# BRD - [BR] Smart Sorting & Routing Solution

| Requestor | Vivian |
|---|---|
| **Date requested** | Dec 2021 |
| **Scope** | SPX system |
| **Priority** | P1 |
| **Reviewed by** | Turk |

**Revision history**

| Date | Changes | Author |
|---|---|---|
| 2021-12-01 | First version | Turk |
| | | |
| | | |
| | | |

# 1 Overview

## 1.1 Business Background

BR SPX is planned to launch (go-live) by End Jan and one key difference between SPX in SEA VS BR is that BR SPX is integrating with an external company (called Routeasy) in order to optimize LM delivery efficiency.

The scope of Routeasy is to provide
1. **Order grouping**: to help sorters improve sorting efficiency in hub by avoiding the need to manually sort parcels based on buyers text address
2. **Delivery sequence:** to reduce the need for drivers to perform manual delivery sequence based on buyers text address (e.g. based on ID SPX, on avg drivers need to spend around 30mins-1hr to manually sequence parcels)
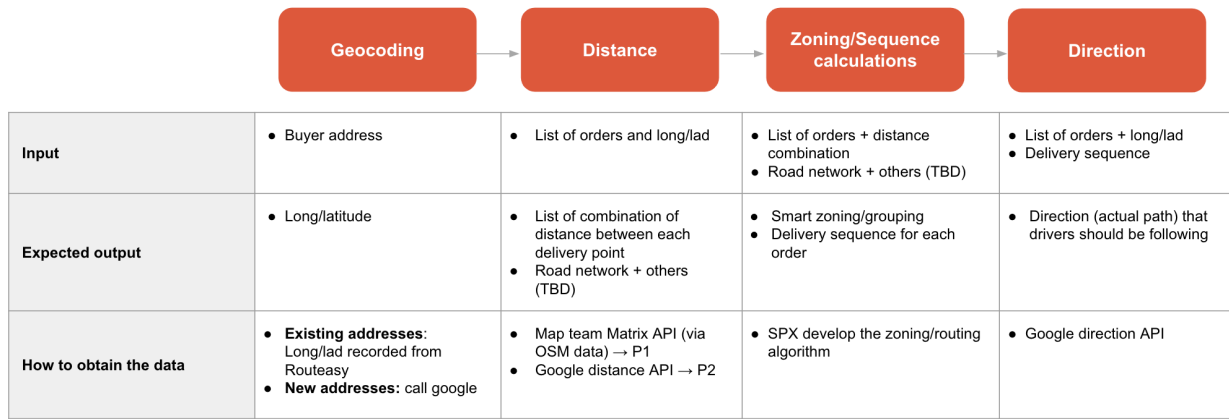
However, it is not sustainable for BR SPX to continue using Routeasy in the long-term due to multiple reasons
- **Cost:** Shopee needs to pay 0.04 USD for every order that we use Routeasy service
  Forecasted ADO for BR SPX in Dec'22 will be around 190k which can be translated into 7.6k of cost for calling Routeasy per day (228k/month)

- **Data security**: Shopee needs to send order information, including buyer address, to Routeasy; hence, it is not ideal to share this information to external parties

## 1.2 Business Objective

To replace Routeasy by developing in-house capability to perform order grouping and routing solution to improve LM delivery efficiency

| Geocoding | Distance | Zoning/Sequence calculations | Direction |
| --- | --- | --- | --- |

| | Geocoding | Distance | Zoning/Sequence calculations | Direction |
| --- | --- | --- | --- | --- |
| **Input** | ● Buyer address | ● List of orders and long/lad | ● List of orders + distance combination<br>● Road network + others (TBD) | ● List of orders + long/lad<br>● Delivery sequence |
| **Expected output** | ● Long/latitude | ● List of combination of distance between each delivery point<br>● Road network + others (TBD) | ● Smart zoning/grouping<br>● Delivery sequence for each order | ● Direction (actual path) that drivers should be following |
| **How to obtain the data** | ● **Existing addresses**: Long/lad recorded from Routeasy<br>● **New addresses:** call google | ● Map team Matrix API (via OSM data) → P1<br>● Google distance API → P2 | ● SPX develop the zoning/routing algorithm | ● Google direction API |

