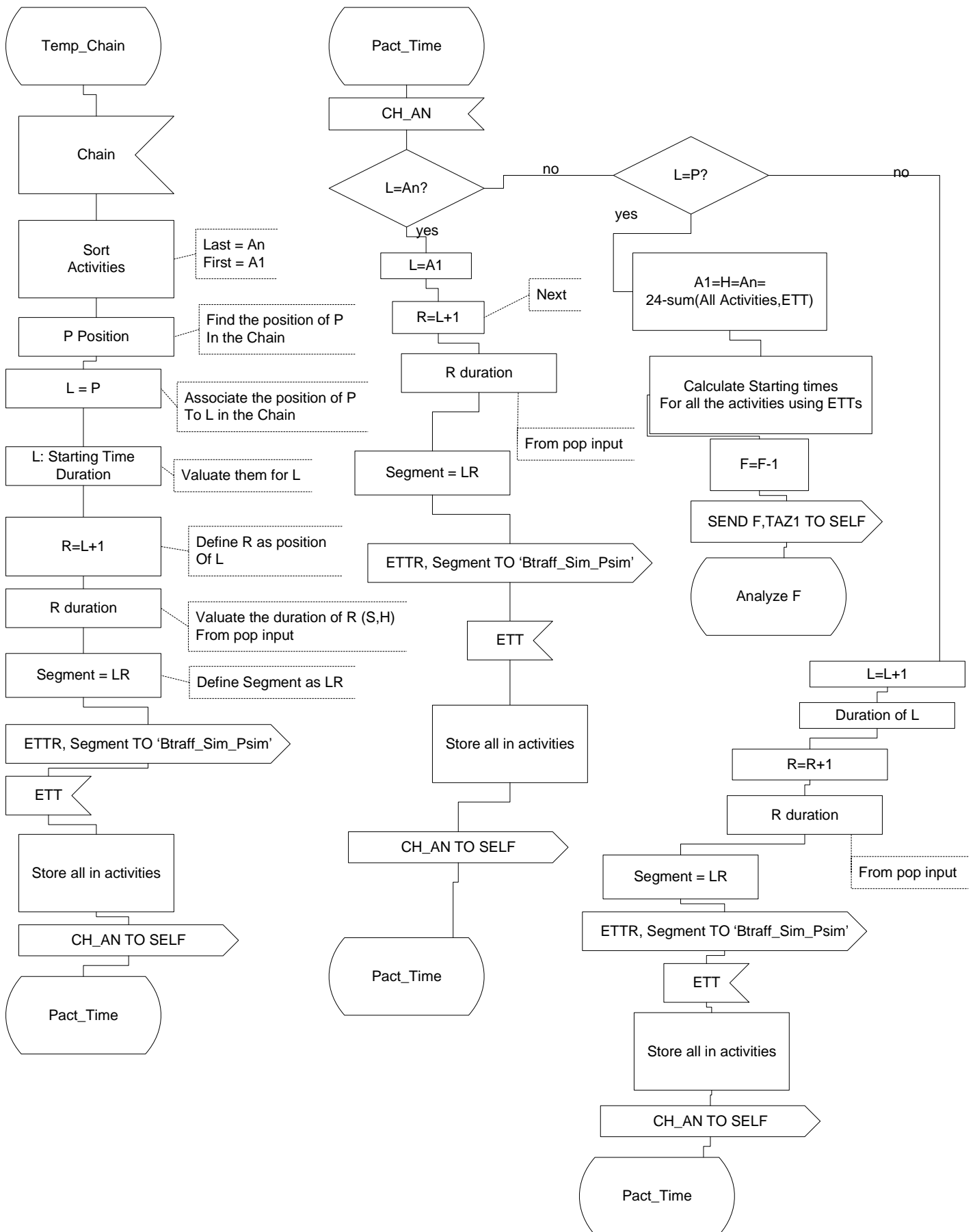


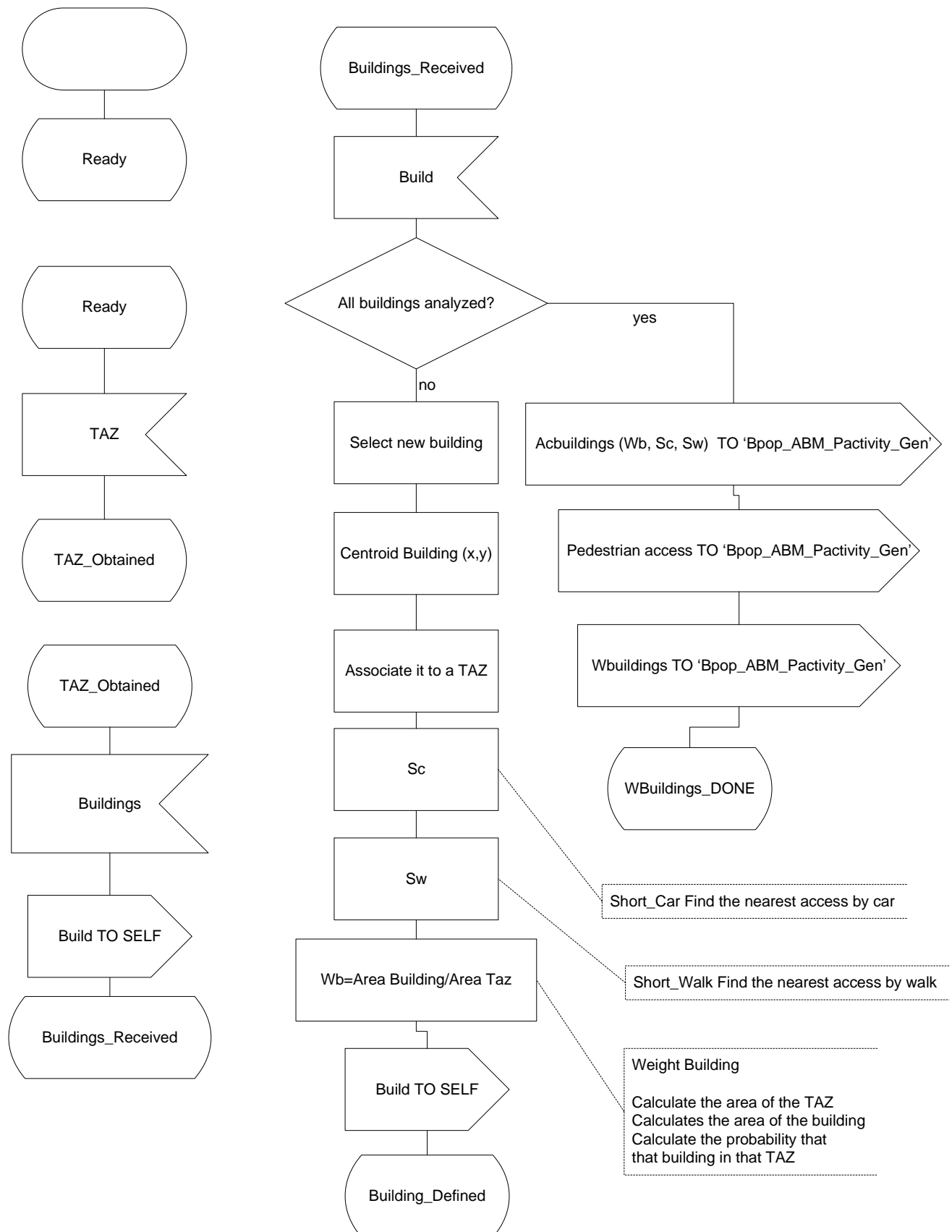




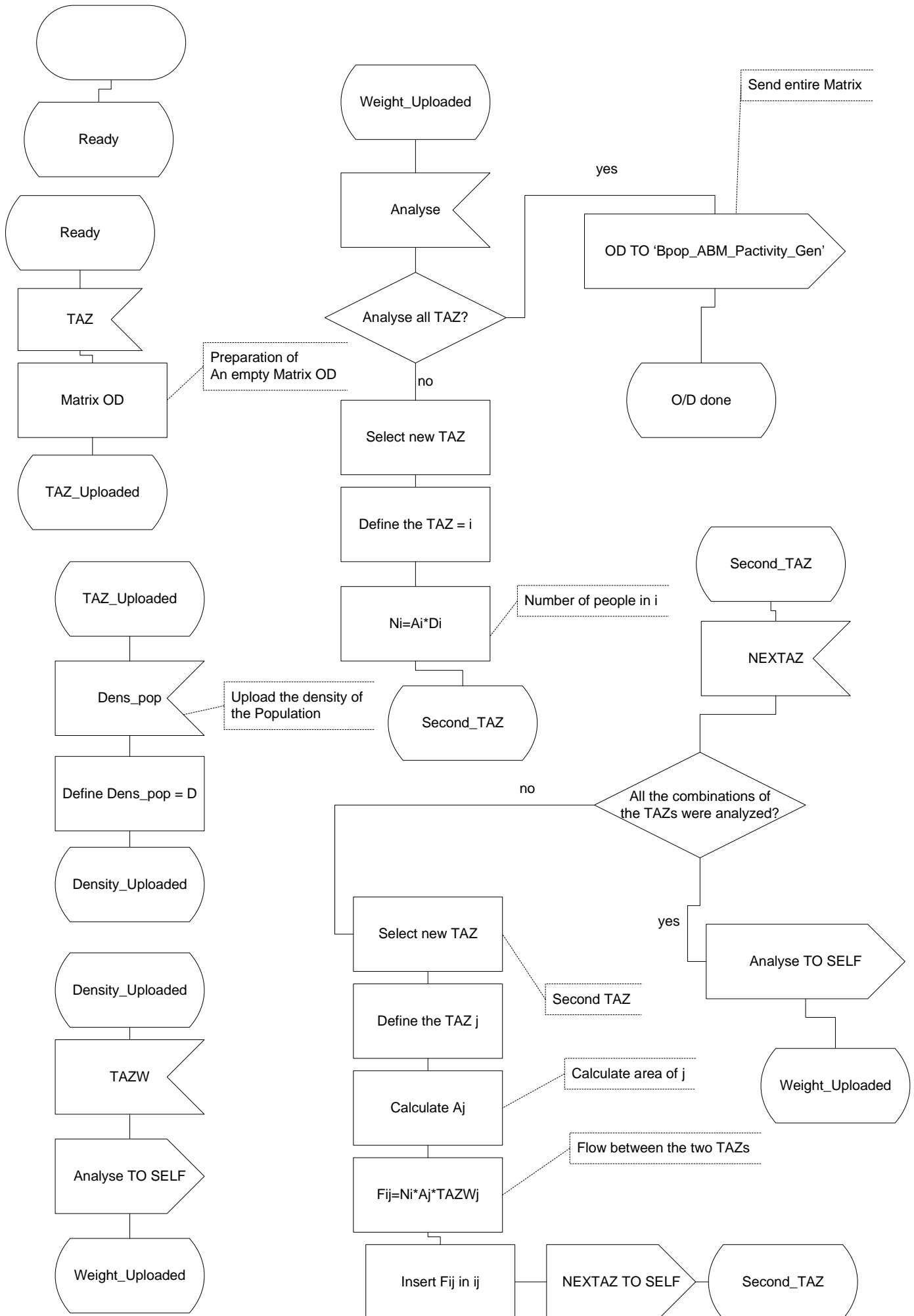


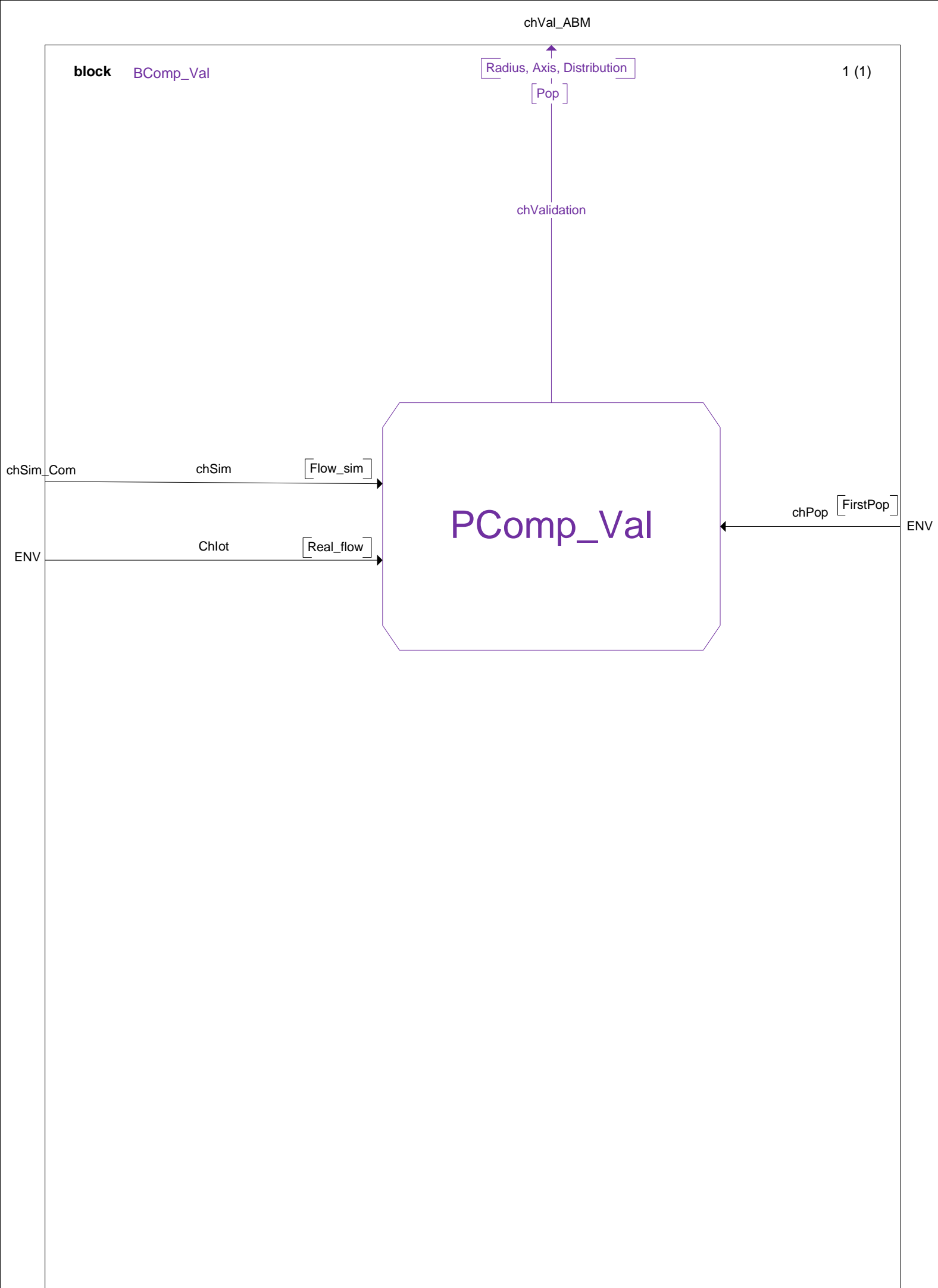














process

PComp\_Val

Constraints and initial Values  
Of Radius, Ellipsoid, (see ABM)

Change Hours

Define DELTA

Define first Geometry

Opt\_Initialized

Time sample  
24 h  
Min, seconds

Radius TO 'Bpop\_ABM\_Pactivity\_Gen'

Axis TO 'Bpop\_ABM\_Pactivity\_Gen'

Distribuiton TO 'Bpop\_ABM\_Pactivity\_Gen'

Mean and variance

ready

Sim\_Captured

ready

init

Ztot, Time, Mtot=0

Opt\_Initialized

FirstPop

Ztot TO SELF

Store Pop

Time To SELF

Pop TO 'BPop\_ABM\_PActivity\_Gen'

Ztot

Optimization done?

Pop\_ok

DataR\_Captured

Sum Ztot To Mtot

According  
To criterrias

Pop\_ok

Flow\_sim

Implement Delta to time

Real\_flow

Y=Flow\_sim

Sensor TO SELF

HP  
From ENV every  
24 h

X=Real\_Flow

init

During all 24 h  
And for each hour

DataR\_Captured

Sim\_Captured

Checking\_Sensor

BS

ABM

Change time

Time

Relative  
To the file

All 24 h checked?

