

# Session 6B, Hur långt kan vi nå?

- **Restidsanalyser med hjälp av Open Trip Planner och FME**  
Föreläsare: Per Karlsson

# Restidsanalyser för kollektivtrafik med Open Trip Planner och FME

## Innehåll

Bakgrund

Metodik

Exempel på tillämpningar



# Introduktion

## Accessibility Planning Lab

## Västra Götalandsregionen

### Rapport

Implementation of methods to support transport and land-use planning in Region Västra Götaland using OpenTripPlanner and GTFS data

Within the framework of the project Act

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### Mjukvara och data

```
\\accessibility_vaestra_goetaland [name of the project: place this to C:\projects]\  
  \data  
    \gis  
      \areatype  
      \lat  
      \lon  
      \centroid  
      \G  
      \G  
      \grid  
      \G  
      \osm  
      \at  
      \nd  
      \at  
      \norway-latest.osm [file from intermediate step of conversion]  
      \sweden-norway.osm [file from intermediate step of conversion]  
      \sweden-norway.pbf [this file is used as input for OTP]  
      \not used]
```

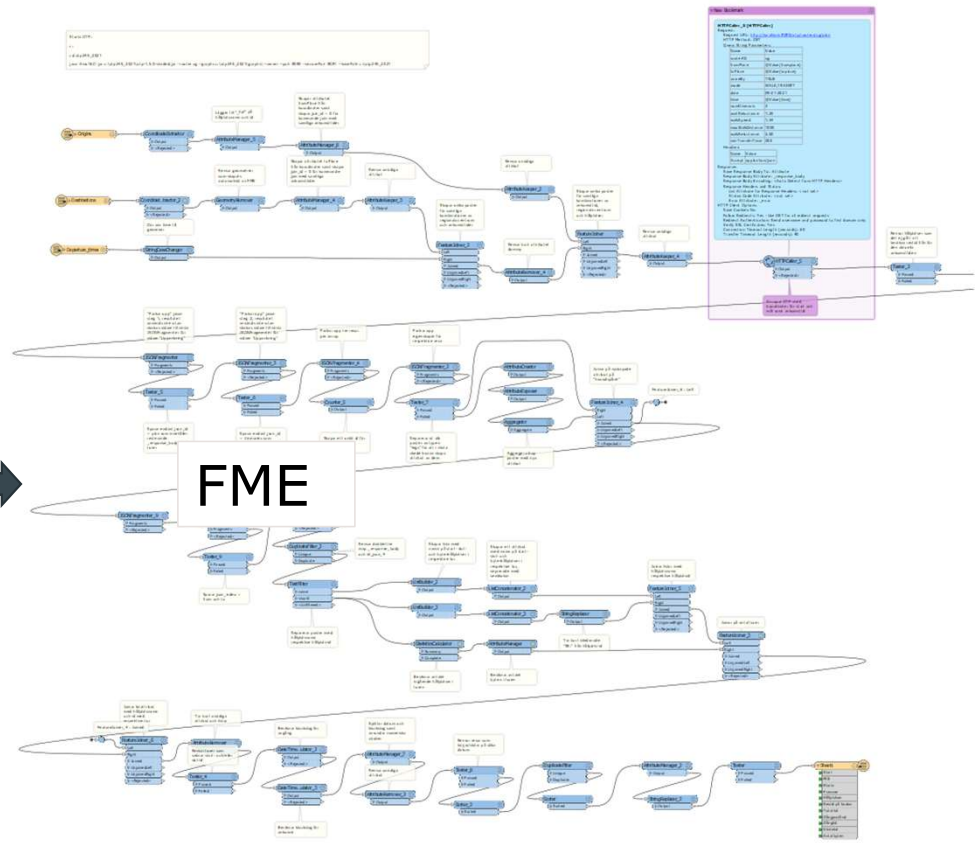
```
RStudio  
File Edit View Plots Session Build Debug Profile Tools Help  
D4 vgr_compute_traveltimes_step6.R  
Source Save  
379  
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418  
419  
420  
421  
422-  
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428  
429  
430
```

```
for (t in 1:nArrivalTimes) {  
  # Build time request string, e.g., time_request <- '07:00am' # h:mm + am or pm  
  time_request <- vgr_get_time_request(arrivalTimes[t])  
  print(time_request)  
  for (j in 1:nDest) { # Loop over all destinations  
    # Get coordinates of destination j  
    lon <- toString(lon_dest[j])  
    lat <- toString(lat_dest[j])  
    # Set time surface  
    # https://cran.r-project.org/web/packages/htr/vignettes/quickstart.html  
    surface_data <- system.paste("curl -s https://www.vgregion.se/otp/otp-api/v1/surface?lon=", lon, "&lat=", lat, "&time=", time_request, "&format=json", sep="")  
    # Check contents of surface2D.json  
    check_json <- scan(file = paste(parameters_vgpath_graphs, "/", parameters_vgicasesetudy, "surface2D.json", sep=""), what = "character", nmax = 1)  
    if (nchar(check_json) < 100) {  
      # Node is unconnected  
      print(paste("Node ", toString(j), " is unconnected", sep=""))  
    } else {  
      # Load json file surface2D.json  
      data0 <- read_json(paste(parameters_vgpath_graphs, "/", parameters_vgicasesetudy, "surf", toString(j), ".json", sep=""))  
      surfareth <- data0$th
```

### R-script



### FME



# Open Trip Planner

- Multimodal reseplanerare
  - Kollektivtrafik, gång, cykel och kombinationer av dessa
- Open source
- Två "gränssnitt":
  - Grafiskt gränssnitt för planering av enstaka resor
  - Server för analyser och motor till egna gränssnitt
- Exempel på användare:

Skånetrafiken

New York State Department of Transportation

Arlington County Commuter Services

Helsinki Regional Transport Authority

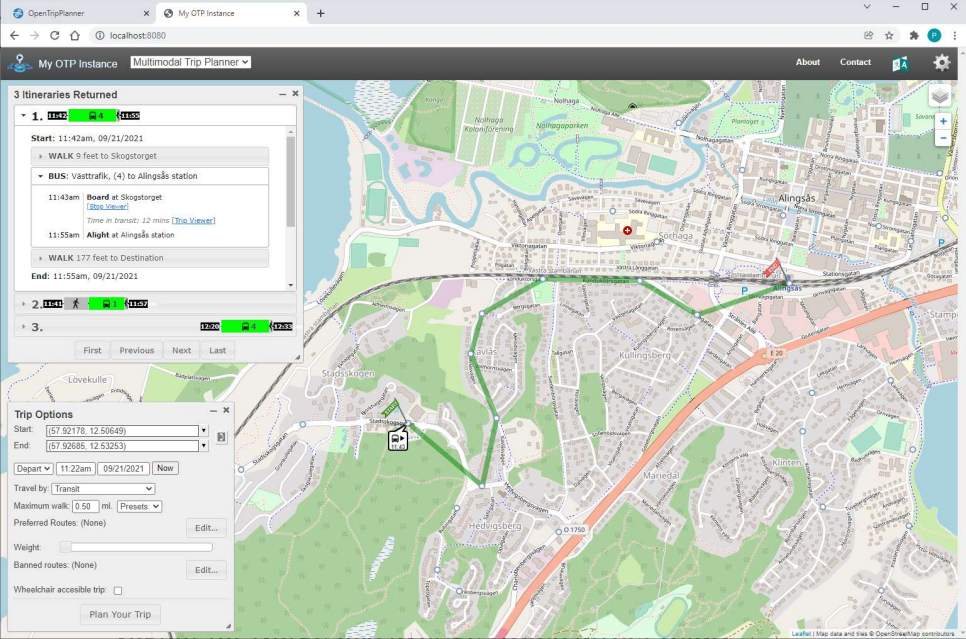
Municipal Transport Company of Valencia

Ruter (Oslo)

ZTM Lublin

Adelaide Metro

ViaggiaTrento & ViaggiaRoverta



The screenshot displays the Open Trip Planner web application. The main interface features a map of a city with a green route highlighted. A sidebar on the left shows '3 Itineraries Returned' with details for the first one: Start: 11:42am, 09/21/2021; WALK 9 feet to Skogstorget; BUS: Västrafik, (4) to Alingsås station; Board at Skogstorget; Alight at Alingsås station; WALK 177 feet to Destination; End: 11:55am, 09/21/2021. Below the map is a 'Trip Options' panel with fields for Start, End, Depart, and Travel by, along with checkboxes for 'Maximum walk' and 'Wheelchair accessible trip'. At the bottom, a terminal window shows the application's startup logs, including the following code snippet:

```
org.opentripplanner.api.resource.StationResource
org.opentripplanner.api.resource.PlannerResource
org.opentripplanner.api.resource.TicketResource
org.opentripplanner.api.resource.GeoCodeResource
org.opentripplanner.api.resource.ScheduleResource
org.opentripplanner.api.resource.ServerInfoResource
org.opentripplanner.api.resource.AlertResource
org.opentripplanner.api.resource.ExternalGeoCodeResource
org.opentripplanner.api.resource.AlertChannelResource
org.opentripplanner.api.resource.RepeatedDepartureResource
org.opentripplanner.api.resource.CatchmentAreaResource
org.opentripplanner.api.resource.RoutersResource
org.opentripplanner.api.resource.VehicleStatusResource
org.opentripplanner.api.resource.LegendResource
org.opentripplanner.api.resource.PrivacyResource
org.opentripplanner.api.resource.PointResource
org.opentripplanner.api.resource.LicenseResource
org.opentripplanner.api.resource.BikeRentalResource
org.opentripplanner.api.resource.SocialResource
org.opentripplanner.api.resource.FeedServiceResource
Global Request Filters:
org.opentripplanner.standalone.AuthFilter
org.opentripplanner.standalone.CorsFilter
Global Response Filters:
org.opentripplanner.standalone.CorsFilter
Global Header Interceptors:
org.opentripplanner.standalone.CorsFilter
Global Writer Interceptors:
org.glassfish.jersey.server.internal.MappableExceptionWrapperInterceptor
org.glassfish.jersey.server.internal.MappableExceptionWrapperInterceptor
org.glassfish.jersey.server.internal.MappableExceptionWrapperInterceptor
Global Features:
```