### SPX BR ADO forecast for reference

| Hub Name | Jan-22 | Feb-22 | Mar-22 | Apr-22 | May-22 | Jun-22 | Jul-22 | Aug-22 | Sep-22 | Oct-22 | Nov-22 | Dec-22 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Barueri | 2,615 | 2,771 | 2,938 | 3,114 | 3,301 | 3,499 | 3,709 | 3,931 | 4,762 | 5,048 | 6,222 | 5,973 |
| Central SP | | 4,620 | 4,898 | 5,192 | 5,503 | 5,833 | 6,183 | 6,554 | 7,940 | 8,416 | 10,373 | 9,958 |
| North SP | | 3,880 | 4,112 | 4,359 | 4,621 | 4,898 | 5,192 | 5,503 | 6,667 | 7,067 | 8,710 | 8,361 |
| Southeast SP | | | 4,783 | 5,070 | 5,374 | 5,697 | 6,039 | 6,401 | 7,754 | 8,219 | 10,130 | 9,725 |
| West SP | | | 5,030 | 5,332 | 5,652 | 5,991 | 6,351 | 6,732 | 8,155 | 8,644 | 10,654 | 10,228 |
| Guarulhos | | | | 6,835 | 7,245 | 7,680 | 8,141 | 8,629 | 10,454 | 11,081 | 13,657 | 13,111 |
| São Bernardo | | | | 6,792 | 7,200 | 7,631 | 8,089 | 8,575 | 10,388 | 11,011 | 13,571 | 13,028 |
| Osasco | | | | | 4,548 | 4,821 | 5,110 | 5,417 | 6,562 | 6,956 | 8,573 | 8,230 |
| Aruja | | | | | 1,462 | 1,550 | 1,643 | 1,742 | 2,110 | 2,236 | 2,756 | 2,646 |
| Suzano | | | | | | 5,502 | 5,832 | 6,182 | 7,488 | 7,938 | 9,783 | 9,392 |
| Cidade Dutra | | | | | | 3,296 | 3,494 | 3,703 | 4,486 | 4,755 | 5,861 | 5,626 |
| Maua | | | | | | 2,716 | 2,879 | 3,052 | 3,697 | 3,919 | 4,831 | 4,637 |
| Cajamar | | | | | | | 2,271 | 2,407 | 2,916 | 3,091 | 3,810 | 3,658 |
| Total ADO | 2,615 | 11,271 | 21,761 | 36,694 | 44,906 | 59,114 | 64,932 | 68,828 | 83,380 | 88,383 | 108,932 | 104,575 |
| % ADO Growth | | 331.11% | 93.06% | 68.62% | 22.38% | 31.64% | 9.84% | 6.00% | 21.14% | 6.00% | 23.25% | -4.00% |

Please find the process flow below
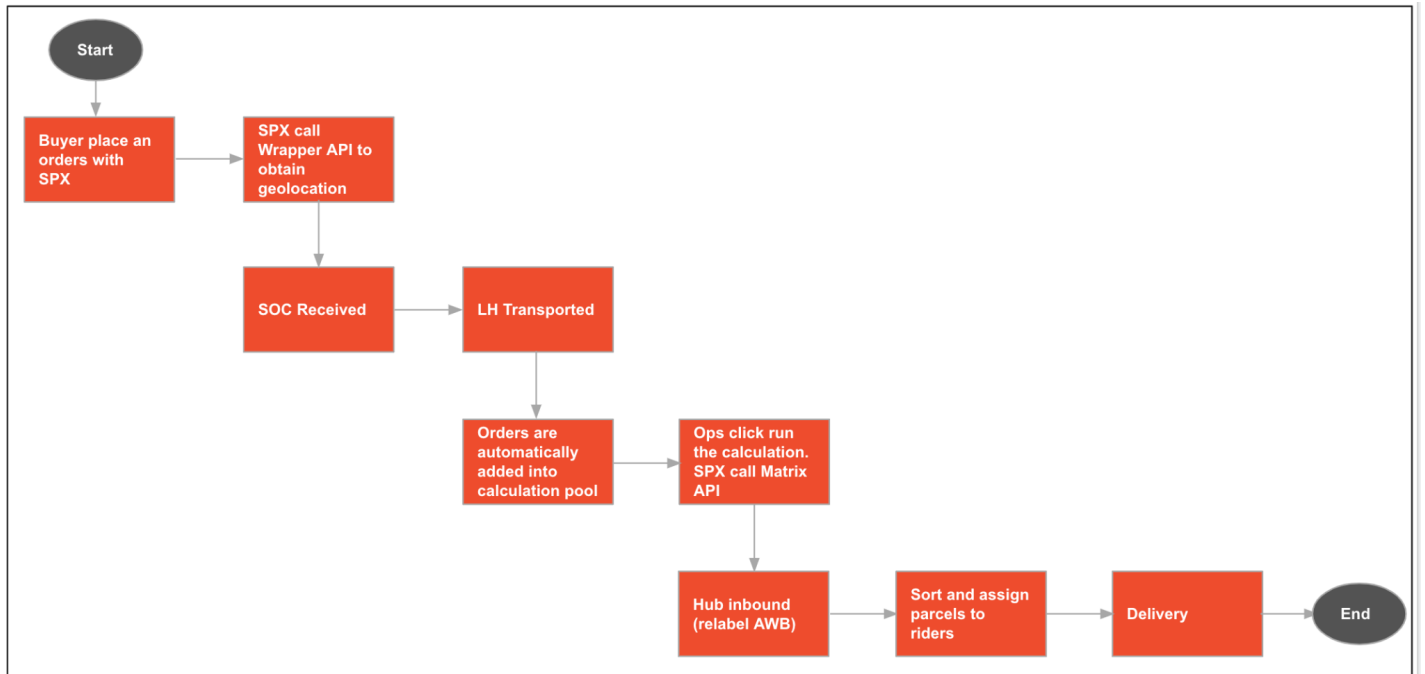
# 2 Detailed Business Requirements