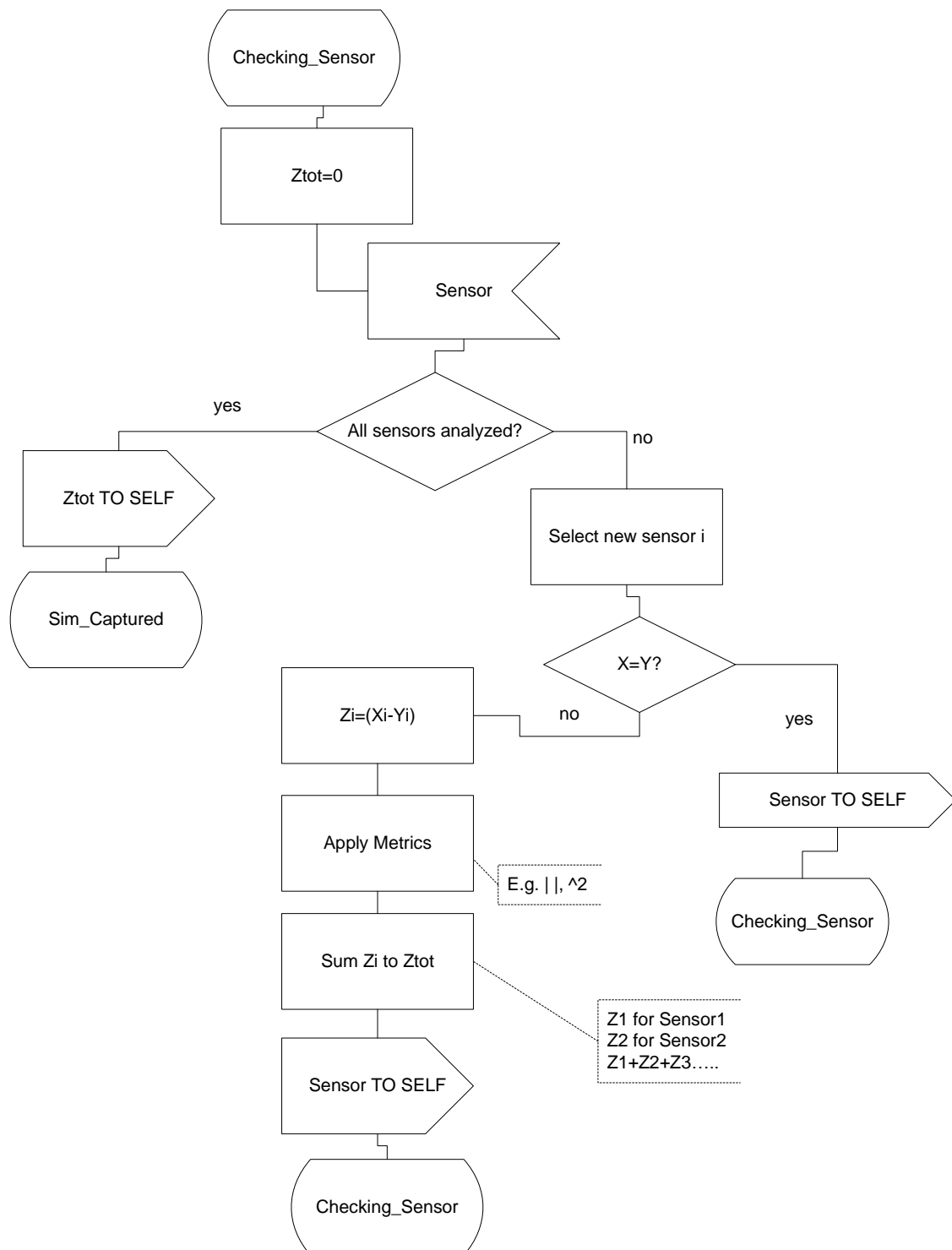
yes

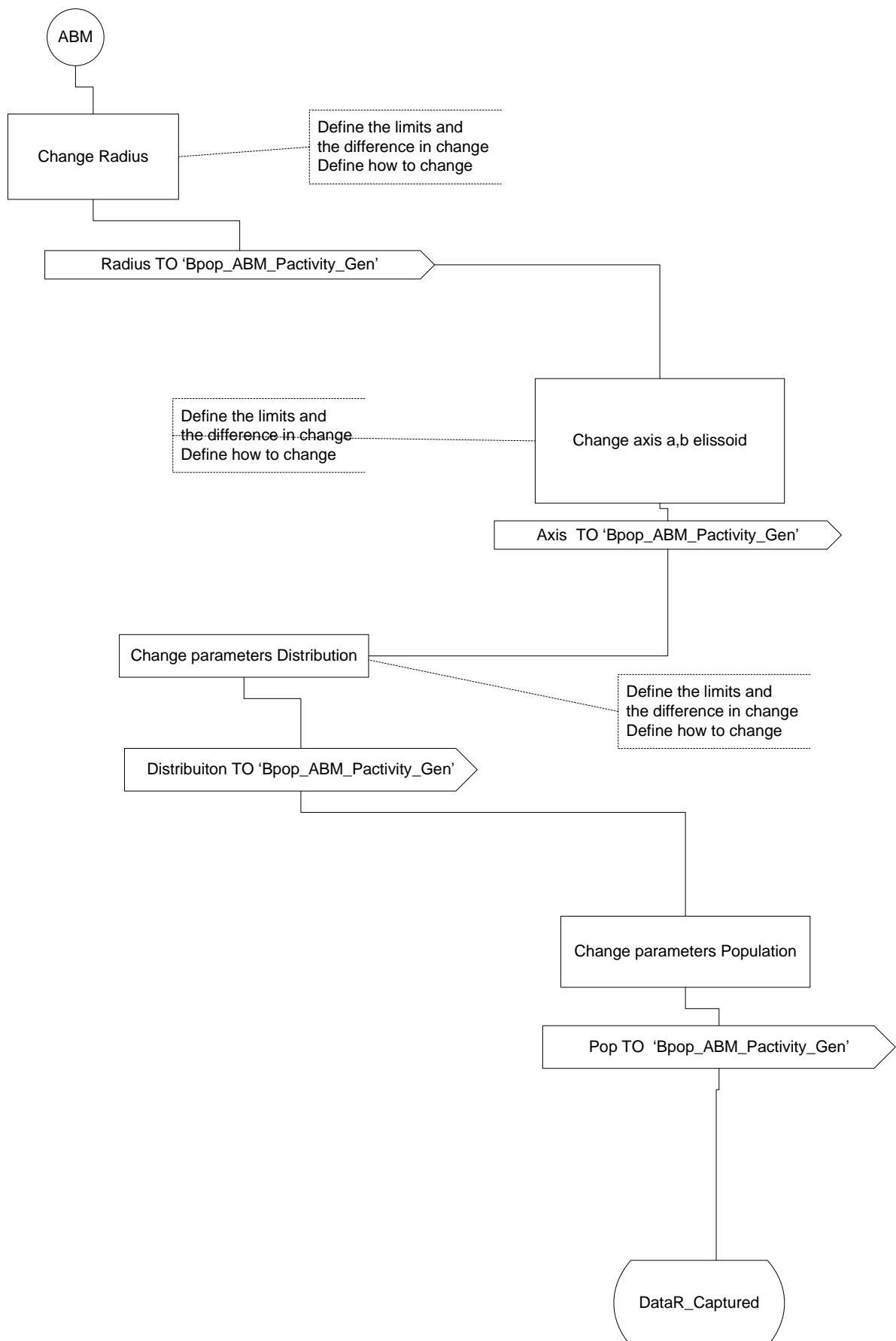
Apply Metric and  
Store the result

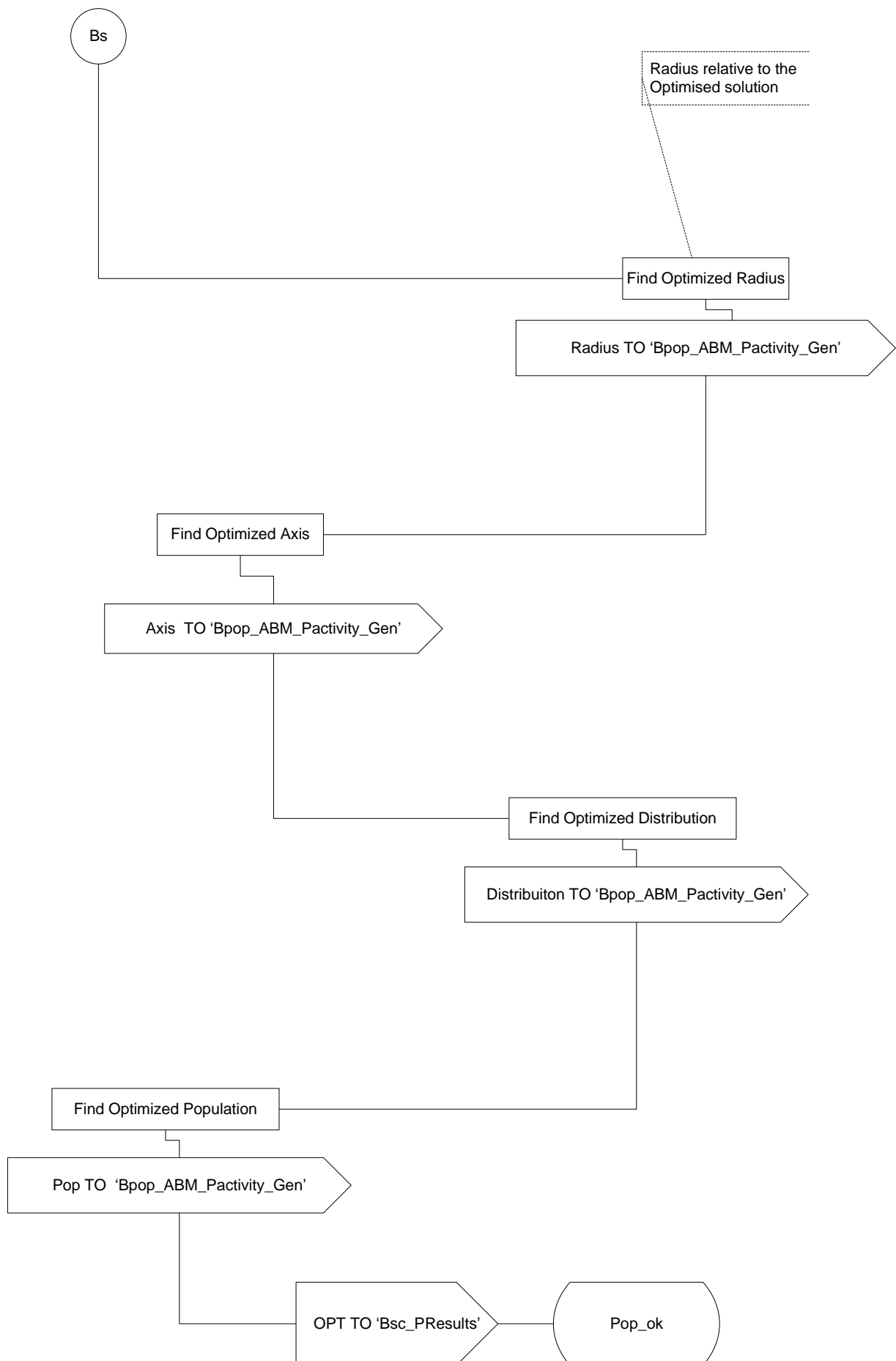
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