# FME - Feature Manipulation Engine

Importerera data

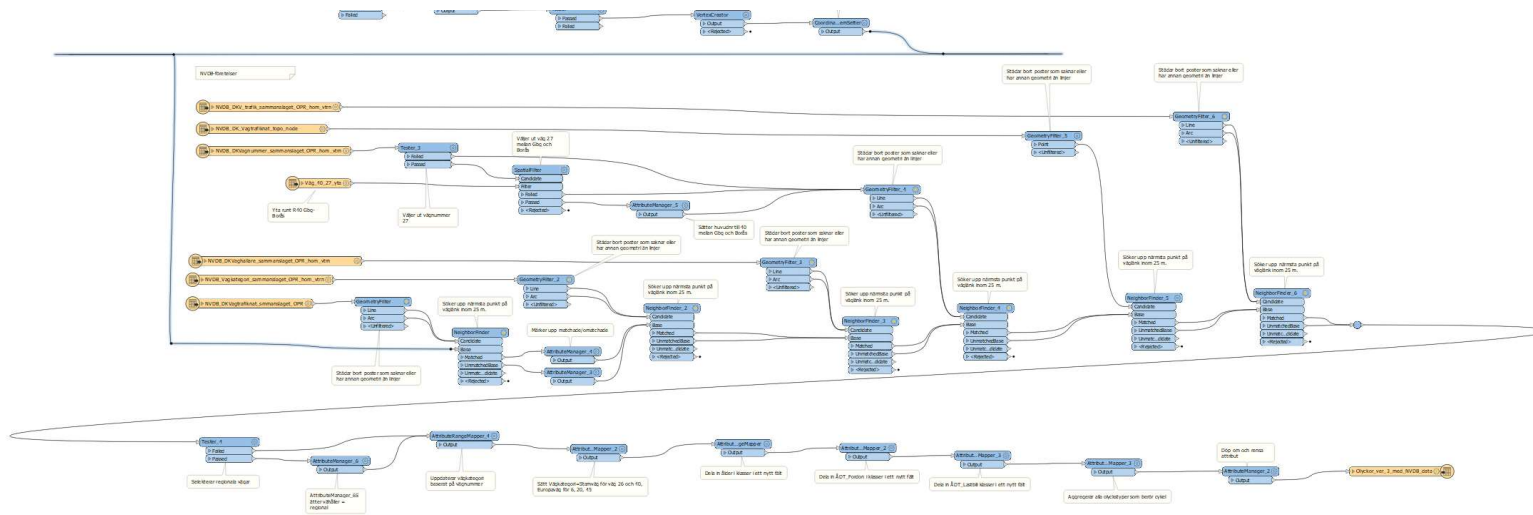
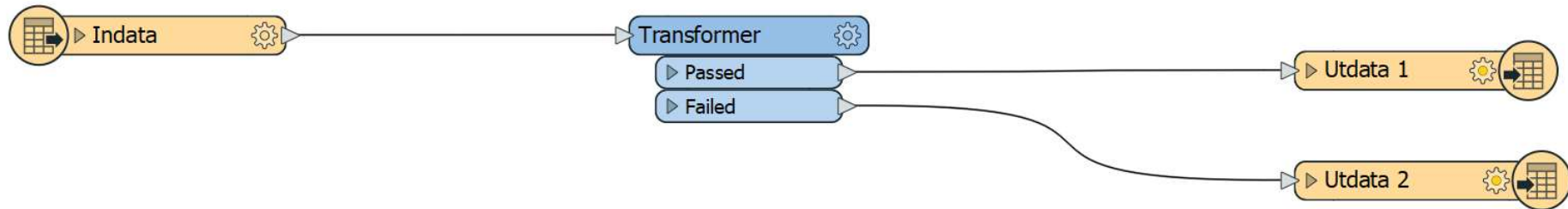
450 format

Bearbeta

500 transformers

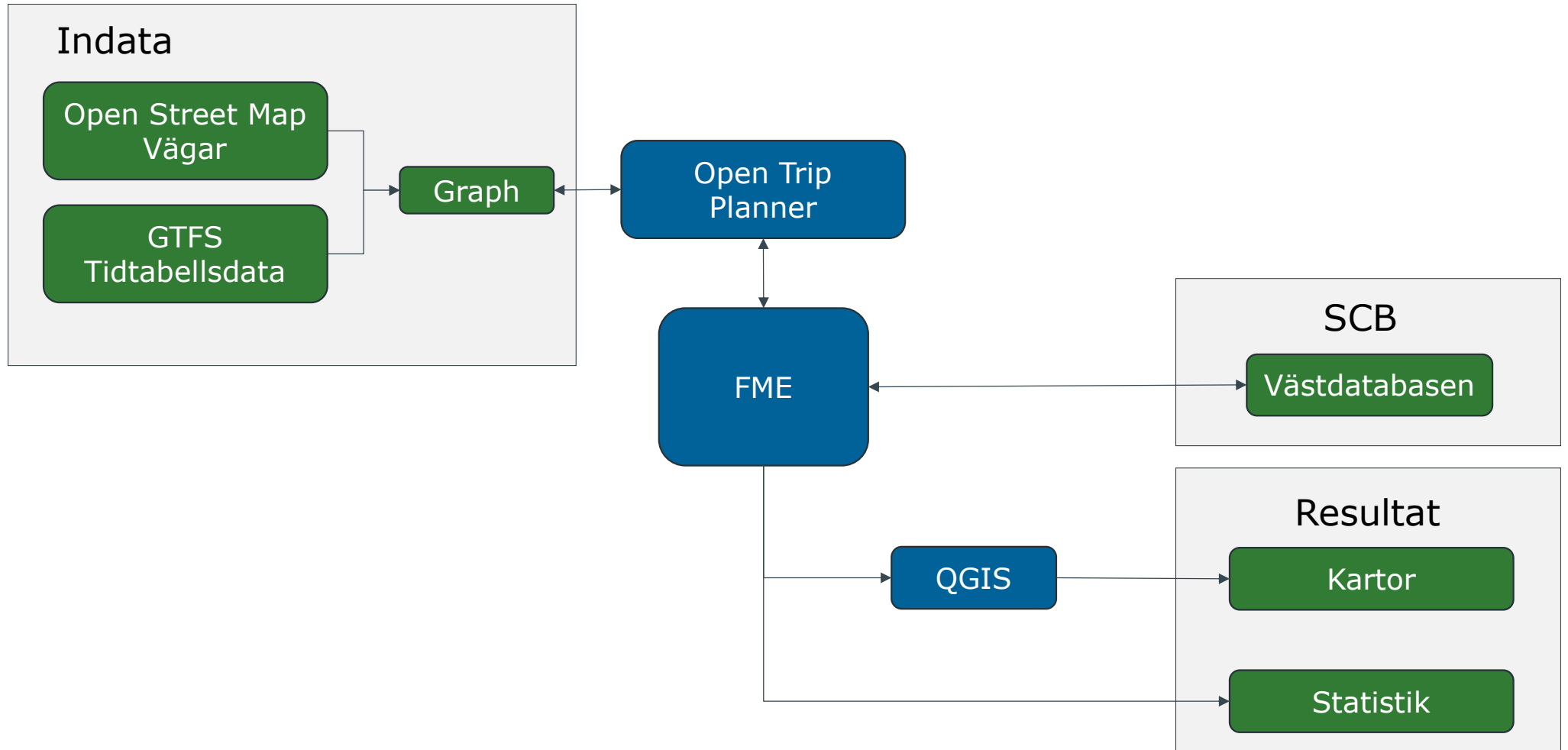
Exportera data

450 format



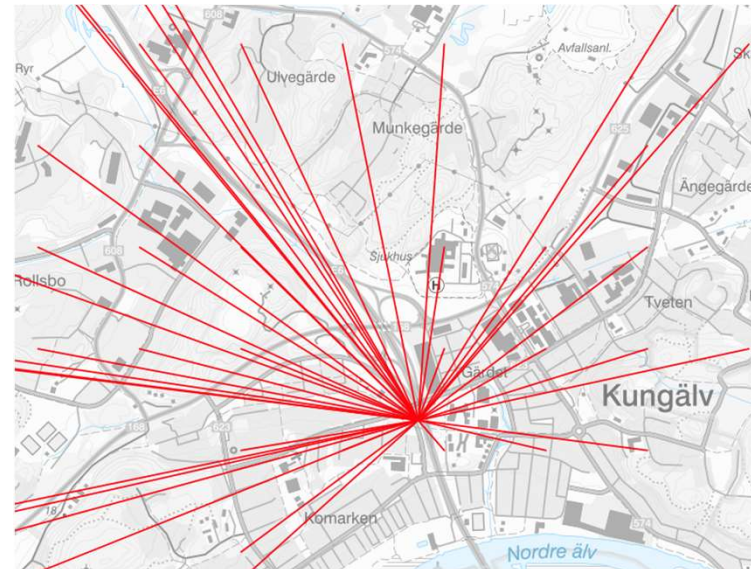
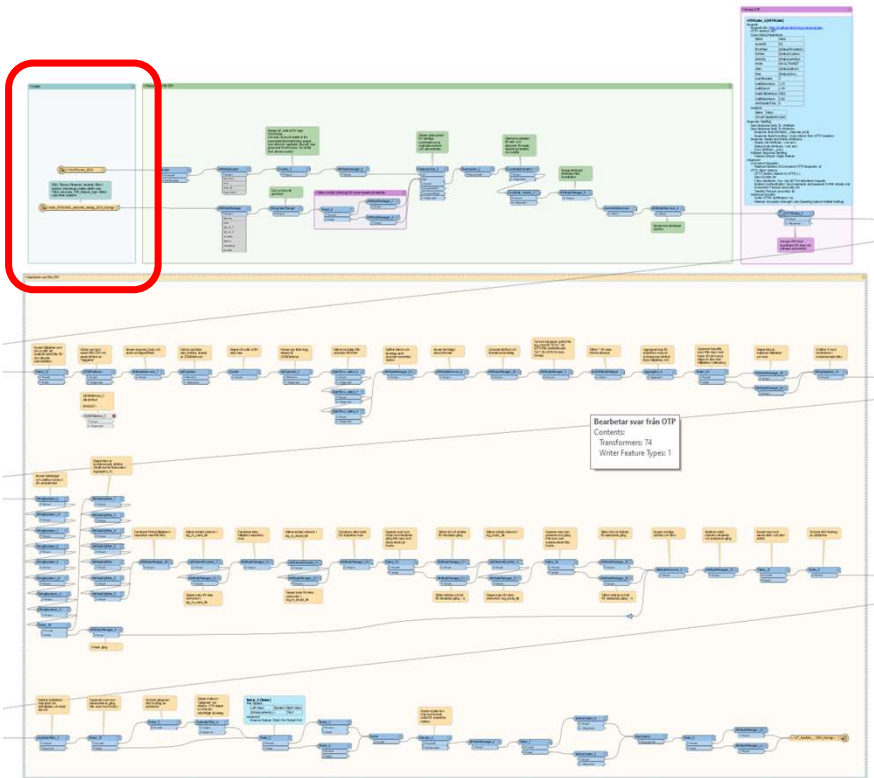
# Metodik