## 2.0 Building address DB for obtaining order geolocation

| Function | Details | Team |
|---|---|---|
| Build address DB for BR SPX | • Order geolocation is a key prerequisite that system needs to obtain in order to perform order grouping/routing<br>• Hence, SPX will need to build address DB by utilizing address info based on a few sources | SPX/Map |

| | Category | Description | Data source |
|---|---|---|---|
| 1 | Geolocation from routeasy | Utilize the geolocation that SPX called and recorded from Routeasy | Table name: xxx |
| 2 | Geolocation from google | Geolocation that SPX can obtain from calling google via Map team API | Map team wrapper API |
| 3 | Geolocation from pickup drivers | Geolocation obtained from the proof of pickup that | Table name: xxxx |

| | | system recorded | | |
|---|---|---|---|---|
| | 4 | Geolocation from delivery drivers | Geolocation obtained from the proof of delivery (POD) that system recorded | Table name <mark>xxx</mark> | |

| Function | Details | Function |
|---|---|---|
| Logic for determining the geolocation that the system shall use | • After the buyer places an order for SPX as LM delivery, system to search for the specific address in the address library<br>   - If there is an exact match, to use the existing long/lad obtained from address DB<br>   - If there is no exact match, to call Map team wrapper API to obtain the long/lat from google<br>• Once the system called google to obtain long/lad, to record it in our address DB | SPX |
| Validating the accuracy of the geolocation | • System will need to have some validation before ingesting the geolocation into our address DB, especially for data source 3) and 4)<br>• <span style="color:red">To call geo reverse admin polygon API to convert driver confirmation long/lad into admin polygon VS buyer input admin level. If same then, add long/lat into the address DB</span> | SPX |
| Updating address library | • To update the address library on a <u>weekly basis</u> by including data source 3) geolocation from pickup drivers and 4) geolocation from delivery drivers | SPX |

## 2.1 Calculating the distance between each order in the pool

| Function | Details | Function |
|---|---|---|
| Calculating the distance between each order | • SPX will need the distance calculation between each buyer location by Map team<br>• This will be mainly used for SPX to determine order grouping/routing based on our business logic | SPX/Map |
| SPX to call Map's Matrix API | • SPX to call Map's Matrix API to obtain this distance combination<br>• API document for reference https://confluence.shopee.io/pages/viewpage.action?spaceKey=SGST&title=%5BPRD%5D+All-Matrix+API<br>• (Specific inputs parameter required will further be determined by SPX | SPX |

| | FPM & Map PM) | |
|---|---|---|
| |  | |

## 2.2 Building order grouping and routing tool to improve LM delivery efficiency

| Function | Details | Function |
|---|---|---|
| Determine order grouping and routing tool | <ul><li>SPX will need to run the order grouping and routing to improve the last mile delivery efficiency</li><li>Hub operator will use this order grouping to do sorting in hub based on the same group</li><li>Then, after handover the parcels to drivers, they will use the routing to determine the delivery sequence that they will need to follow</li></ul> | SPX |
| Objective function for running the order grouping/routing | <ul><li>At the start, the objective function for SPX is to run order grouping/routing by minimizing the total travelling distance by drivers in each batch</li><li>In the future (phase 2), SPX can also increase the complexity by including other consideration such as duration and cost</li></ul> | SPX |
| Order calculation pool | <ul><li>Ops will be the one to do this calculation manually; hence, system will need to add the list of orders into the calculation pool</li><li>The module for triggering this calculation will be determined in section 2.3</li></ul> How to determine which orders to be added into the calculation pool <ul><li>Same as current logic</li></ul> | SPX |