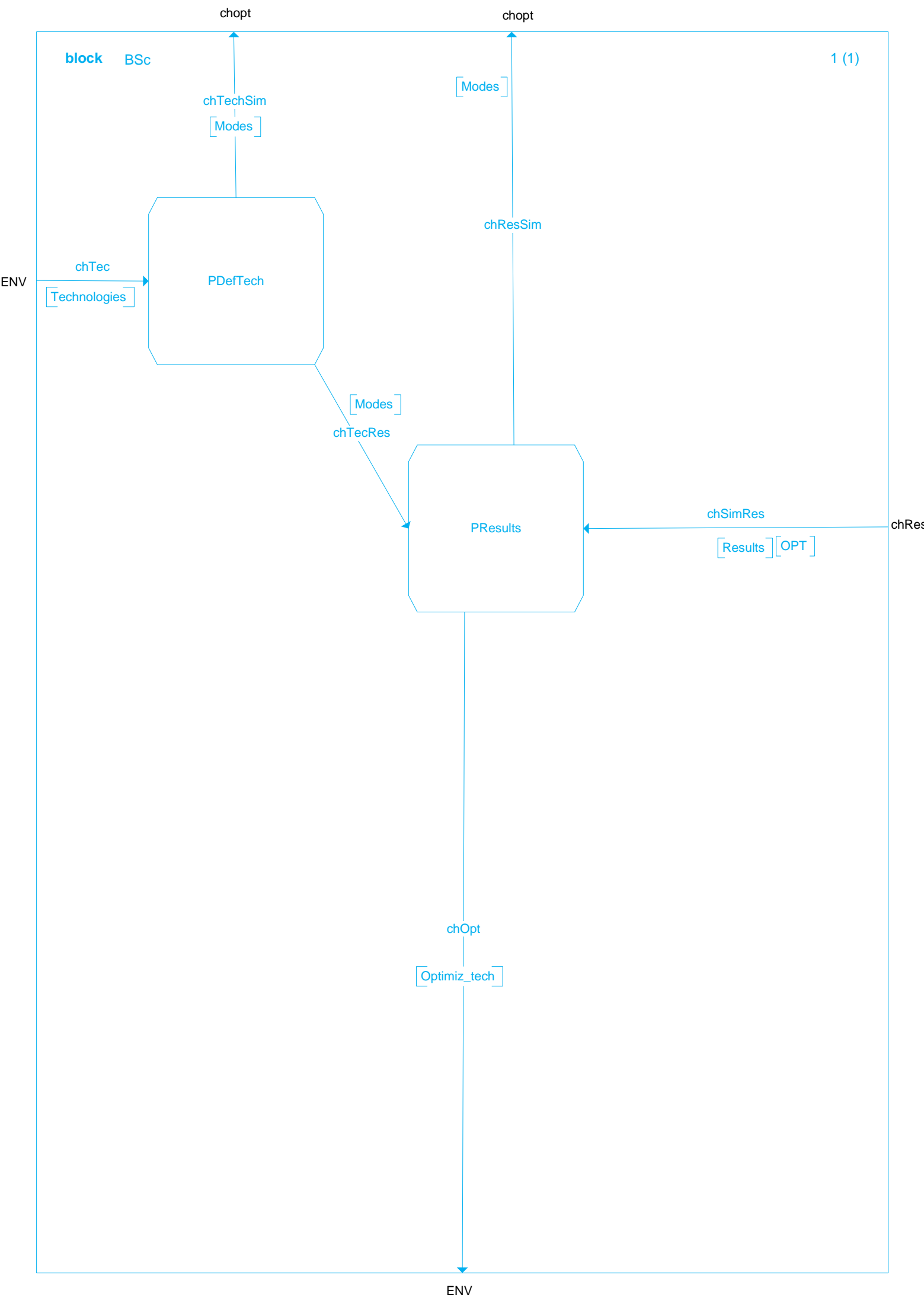
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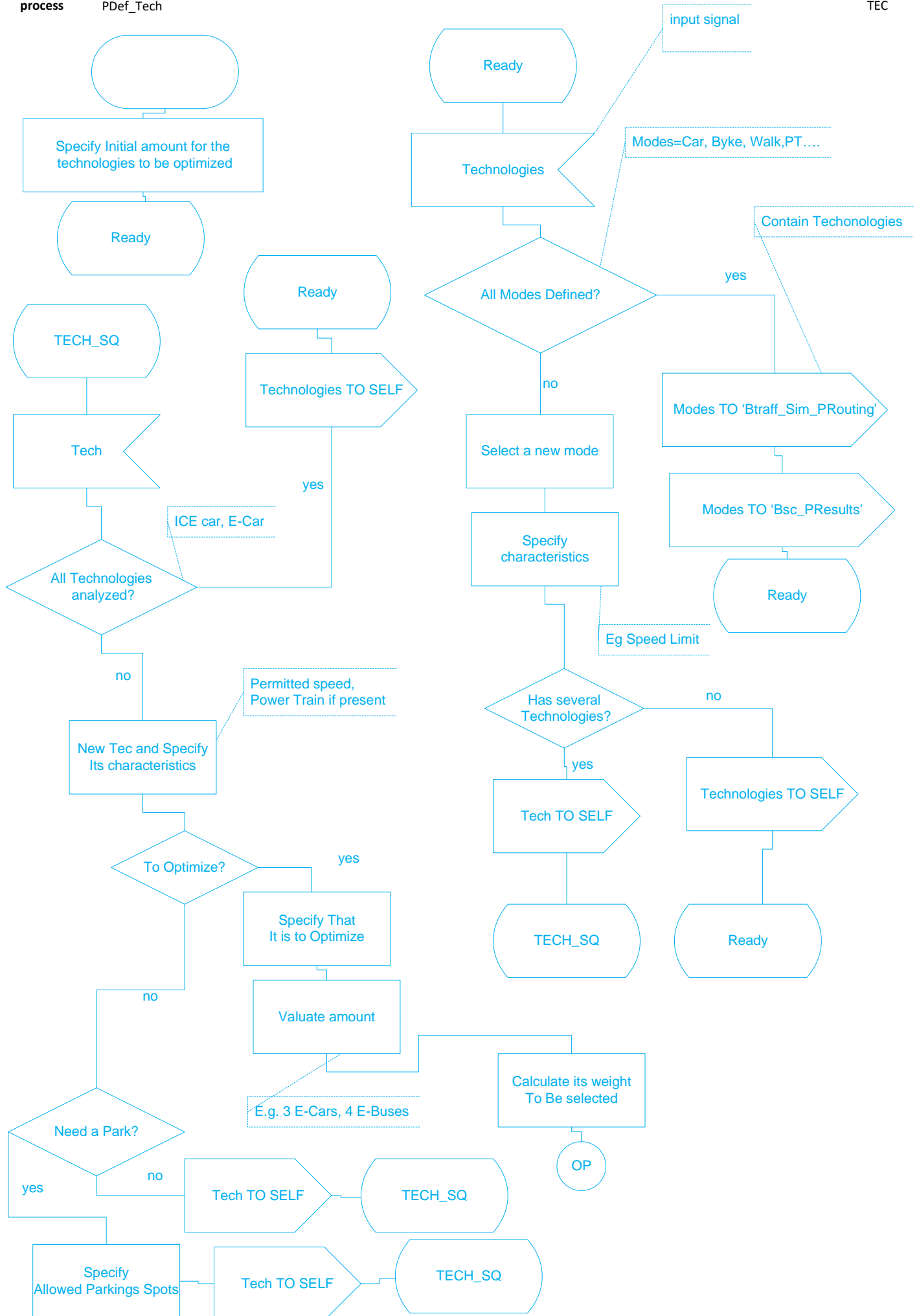
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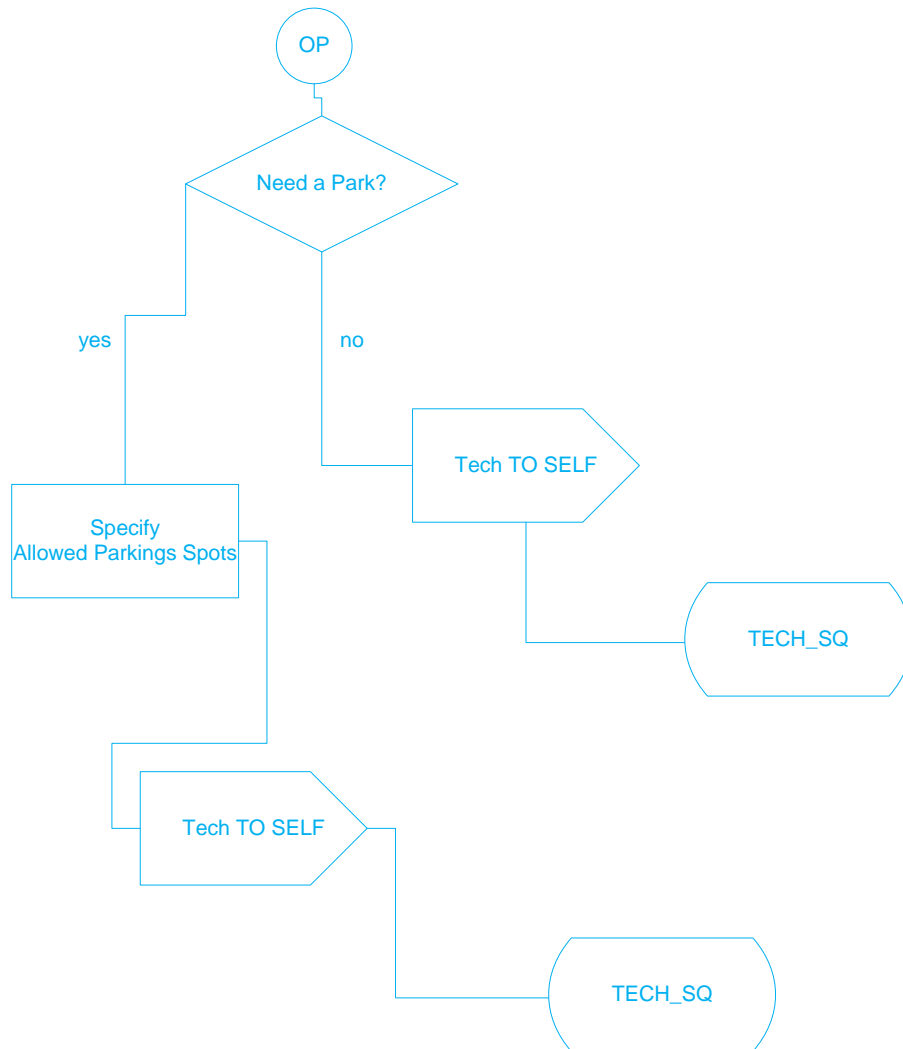