# Översikt metodik – data och programvaror



# Metodik FME - Indata

“FromToLines”,  
egentligen x,y för startpunkt  
respektive målpunkt

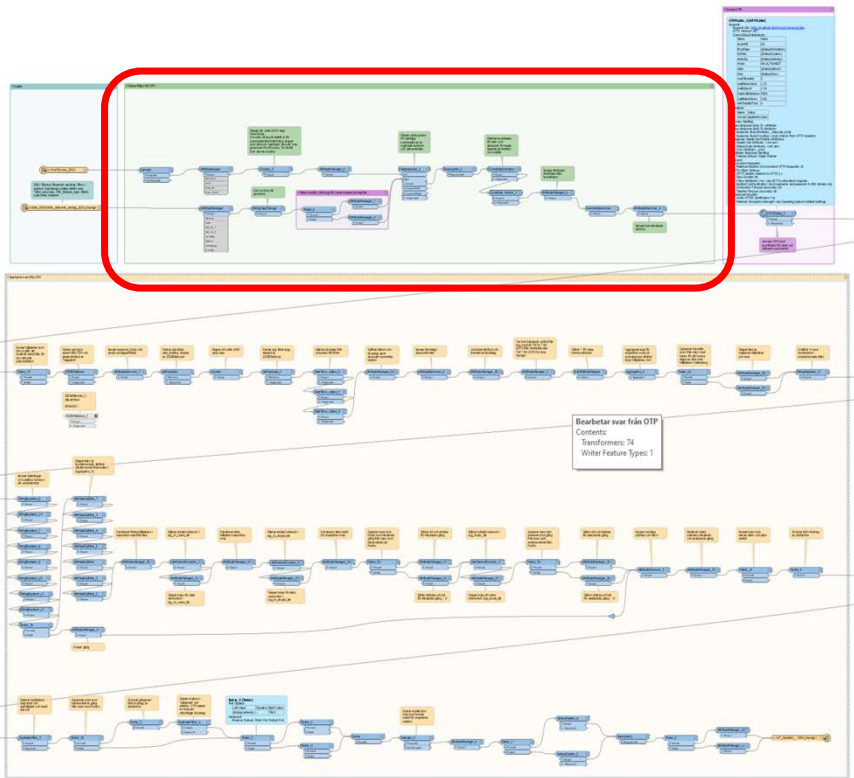


Ankomst/avgångstid: datum och klockslag  
Arriveby: TRUE/FALSE

time	arriveby	datum
7:30 AM	TRUE	02-07-2024
8:01 AM	TRUE	02-07-2024



# Metodik FME – Skapa parametrar för anrop till OTP



	fromplace	toplace	time	arriveby	datum	ruta	stop_id
1	58.26712377694129,12.967198381420603	58.260840999154816,12.95184099999927	7:30 am	TRUE	02-07-2024	3805006460000	14040010
2	58.26712377694129,12.967198381420603	58.260840999154816,12.95184099999927	8:01 am	TRUE	02-07-2024	3805006460000	14040010
3	58.494263349846804,13.134259228605508	58.50472799915988,13.163482999999509	7:30 am	TRUE	02-07-2024	3910006485000	14037001
4	58.494263349846804,13.134259228605508	58.50472799915988,13.163482999999509	8:01 am	TRUE	02-07-2024	3910006485000	14037001
5	58.50348818198538,13.150933174599121	58.50472799915988,13.163482999999509	7:30 am	TRUE	02-07-2024	3920006486000	14037001
6	58.50348818198538,13.150933174599121	58.50472799915988,13.163482999999509	8:01 am	TRUE	02-07-2024	3920006486000	14037001
7	58.50373413968129,13.16808373925057	58.50472799915988,13.163482999999509	7:30 am	TRUE	02-07-2024	3930006486000	14037001
8	58.50373413968129,13.16808373925057	58.50472799915988,13.163482999999509	8:01 am	TRUE	02-07-2024	3930006486000	14037001
9	58.495000964798834,13.185697805221604	58.50472799915988,13.163482999999509	7:30 am	TRUE	02-07-2024	3940006485000	14037001
10	58.495000964798834,13.185697805221604	58.50472799915988,13.163482999999509	8:01 am	TRUE	02-07-2024	3940006485000	14037001
11	58.37665025973761,13.405542874450184	58.383293999158695,13.440322999999735	7:30 am	TRUE	02-07-2024	4065006471500	14038000
12	58.37665025973761,13.405542874450184	58.383293999158695,13.440322999999735	8:01 am	TRUE	02-07-2024	4065006471500	14038000
13	58.381455972052585,13.430980500711486	58.383293999158695,13.440322999999735	7:30 am	TRUE	02-07-2024	4080006472000	14038000
14	58.381455972052585,13.430980500711486	58.383293999158695,13.440322999999735	8:01 am	TRUE	02-07-2024	4080006472000	14038000
15	58.390745780998664,13.456228926217891	58.383293999158695,13.440322999999735	7:30 am	TRUE	02-07-2024	4095006473000	14038000
16	58.390745780998664,13.456228926217891	58.383293999158695,13.440322999999735	8:01 am	TRUE	02-07-2024	4095006473000	14038000
17	58.167084344611716,13.533930628219371	58.175677999155646,13.553351999999805	7:30 am	TRUE	02-07-2024	4135006448000	14041001

# Metodik FME – Anrop till OTP

## Anrop

### HTTPCaller\_5 [HTTPCaller]

Request:

Request URL: <http://localhost:8080/otp/routers/vg/plan>

HTTP Method: GET

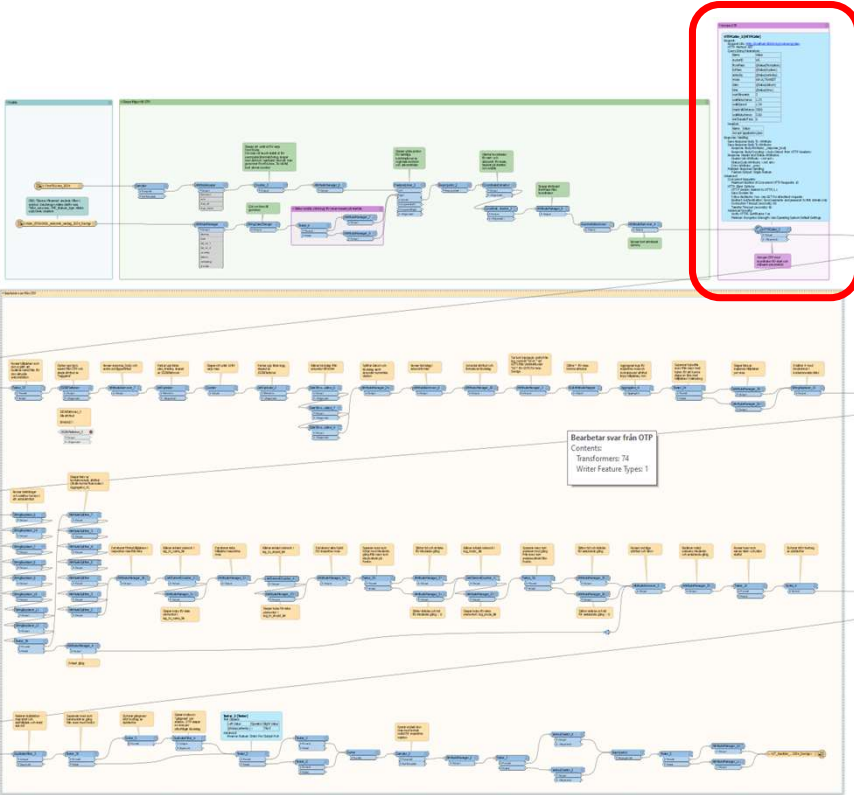
Query String Parameters:

Name	Value
routerID	VG
fromPlace	@Value(fromplace)
toPlace	@Value(toplace)
arriveBy	@Value(arriveby)
mode	WALK,TRANSIT
date	@Value(datum)
time	@Value(time)
numItineraris	3
waitReluctance	1.25
walkSpeed	1.34
maxWalkDistance	3000
walkReluctance	2.00
minTransferTime	0