| | | |
|---|---|---|
| | ● For those orders that belong to the same LM hub and are in "<mark>LH_transported</mark>" status, system will need to add those orders into the same calculation pool (<u>similar to the current Routeasy logic</u>) | |
| Input parameter that the system to consider | ● System will need to allow users to set a number of input parameters to generate order grouping/routing | SPX |

| | Input parameter | Description |
|---|---|---|
| 1 | Objective function | ● Default based on <span style="color:red">min total travelling distance</span> |
| 2 | Vehicle type | ● <mark>Define different vehicle types that operation has e.g. 2WH/3WH/4WH etc.</mark> |
| 3 | # Vehicle/Drivers | ● <mark>Define # of drivers that are available so that system can allocate/distribute parcels among those available drivers</mark> |
| 4 | Drivers capacity | ● Define drivers capacity based on weight/dimension |
| 5 | Max travelling distance | ● Define max travelling distance that drivers can travel in each trip |
| 6 | Clustered/group | ● Define cluster/area which can be grouped together based on zip codes |

<table>
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○

- System would need to run the order grouping that satisfied all of these 6 conditions e.g. allocate/distribute orders to all available drivers by ensuring that each driver will travel in a min distance
- The detail logic on how users can do this setting will be determined in section 2.3
- Other parameter such as priority of customer, hour of operation will be considered in later phase

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**Exception case that system can't satisfy all 5 input parameters**

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- In some circumstances where system can't run the order grouping, users can have two options
  1. To continue with the ops process by manually add the orders into the assignment task themselves
  2. To manually orders into the order calculation pool so that it can be recalculated in the next batch

</td><td>SPX</td></tr>
</table>

## 2.3 Changes to the SPX system to support order grouping/routing

| Function | Details | Function |
|---|---|---|

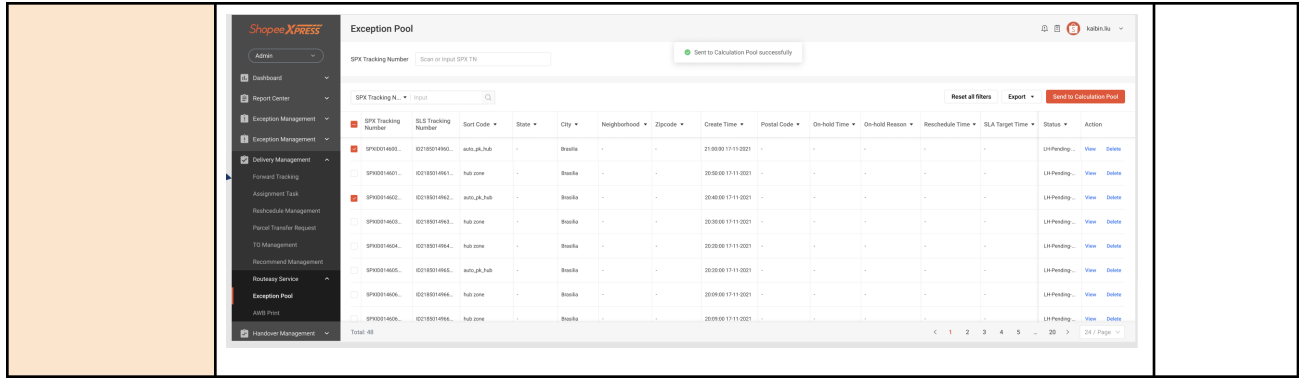| Function | Details | Function |
|---|---|---|
| Hub receiving and assignment task creation | • LM hub inbound and assignment task creation process will **remain the same as current**<br>• System to automatically create the assignment task and add the orders into the task based on the order grouping done by the system | SPX |
| Module for running order calculation | • To change the wording from "Routeasy service" module to "Order routing service" module<br>• To split into 3 sub-modules<br>  ○ Input parameters config<br>  ○ Route calculation pool<br>  ○ AWB printing<br>  ○ Route overview | SPX |