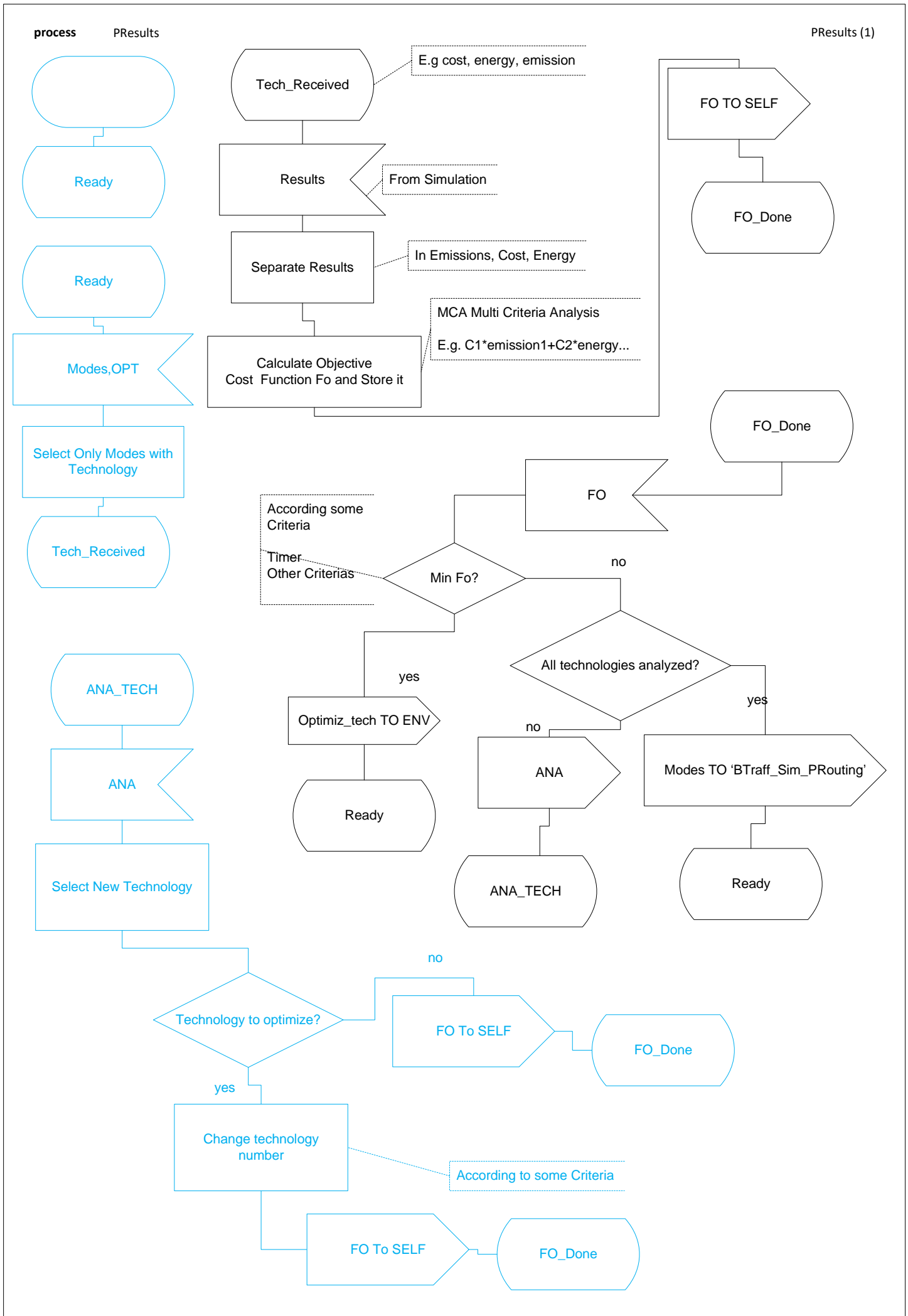




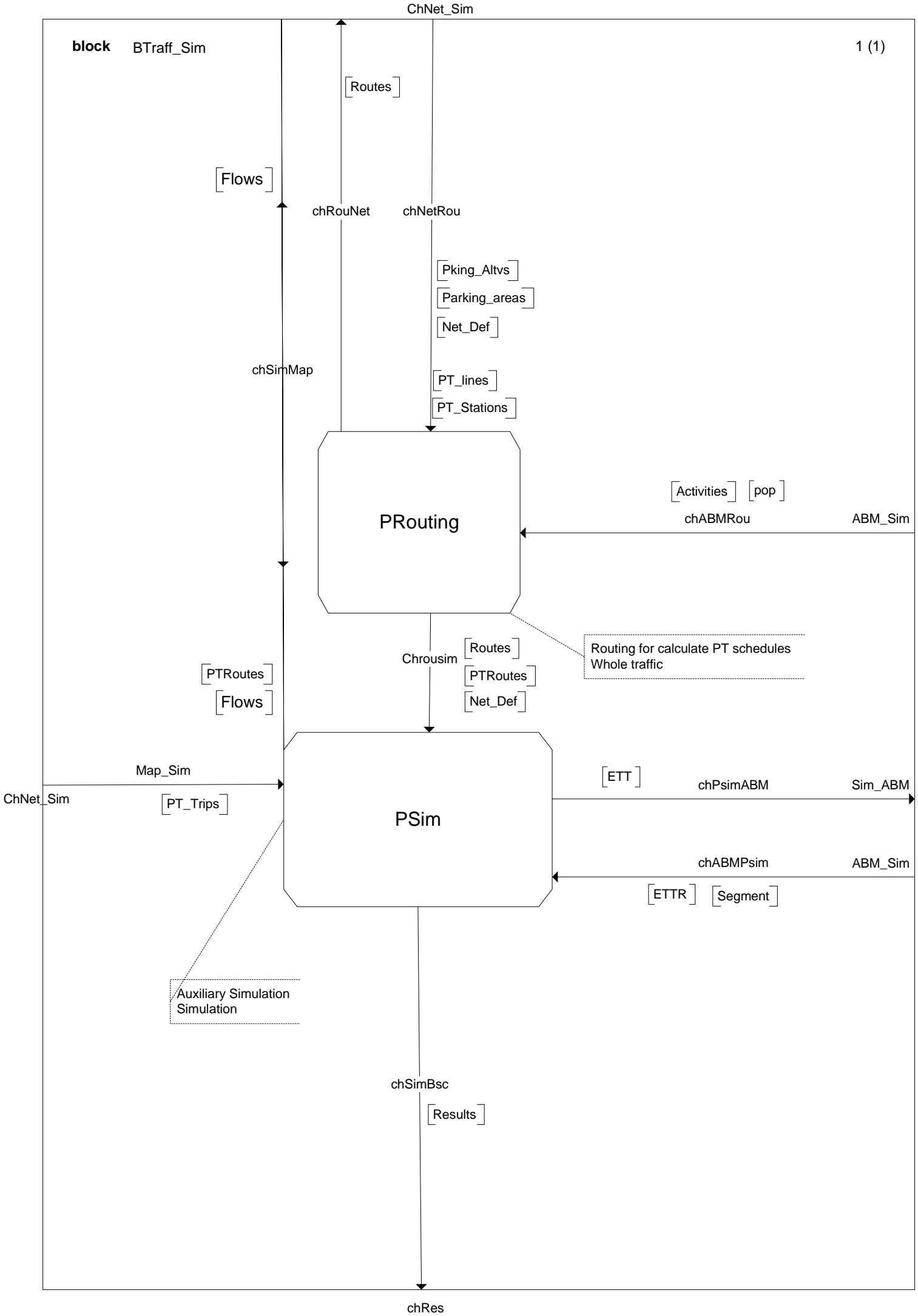


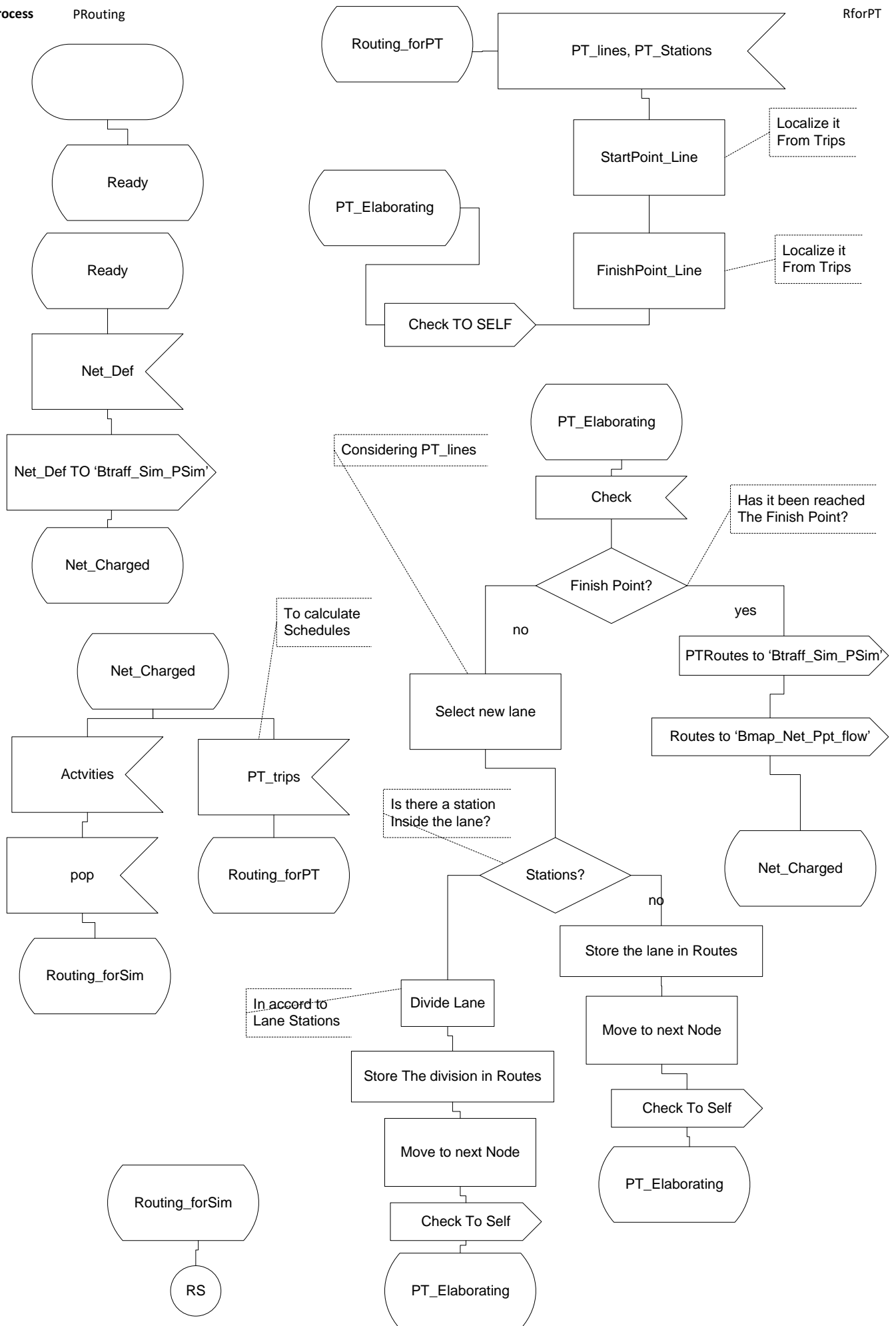


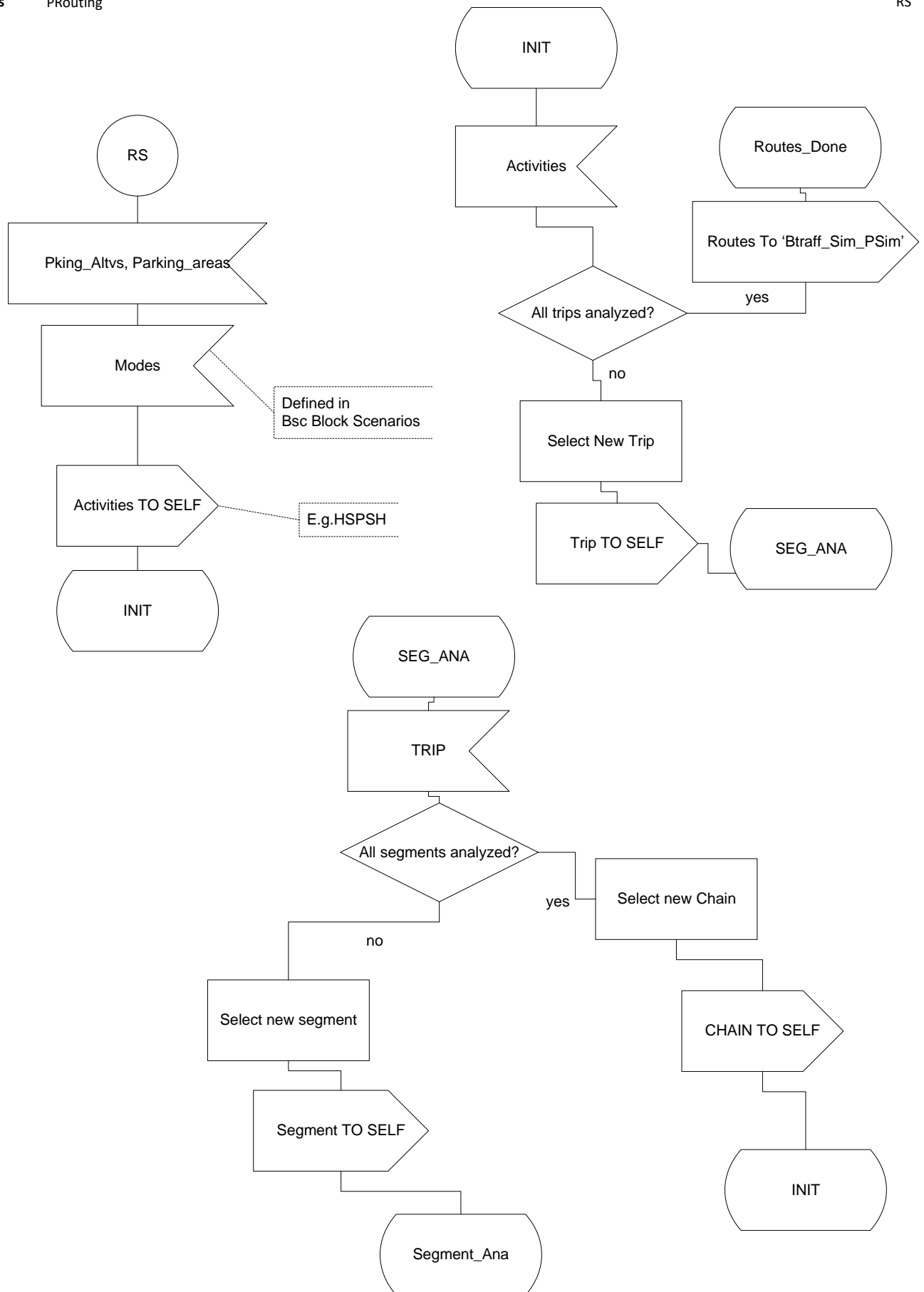