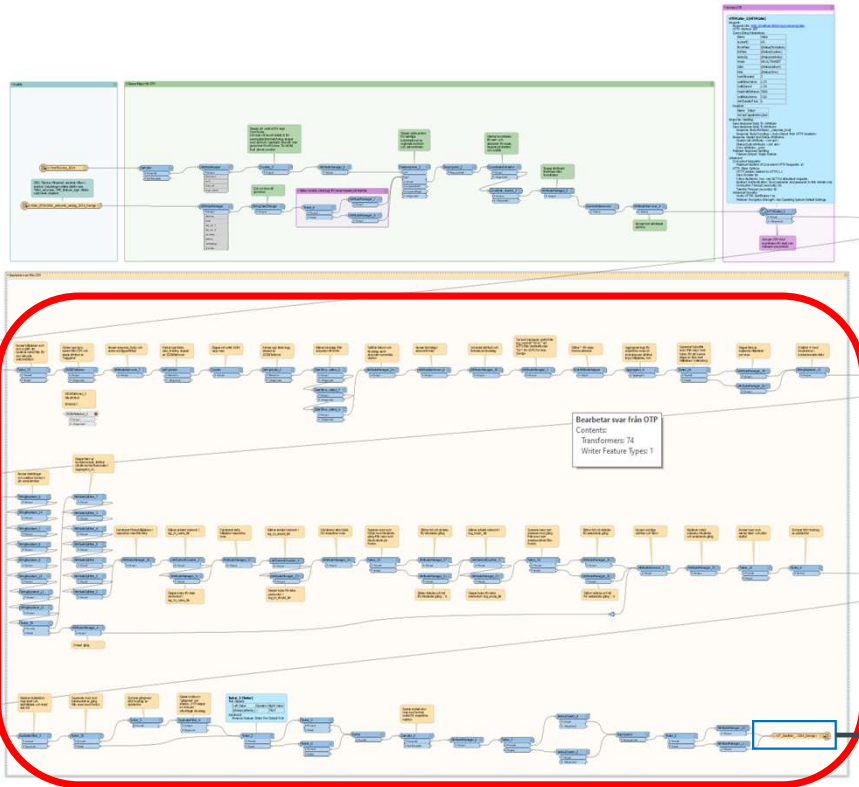
## Resultat: JSON

```

walkReluctance":2.00,"fromPlace":58.26712377694129,12.967198381420603,"waitReluctance":1.25,"maxWalkDistance
Time":0,"routerID":"VG","numItineraris":3,"toPlace":58.260840999154816,12.951840999999927,"time":7:30
:12.9671984,"lat":58.2671238,"vertexType":"NORMAL"},"to":{"name":"Destination","lon":12.951841,"lat":58.260841,"verte
7286022000,"endTime":1707287400000,"walkTime":1378,"transitTime":0,"waitingTime":0,"walkDistance":1742.47,"walkLimit
ationGained":0.0,"transfers":0,"fare":{"fare":{},"details":{},"legs":[{"startTime":1707286022000,"endTime":170728740000
1742.47,"generalizedCost":2639,"pathway":false,"mode":"WALK","transitLeg":false,"route":"","agencyTimeZoneOffset":360
:12.9671984,"lat":58.2671238,"departure":1707286022000,"vertexType":"NORMAL"},"to":{"name":"Destination","lon":12.
NORMAL"},"legGeometry":{"points":"hbsj_uonAa@{@s@{AEW?}HRG@Vm@Tk@RK@NWJMAAdc~@Bv@{AXAXCDJv@xAFAL
TT@~@{BPHV}||@DPHDP?F?CXE|\\KAD`bpeSBdFx@fBJRcEDJ@DTGDCK","length":57},"steps":[{"distance":179.34,"r
":"NORTHEAST","stayOn":false,"area":false,"bogusName":true,"lon":12.9673604,"lat":58.2671927,"elevation":"","walkingB
Name":"Allgatan","absoluteDirection":"SOUTHWEST","stayOn":false,"area":false,"bogusName":false,"lon":12.9695558,"lat":
,absoluteDirection":"CIRCLE_COUNTERCLOCKWISE","streetName":"road","absoluteDirection":"WEST","exit":1,"stayOn":false,
absoluteDirection":"WEST","stayOn":false,"area":false,"bogusName":false,"lon":12.9568617,"lat":58.2596619,"elevation":"","walkingBike":false},"(distance":82.34,"relativeDirection":"LEFT","stre
etName":"Solhemsgatan","absoluteDirection":"SOUTHWEST","stayOn":false,"area":false,"bogusName":false,"lon":12.9556758,"lat":58.2600913,"elevation":"","walkingBike":false},"(distance":
92.92,"relativeDirection":"RIGHT","streetName":"Södergatan","absoluteDirection":"NORTHWEST","stayOn":false,"area":false,"bogusName":false,"lon":12.9546206,"lat":58.2596012,"elevatio
n":"","walkingBike":false},"(distance":44.34,"relativeDirection":"LEFT","streetName":"Tvärögatan","absoluteDirection":"SOUTHWEST","stayOn":false,"area":false,"bogusName":false,"lon":12.95
34754,"lat":58.2601803,"elevation":"","walkingBike":false},"(distance":146.06,"relativeDirection":"RIGHT","streetName":"path","absoluteDirection":"NORTHWEST","stayOn":false,"area":false,"
bogusName":true,"lon":12.9529528,"lat":58.2598915,"elevation":"","walkingBike":false},"(distance":4.44,"relativeDirection":"RIGHT","streetName":"platform","absoluteDirection":"NORTHEAS
T","stayOn":false,"area":true,"bogusName":false,"lon":12.9517401,"lat":58.2608144,"elevation":"","walkingBike":false},"(distance":1378.00),"tooSloped
":false,"arrivedAtDestinationWithRentedBicycle":false},"(duration":6.16,"startTime":1707286506000,"endTime":1707287122000,"walkTime":256,"transitTime":360,"waitingTime":0,"walkDistanc
e":301.84,"walkLimitExceeded":false,"generalizedCost":1435,"elevationLost":0.0,"elevationGained":0.0,"transfers":0,"fare":{"fare":{},"details":{},"legs":[{"startTime":1707286506000,"endTim
e":1707286740000,"departureDelay":0,"arrivalDelay":0,"realTime":false,"distance":285.03,"generalizedCost":440,"pathway":false,"mode":"WALK","transitLeg":false,"route":"","agencyTime
ZoneOffset":3600000,"interlineWithPreviousLeg":false,"from":{"name":"Origin","lon":12.9671984,"lat":58.2671238,"departure":1707286506000,"vertexType":"NORMAL"},"to":{"name":"Vära
Lagmångslynnasiet","stopId":"SE:740024164","lon":12.968327,"lat":58.26633,"arrival":1707286740000,"departure":1707286740000,"vertexType":"TRANSIT"},"legGeometry":{"points":"hbsj
_uonAa@{@s@{AEW?}HRG@Vm@Tk@RK@dATBFJHAFHO~@IBA@","length":17},"steps":[{"distance":160.03,"relativeDirection":"DEPART","streetName":"road","absoluteDirection":"NORT
HEAST","stayOn":false,"area":false,"bogusName":true,"lon":12.9673604,"lat":58.2671927,"elevation":"","walkingBike":false},"(distance":76.78,"relativeDirection":"RIGHT","streetName":"ser
vice
road","absoluteDirection":"SOUTHWEST","stayOn":true,"area":false,"bogusName":true,"lon":12.9693635,"lat":58.2671761,"elevation":"","walkingBike":false},"(distance":48.23,"relativeDirect
ion":"RIGHT","streetName":"Allgatan","absoluteDirection":"SOUTHWEST","stayOn":false,"area":false,"bogusName":false,"lon":12.9688889,"lat":58.2666476,"elevation":"","walkingBike":false
}],"rentedBike":false,"walkingBike":false,"duration":234.0},"(startTime":1707287400000,"endTime":1707287100000,"departureDelay":0,"arrivalDelay":0,"realTime":false,"distance":1223.4,"g
eneralizedCost":960,"pathway":false,"mode":"BUS","transitLeg":true,"agencyName":"Västtrafik","agencyUrl":"http://www.vasttrafik.se","agencyTimeZoneOffset":3600000,"routeType":700,
routerId":"SE:127931020001","interlineWithPreviousLeg":false,"headsign":"Vära
station","agencyId":"SE:279","tripId":"SE:22793102000004","serviceDate":"2024-02-07","from":{"name":"Vära
Lagmångslynnasiet","stopId":"SE:740024164","lon":12.968327,"lat":58.26633,"arrival":1707286740000,"departure":1707286740000,"stopIndex":34,"stopSequence":35,"vertexType":"TRAN
SIT"},"to":{"name":"Vära
station","stopId":"SE:740000016","lon":12.951876,"lat":58.260825,"arrival":1707287100000,"departure":1707287100000,"stopIndex":37,"stopSequence":38,"vertexType":"TRANSIT"},"legG
eometry":{"points":"cscs1_cnrArLU?x?On_@??@do@","length":6},"steps":[{"distance":12.36,"relativeDirection":"DEPART"},"streetName":"path","absoluteDirection":"SOUTHWEST","stayOn":false,"area":false,"bogusName":true,"lon":12.9518923,"lat":58.2608045,"elevation":"","walkingBike":false},"(distance":4.4
4,"relativeDirection":"RIGHT","streetName":"platform","absoluteDirection":"NORTHEAST","stayOn":false,"area":true,"bogusName":false,"lon":12.9517401,"lat":58.2608144,"elevation":"","wal
kingBike":false}],"rentedBike":false,"walkingBike":false,"duration":22.00},"tooSloped":false,"arrivedAtDestinationWithRentedBicycle":false}],"metadata":{"searchWindowUsed":2400,"nextDat
eTime":1707289800000,"prevDateTime":1707285000000,"previousPageCursor":"TO0ABXc3AQANUFJFVWVWUEHFRQe3EagH0JoAAAlgAAZUJRSRUJLVXOPFR9ERBBURJLVKVFNEVRQ==","nextPageCursor":"TO0ABXc3AQAJTKVYF9QJdF7dAtIAAAAAACWAABITVJFRVRQJSEXORFUEFSVFSRV9USUJF","debugOutput":{"precalculationTime":5941800,"directStreetRouterTime":185286400,"transitRouterTime":3762288700,"filteringTime":117834800,"renderingTime":24980400,"totalTime":3996536400,"transitRouterTimes":{"tripPatternFilterTime":2295982400,"access
EgressTime":44621900,"raptorSearchTime":1417350200,"itineraryCreationTime":41194000},"elevationMetadata":{"ellipsoidToGeoidDifference":30.625796978977156,"geoidElevation":false}}
    
```



# Metodik FME – Bearbetning av resultat



Features Selected: 1 of 1

Property	Value
Exposed Attributes (40)	
F2L_id	30
Starttid	06:49
Sluttid	07:29
Total restid	39,5
Restid_exkl_gång_start_slut	36
Gång_start_tid	2,5
Gång_slut_tid	1
Gång_start_avst	179
Gång_slut_avst	71
Gångtid	3,5
Gångavstånd	250
Tid på fordon	33
Byten	1
Väntetid	3
Fordon	WALK-BUS-TRAM-WALK
Hållplatser	Origin-Brottkärrsmotet-Göteborg Stenpiren-Göteborg Centralst Drottningt-Destination
Första_hpl	Brottkärrsmotet
Sista_hpl	Göteborg Centralst Drottningt
Första_hpl_id	740074229
Sista_hpl_id	740030117
Linjer	X2-9
Deltider	2,5-28-5-1
Delavstånd	179-12439-998-71
Linjer_ID	1279521300001-1279500900001
time	8:01 am
Startdatum	20240207
Slutdatum	20240207
Avgångstider	06:49-06:52-07:23-07:28
lat_to	57.707705999096746
lon_to	11.973204000004207
lat_from	57.599771402844794
lon_from	11.950058957122707
tid_int_1	07:00
tid_int_2	08:01
datum	02-07-2024
veckodag	onsdag
arriveby	Ankomst
ruta	3175006388000
stop_id	14001950
stop_name	Centralstationen