## 2.3.1 Input parameter config

| Function | Details | Function |
|---|---|---|
| Module for users to define input parameter in SPX system | • Under Admin > Order routing service, to add a new module called "Input parameter configuration" for users to perform setting for the input parameters in the following step<br>**Step 1: Vehicle type**<br>• Users can define the vehicle type<br>  ○ 2WH<br>  ○ 3WH<br>  ○ 4WH<br>  ○ 6WH<br>**Step 2: # of Vehicle/Drivers**<br>• Users can define the # of vehicle/driver that are coming to work on each day based on each vehicle type<br>  ○ Integer number 0 to 1,000<br>  ○ If the users set the # of drivers for every vehicle type as 0, do not allow users to perform this setting (display an error saying that at least 1 vehicle need to be set)<br>**Step 3: Vehicle capacity**<br>• Users can define the max capacity for each vehicle type (optional field, users can toggle on/off)<br>  ○ Weight (Kg) | SPX |

| | | |
|---|---|---|
| | ■ Integer, need to be >= 0 <br> ○ Dimension (L x W x H) <br> ■ Integer, need to be >=0 <br> ○ Users can set validation base on either weight or dimension or both weight and dimension <br><br> **Step 4: Max travelling distance/trip** <br> ● Users can define the max travelling distance/trip by the drivers, system will use this information to ensure that the travelling distance by each driver is less than this limit (optional field, users can toggle on/off) <br> ○ Integer, need to be >=0 <br> ● After users fill in info for all the 3 steps, allow users to click confirm setting and also allow users to edit/make changes on the current settings | |
| Clustered/group | ● In addition to the above settings, users will define the clustered/group based on which area that the system can group parcels together <br> ● This clustered will be determined based on the sorting code define in Admin > Address management at the zipcodes level <br> ● For instance, if users define a sorting code 1 consisting of zipcode A and B, then sorting code 2 consisting of zipcode C and D <br> System will need to group orders in zipcode A and B and not mixing orders in zipcode C and D into the same grouping (since they belong to different sorting code) | SPX |

## 2.3.2 Route calculation pool

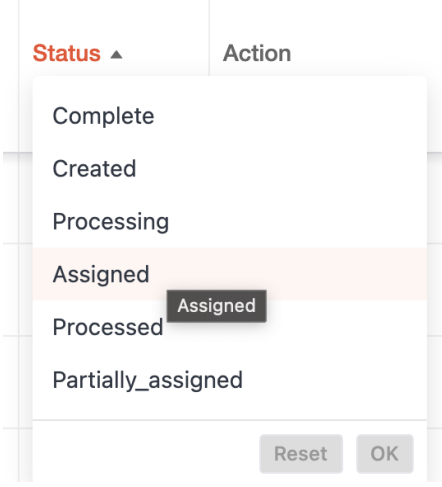| Function | Details | Function |
|---|---|---|
| Route calculator pool | ● To change the wording from "Exception calculation pool" to "Route calculation pool" where both the new and exception orders will be automatically added by the system for running calculation <br> ● The logic for adding exception orders into the pool will remain the same as current | SPX |

## 2.3.3 AWB printing

| Function | Details | Function |
|---|---|---|
| AWB module | ● AWB printing module will remain the same as current where ops will perform relabel after inbound parcels in hub (status LM_hub_received) | SPX |

## 2.3.4 Route overview

| Function | Details | Function |
|---|---|---|
| Route overview | ● To create "Route overview" module for displaying the overall route generated for ops<br>● The module will consist the following info (display the table in ascending orders based on dates)<br><br>_(see table below)_<br><br>● **Date**: Date that the group/route is generated by the system<br>● **Assignment task ID**: assignment task ID displayed on the re-label AWB<br>● **Number of orders**: number of orders based on the group/route | SPX |