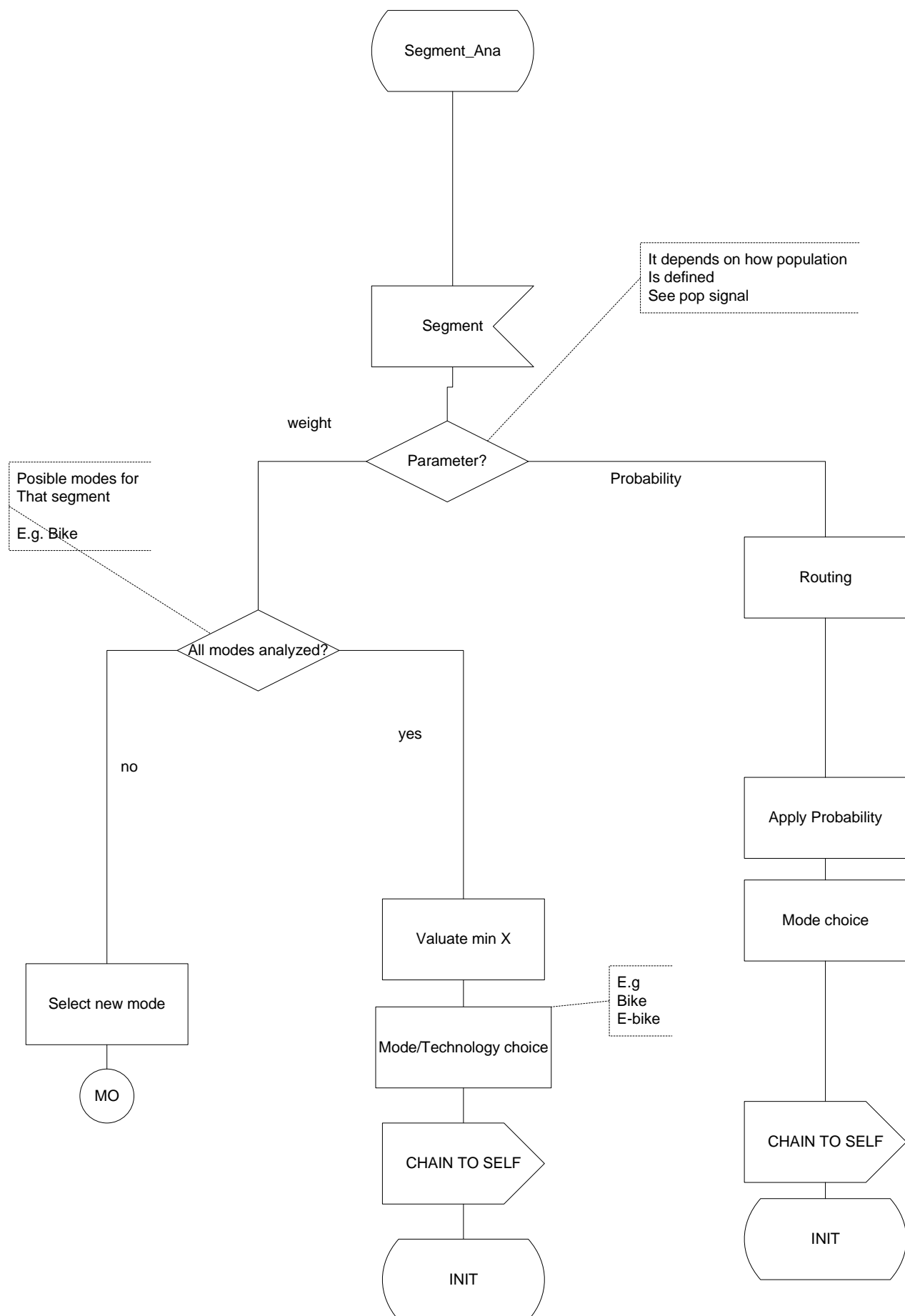


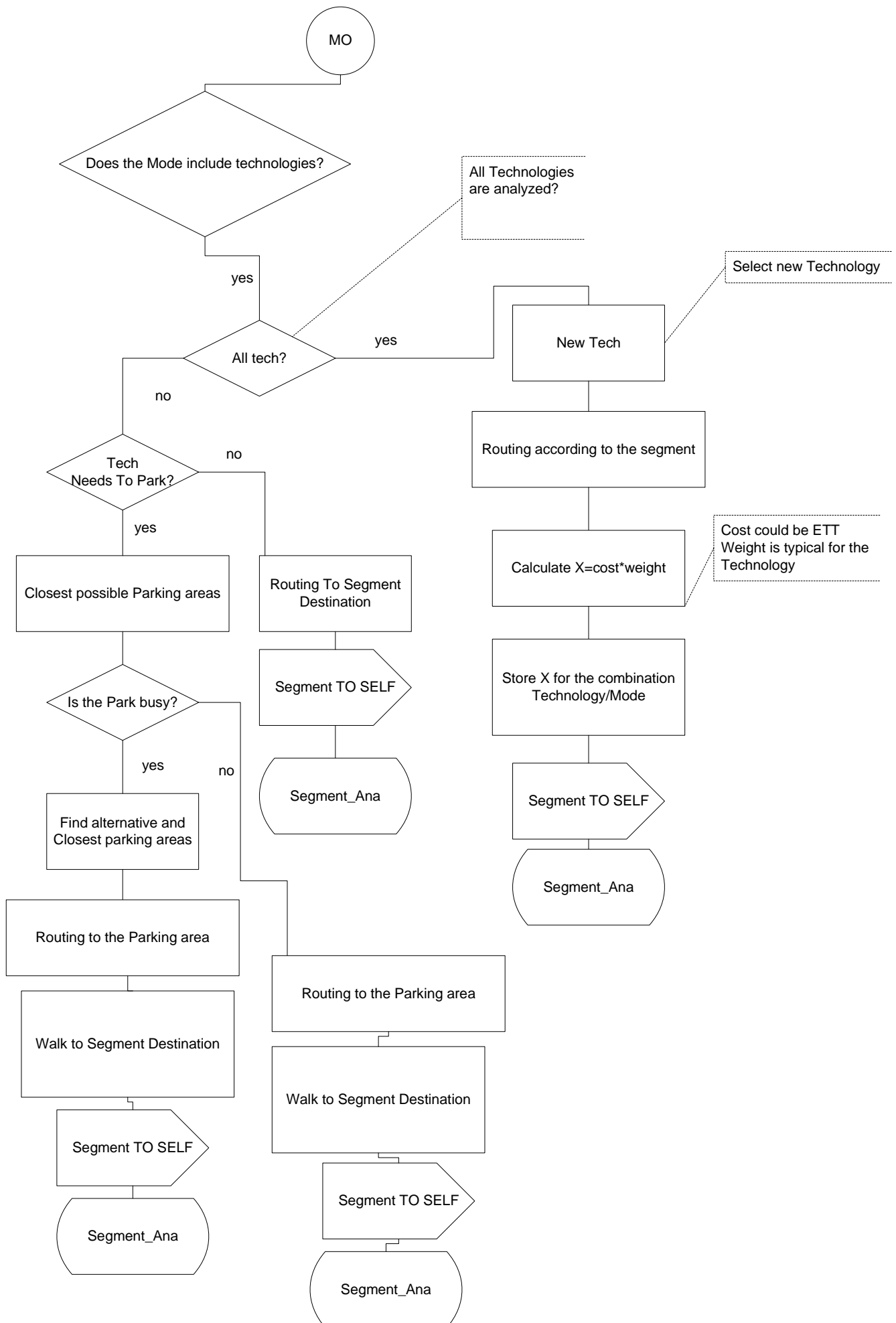


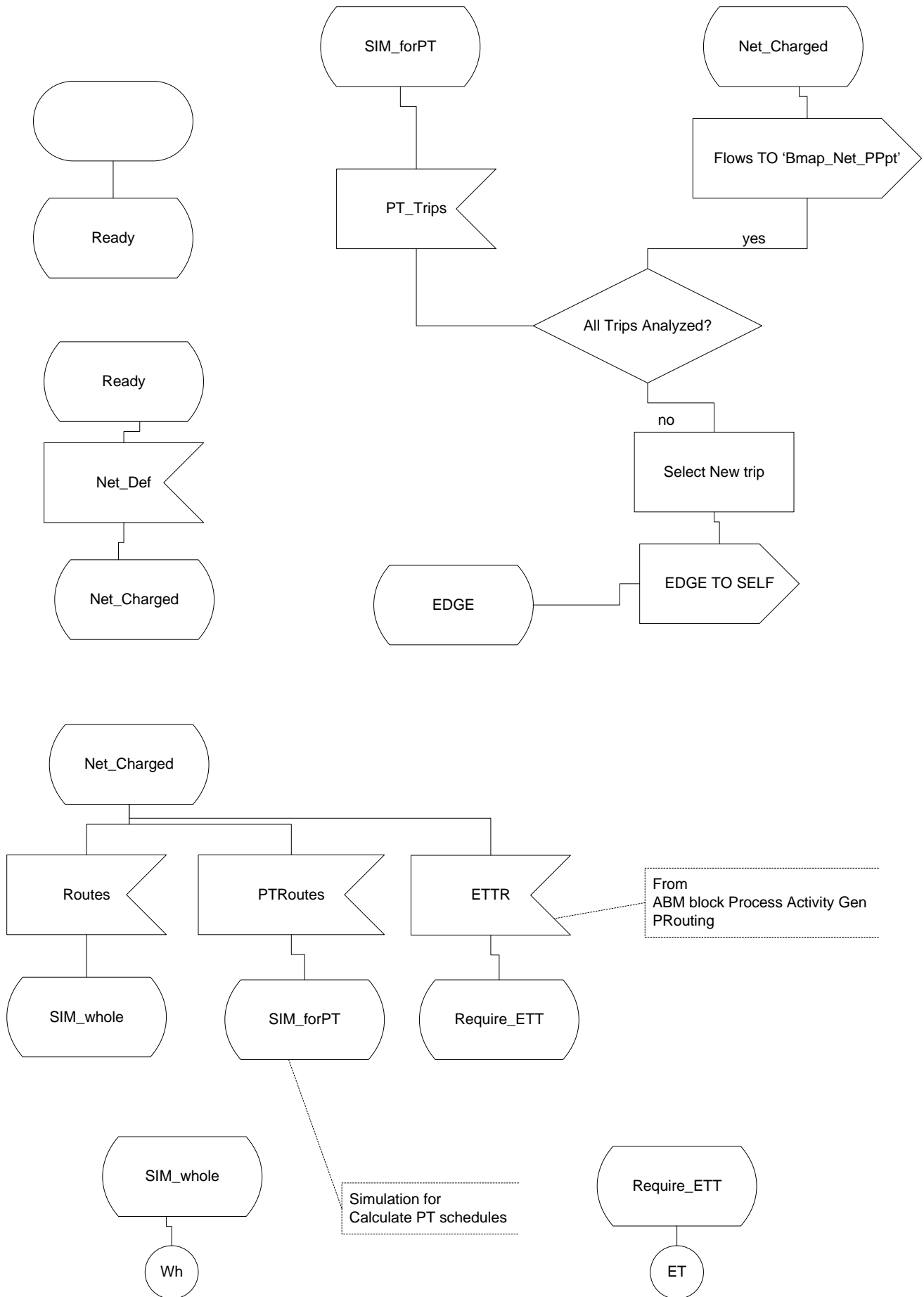


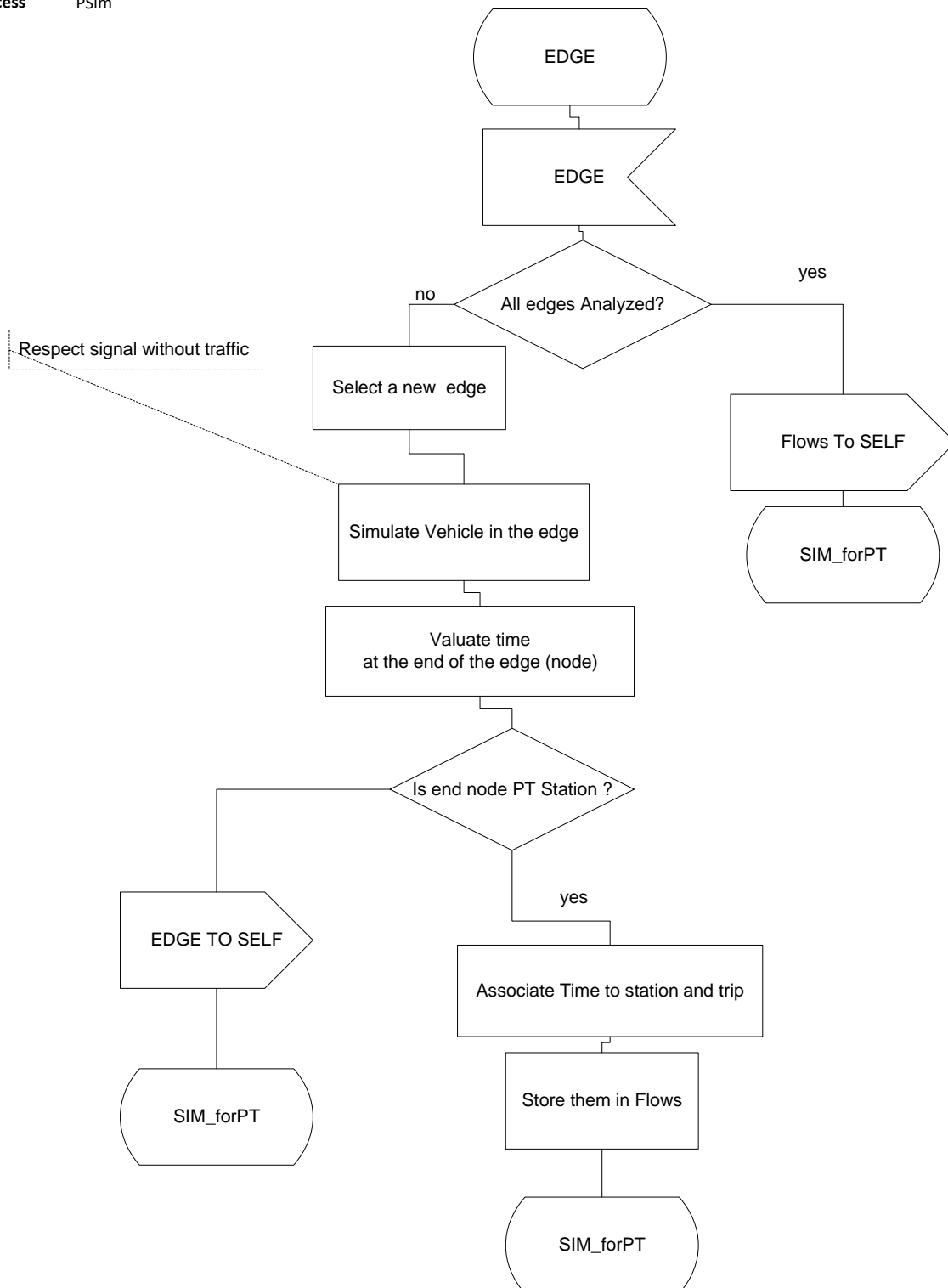