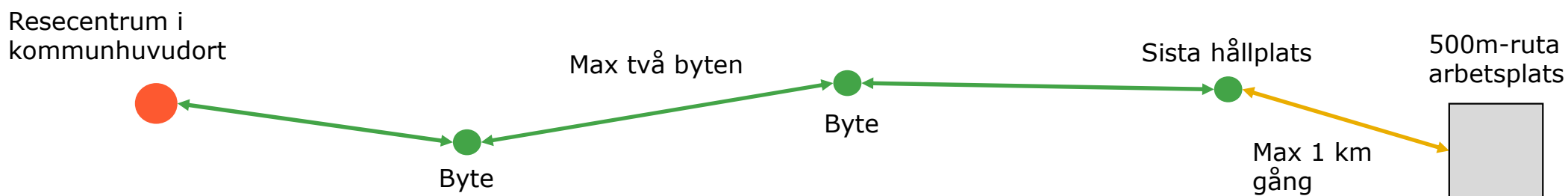
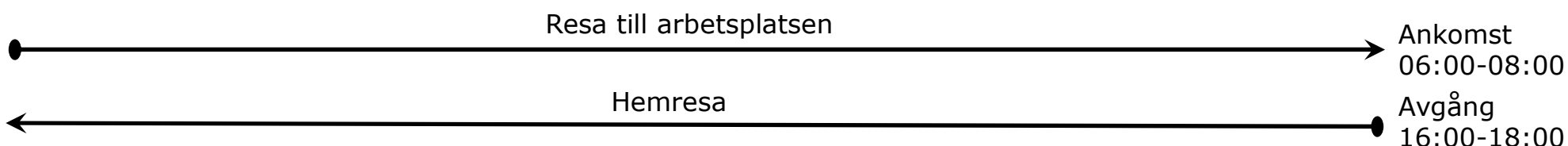
# Demo restidsberäkning med OTP och FME

# Exempel på tillämpningar

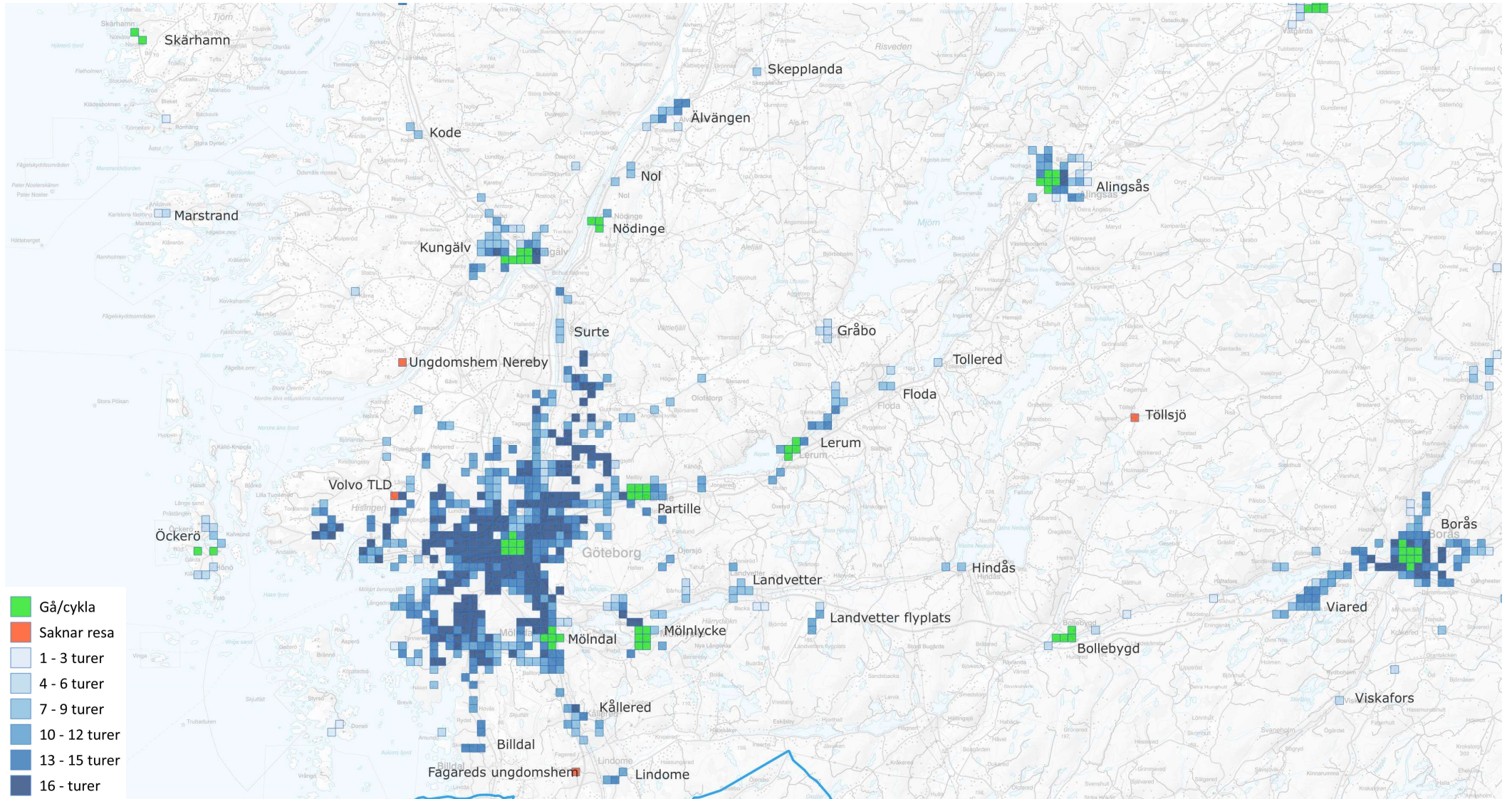
Kartläggning av större arbetsplatser och kollektivtrafik

# Metod 1 - Resor kommuncentrum-arbetsplats

- Urval: 500-metersrutor med minst 100 förvärvsarbetande
- Resa till/från resecentrum i den kommun arbetsplatsrutan finns
- Syfte: att beräkna arbetsplatsers anknnytning till kollektivtrafiken

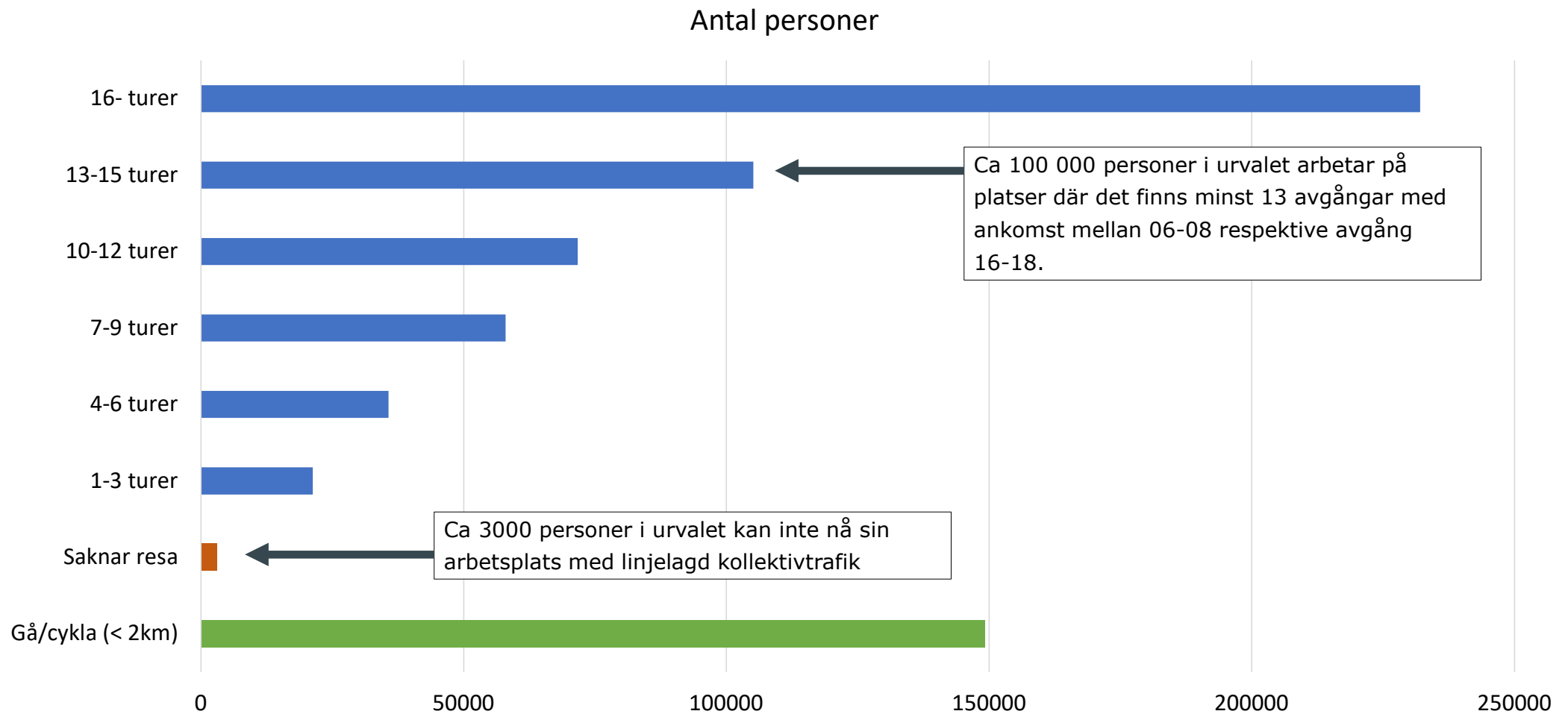


# Antal turer ankomst kl 06-08, avgång kl 16-18 per arbetsplatsruta, del av Göteborgsregionen



# Antal turer mellan kommuncentrum och arbetsplatsruta med ankomst kl 06:00 – 08:00 och avgång 16:00 – 18:00

Antalet turer baseras på det lägsta antalet turer för ankomst 06:00-08:00 respektive avgång 16:00-18:00  
Det faktiska antalet turer i den ena riktningen är därav oftast större än de redovisade värdena