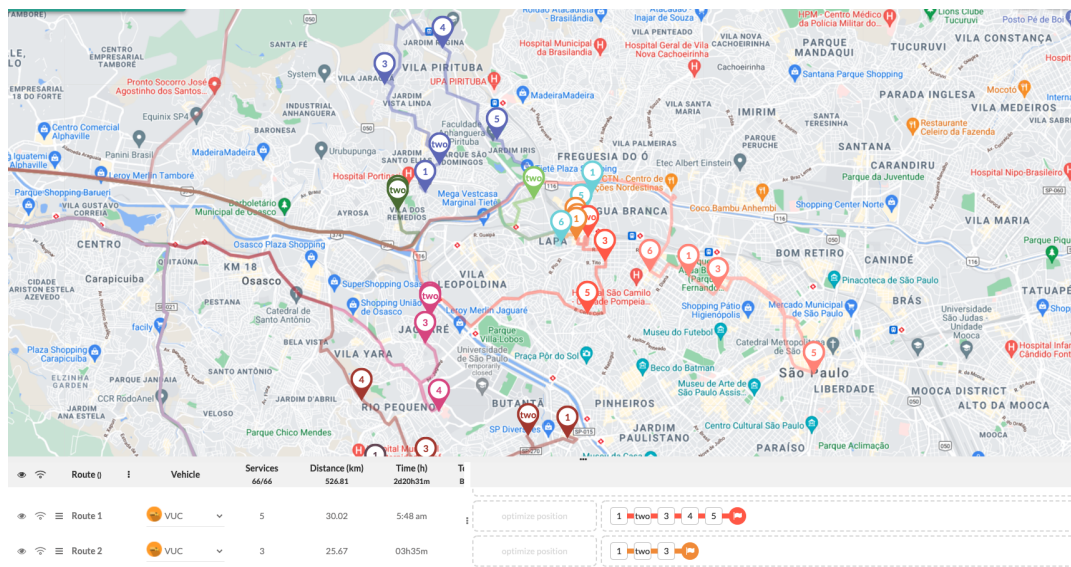| Date | Assignment task ID | Number of orders | Total distance (km) | Status | Action |
|---|---|---|---|---|---|
| 13-12-21 | 12345 | 130 | 20km | Created/ In Process/ Done | View |
| 12-12-21 | | | | | |

| | generated by the system<br>● **Total distance (km)**: total distance that the drivers need to travel in that trip<br>● **Status (follow the assignment task status)**<br><br>Status ▲　　Action<br>　　Complete<br>　　Created<br>　　Processing<br>　　Assigned<br>　　Assigned<br>　　Processed<br>　　Partially_assigned<br>　　　　　　Reset　OK<br><br>● **Action** > View | |
|---|---|---|
| Action > View | ● After users click Action > View, to display the list of orders and route number within each grouping<br>　○ SPX TN<br>　○ Route sequence number<br>　○ Order status<br>　○ View (Go to the order detail page) | SPX |
| Search/Filter | ● Allow users to search/filter based on<br>　○ Date (allow to filter based on date/time range)<br>　○ Assignment task ID (allow for fuzzy search)<br>　○ Status | SPX |
| Export | ● Allow users to export orders out by displaying all info on the above table | SPX |

## 2.4 SPX driver app

| Function | Details | Function |
|---|---|---|

| | | |
|---|---|---|
| Same as current | <ul><li><u>Same as the current design with Routeasy</u></li><li>After the drivers scan at parcels or assignment task level, orders will go into driver To-Do list<ul><li>Default sort will be based on inverted of the sequence of scanning (first scan means last delivery)</li><li>Recommended sort<ul><li>If the driver has only one assignment task assigned to him, to allow drivers to arrange according to the sequence by the system</li><li>If the driver has multiple assignment task assigned to him, system will arrange the sequence within each grouping</li></ul></li></ul></li></ul> | SPX driver app |

# Phase 2 requirement

# operating restrictions

Search Vehicles 🔍                                                                                                                          ✕

| | | Maximum number of vehicles | Maximum number of stops | Minimum vehicle occupancy (%) | Maximum vehicle occupancy (%) | Maximum route time (in hours) | Maximum route distance (km) | Maximum distance between stops (km) | ZMRC Expanded Center |
|---|---|---|---|---|---|---|---|---|---|
| | | on | Off | on | Off | Off | Off | Off | Off |
| | Moto | 0 | 99 | 60 | 100 | 8 | 10000 | 10 | ✔ |
| | Carro | 0 | 99 | 60 | 100 | 8 | 10000 | 10 | ✔ |
| | Carro | 0 | 99 | 60 | 100 | 8 | 10000 | 10 | ✔ |
| | Fiorino | 15 | 10 | 20 | 90 | 6 | 10000 | 10000 | ✔ |
| | Utilitário | 0 | 99 | 60 | 100 | 8 | 10000 | 10 | ✔ |
| | VAN | 2 | 10 | 20 | 90 | 6 | 10000 | 10000 | ✔ |