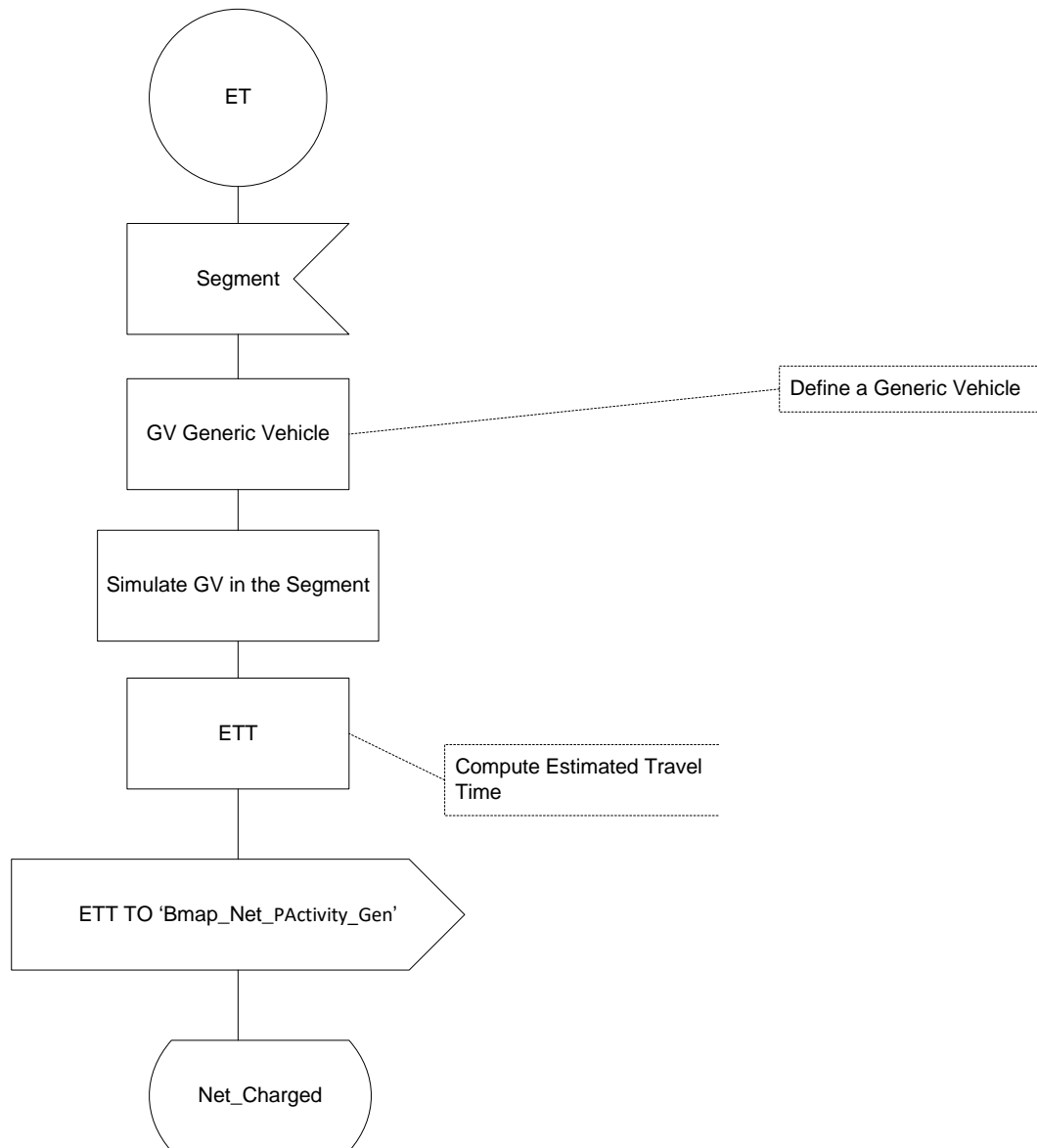




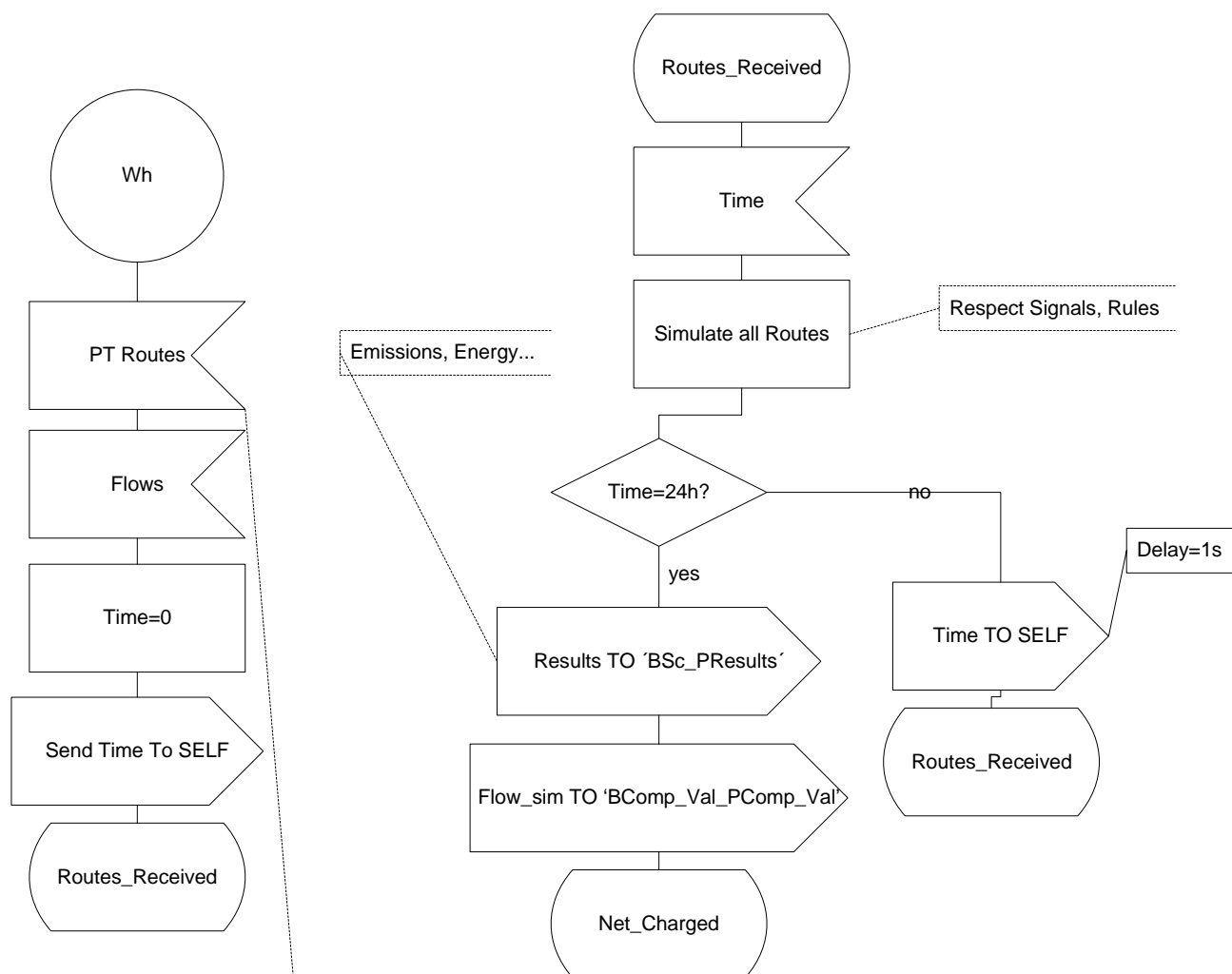












Emissions, Energy...

Respect Signals, Rules

Time=24h?

no

yes

Results TO 'BSc\_PResults'

Flow\_sim TO 'BComp\_Val\_PComp\_Val'

Net\_Charged

Delay=1s

Time TO SELF

Routes\_Received

Wh

PT Routes

Flows

Time=0

Send Time To SELF

Routes\_Received

Vehicles and lines  
Are specified