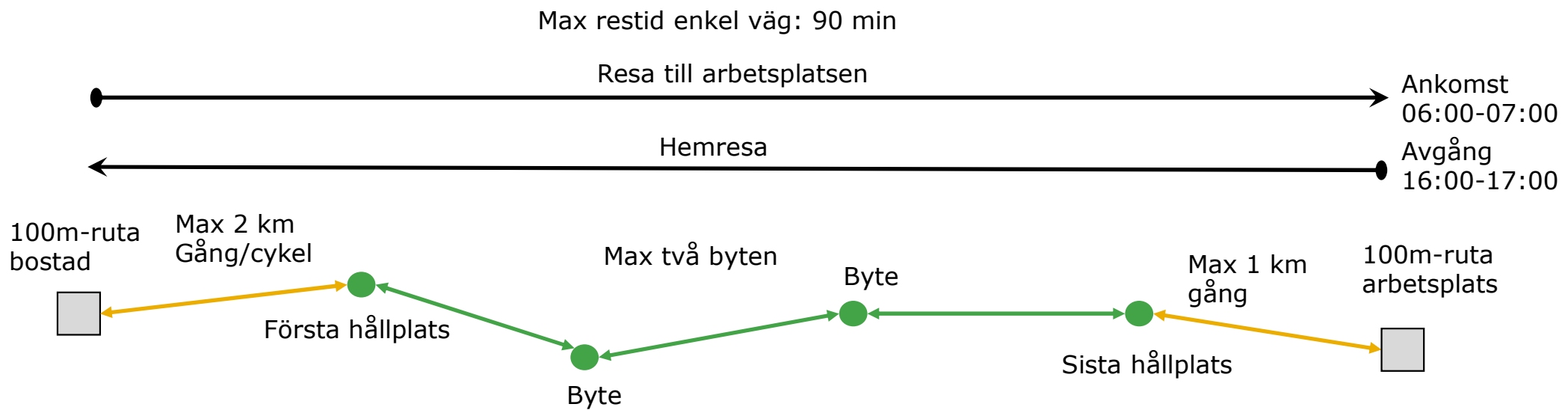
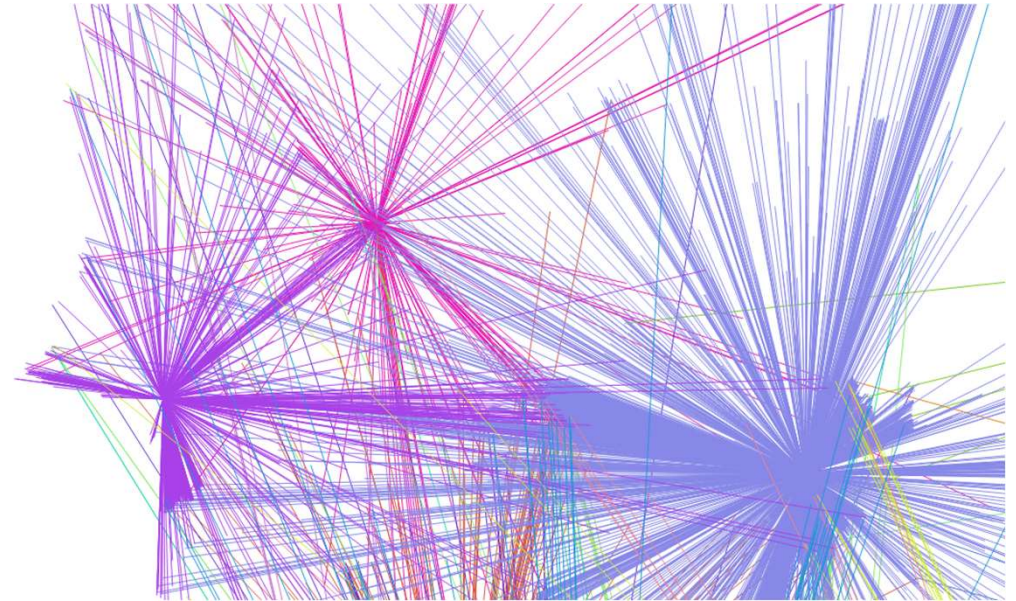


# **Metod 2 – exempel på hur faktiskt anställda kan nå urval av arbetsplatser**



## Metod 2: individuella resor

- Individer med 100-metersruta för bostad respektive arbetsställe
- Urval av större arbetsplatser – industri, logistik och sjukhus



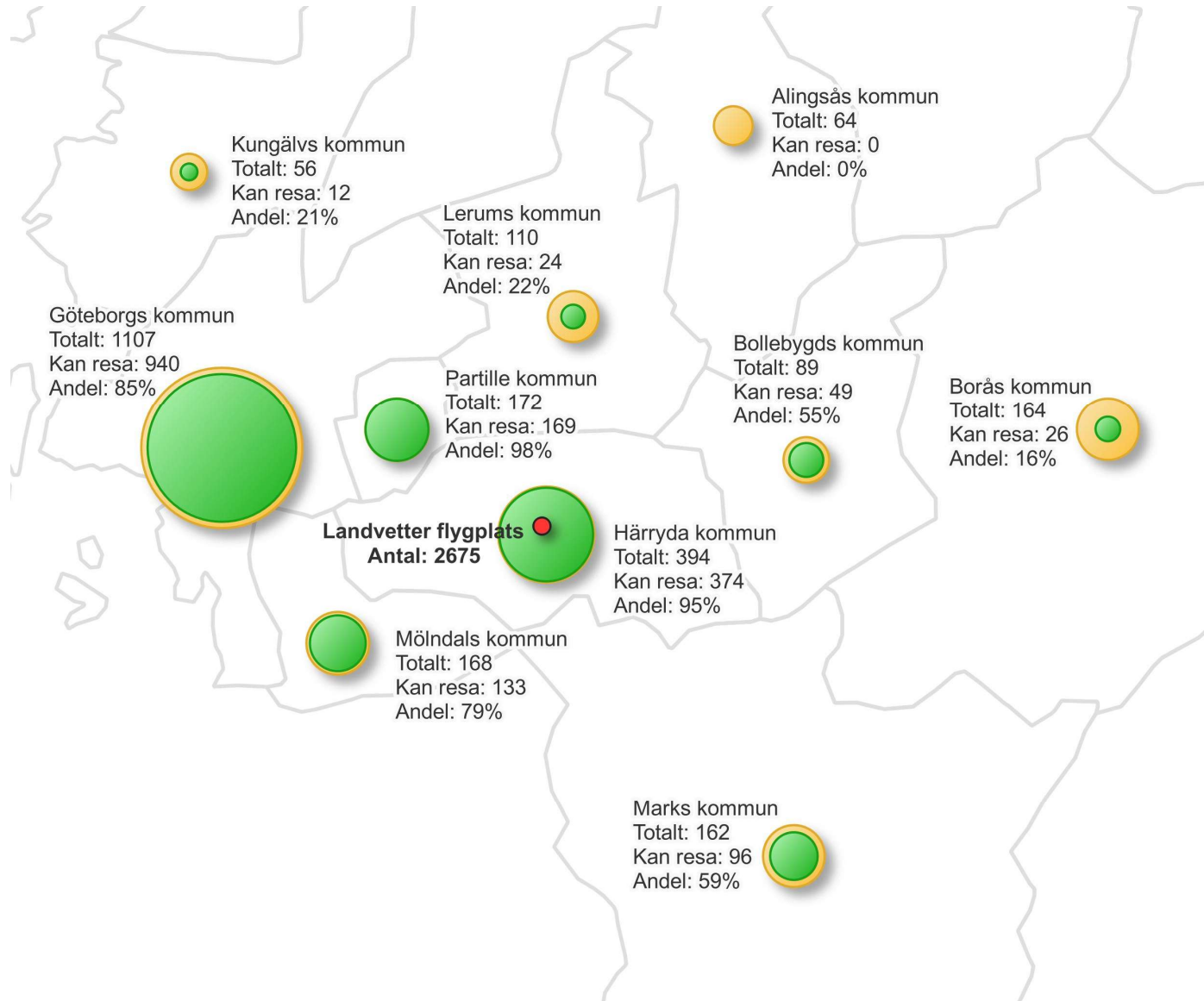
# Urval av arbetsplatser för individuella resor

2024-04-18



Ankomst kl 06-07  
Avgång kl 16-17  
Vardag

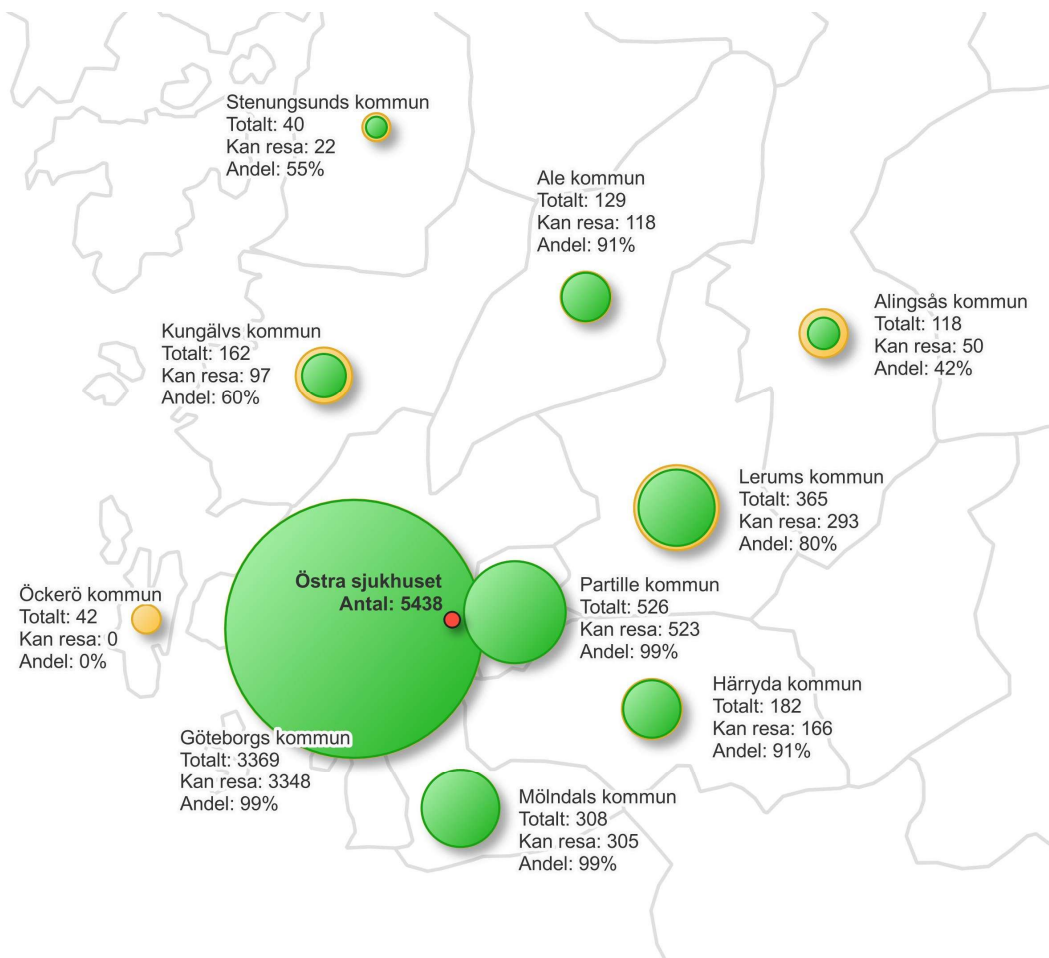
2024-04-18



Ankomst kl 06-07

Avgång kl 16-17

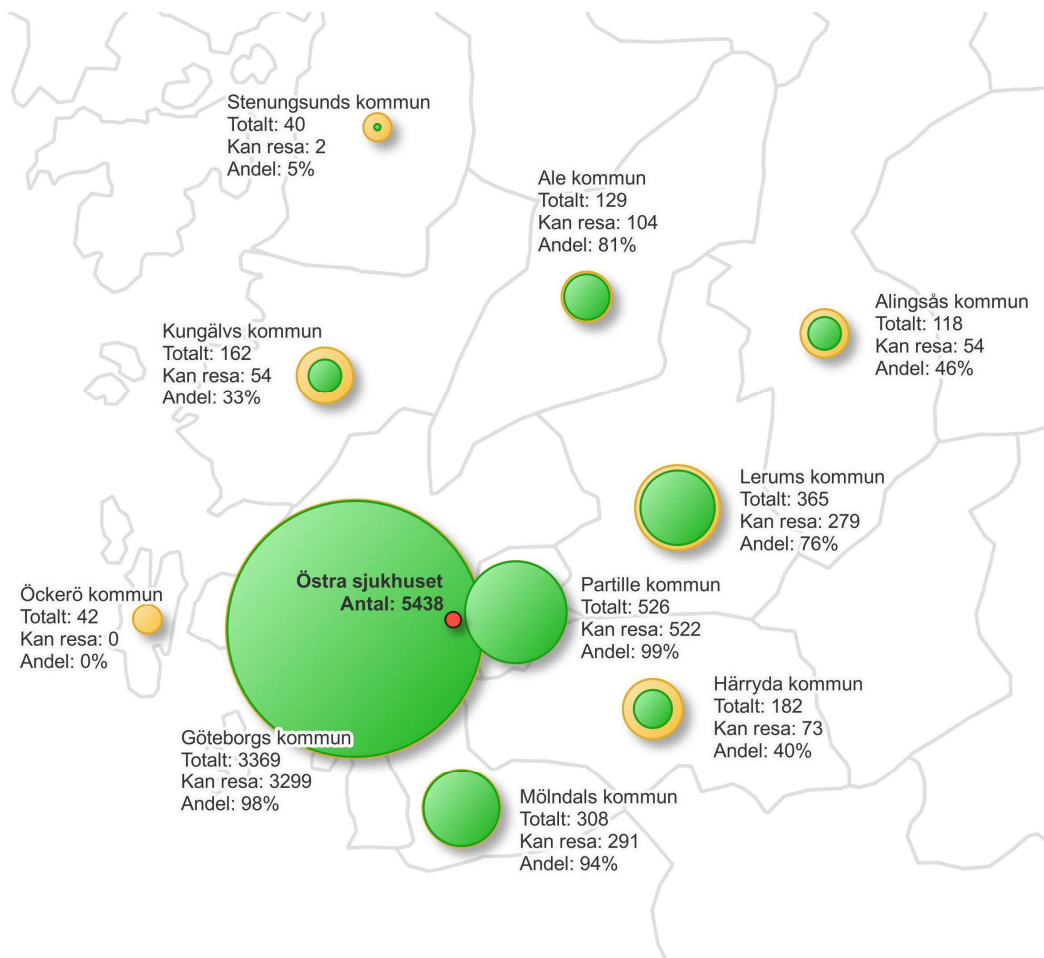
Tisdag



Ankomst kl 06-07

Avgång kl 21-22

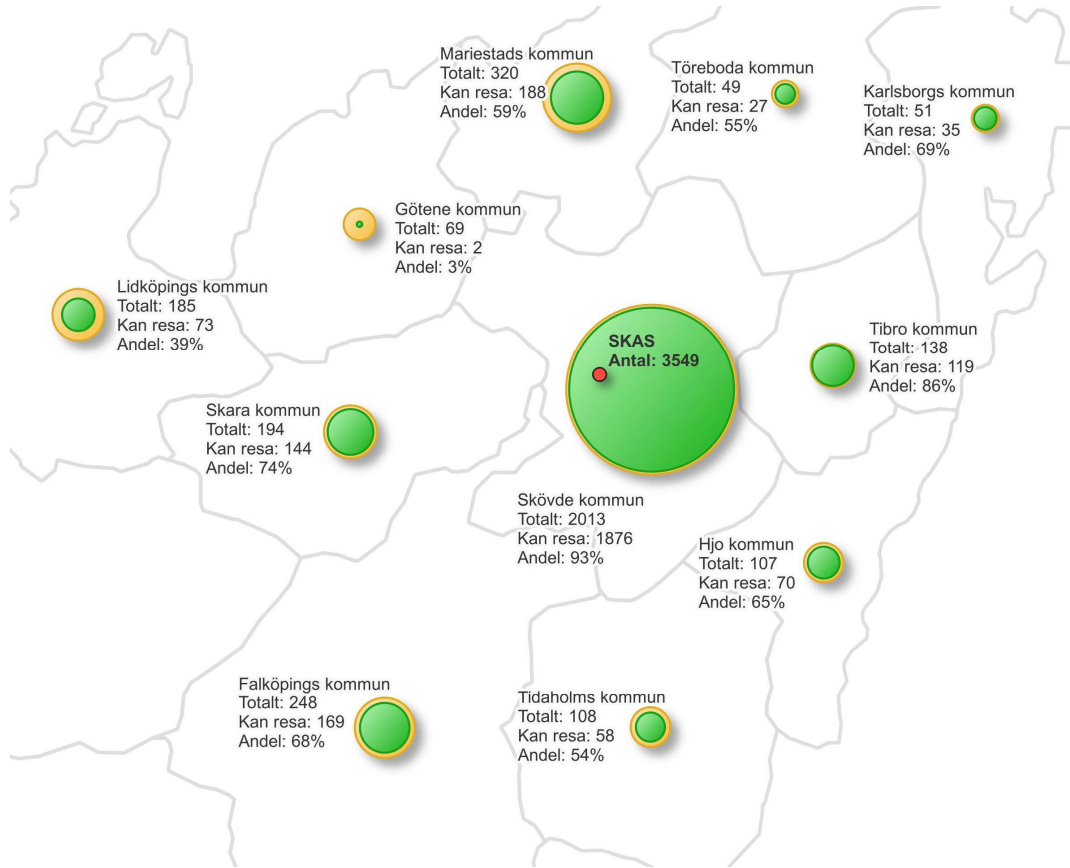
Söndag



### Ankomst kl 06-07

### Avgång kl 16-17

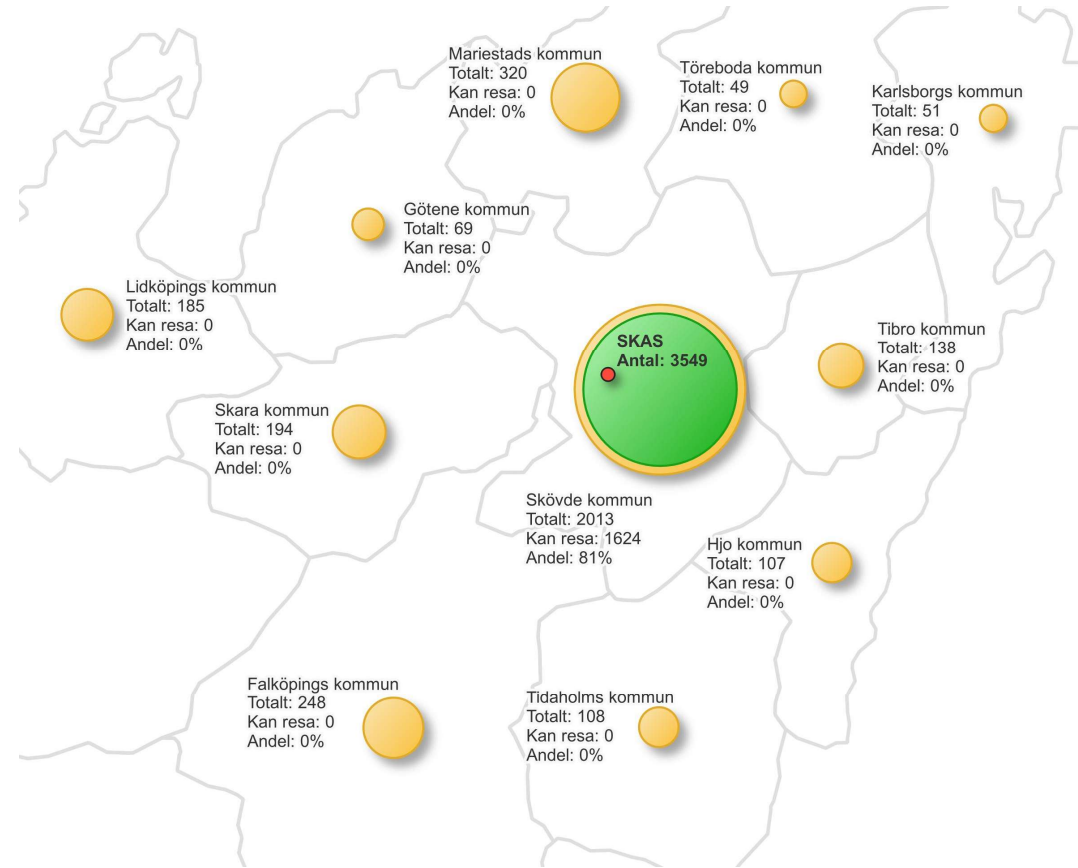
### Tisdag



### Ankomst kl 06-07

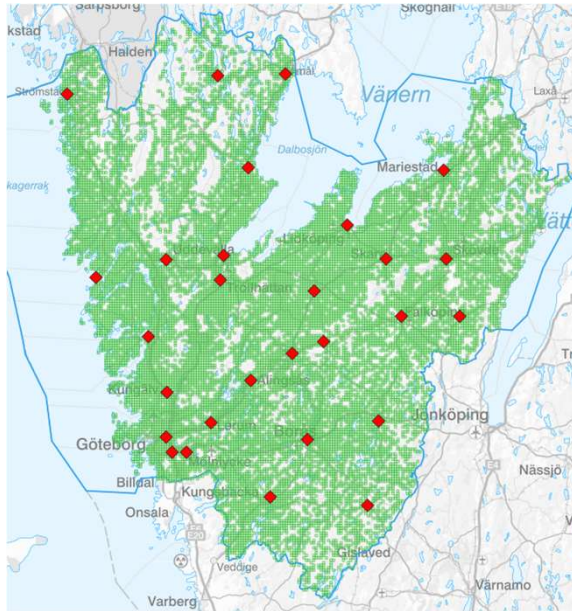
### Avgång kl 21-22

### Söndag



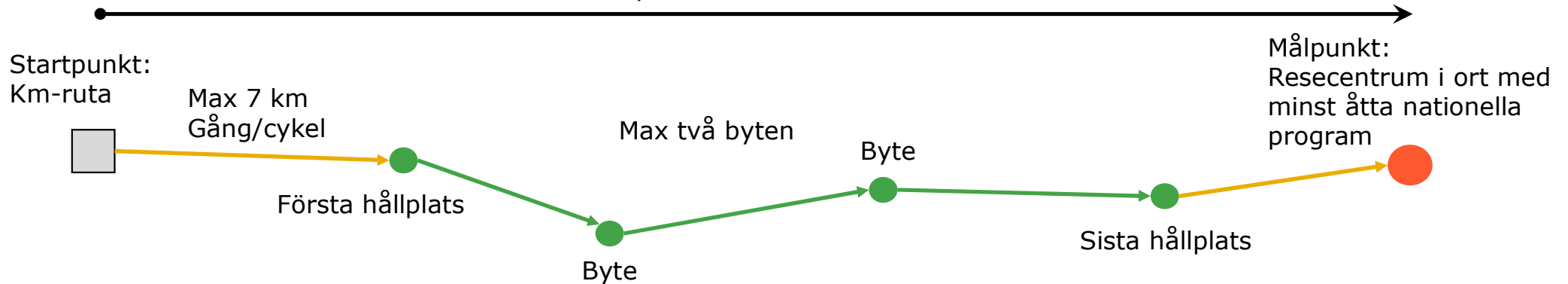
# Gymnasieresor

# Gymnasieresor med kollektivtrafik

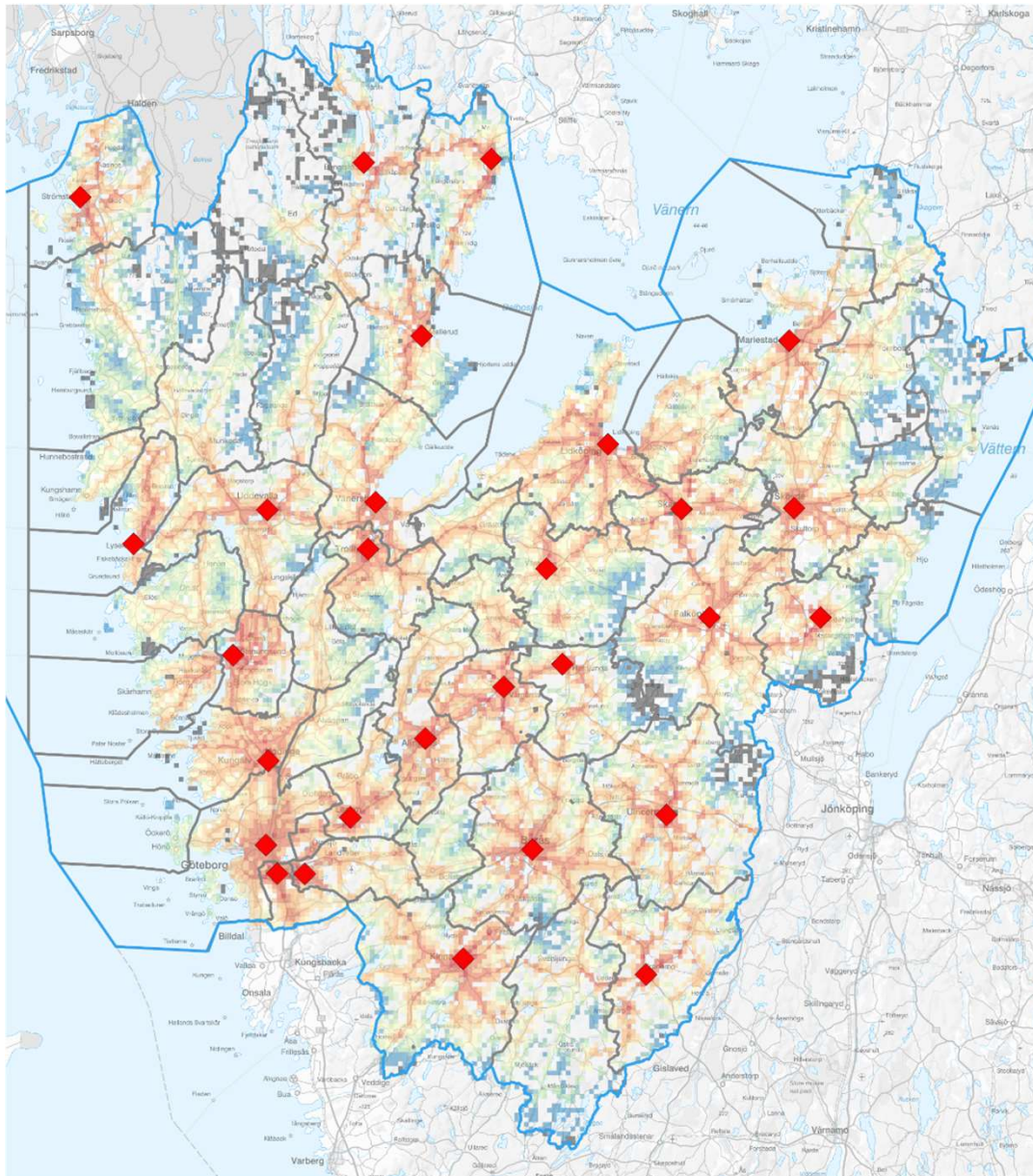


- 28 orter med minst åtta nationella program
- 17 700 befolkade km-rutor
- Kombinationsresor:
  - Inledande och avslutande gång/cykel
  - Buss, tåg, spårvagn, färja
- ca 620 000 resor
- Statistik för befolkning 16-19 år 2021

Total restid, ankomst 06:50-08:10







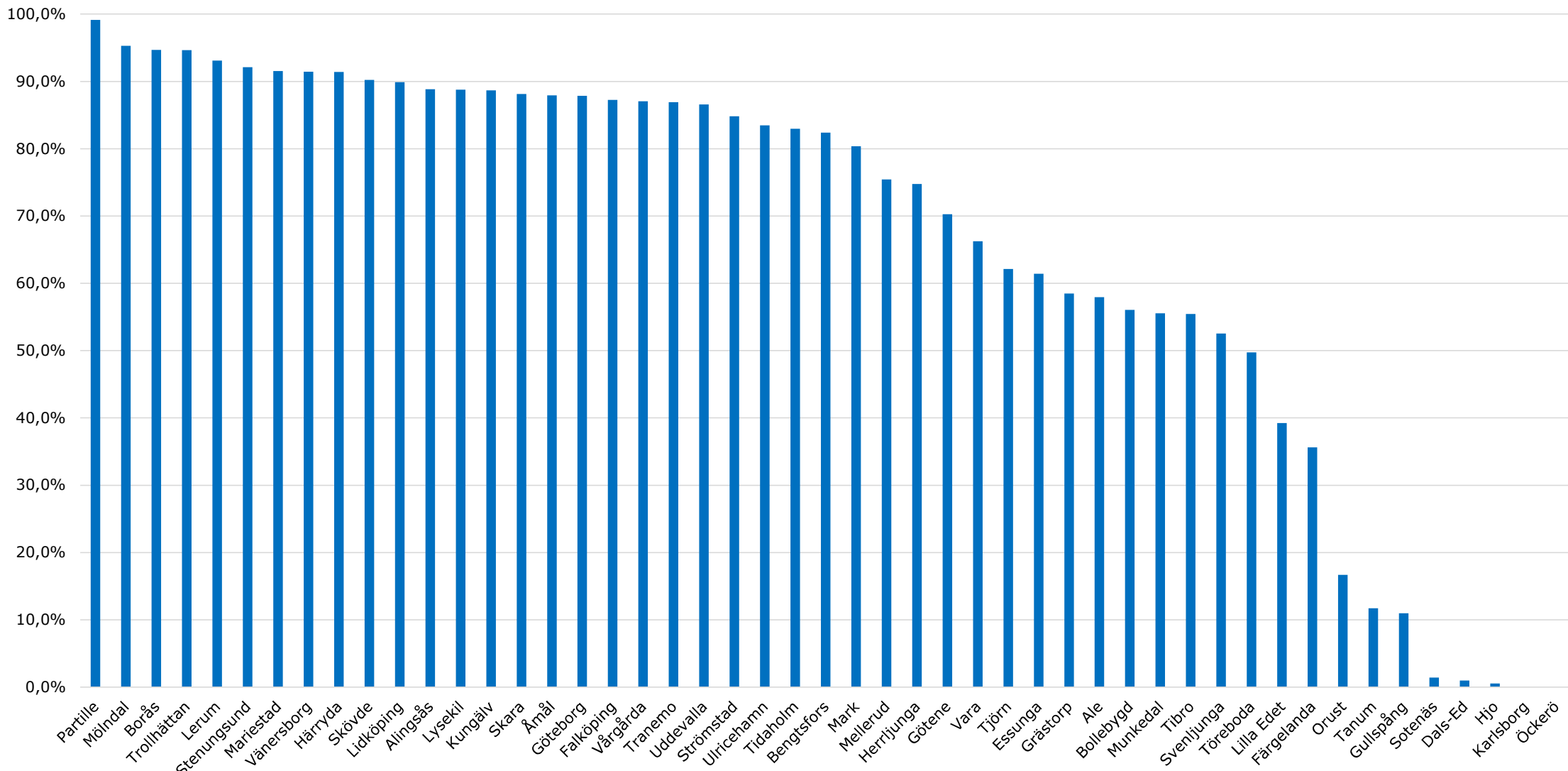
Gymnasieresor 2021  
 Resor från km-rutor  
 till ort med minst åtta  
 program

Restid

- 0 - 15 minuter
- 15 - 30 minuter
- 30 - 45 minuter
- 45 - 60 minuter
- 60 - 75 minuter
- 75 - 90 minuter
- 90 - 105 minuter
- 105 - 120 minuter
- Rutor utan resultat



# Andel 16-19 år med restid 45 minuter eller mindre till ort med gymnasium som har minst åtta nationella program





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