Preferred citation style

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Public transport speeds in the Kanton Zürich

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Problem Statement

- What is the expected (average) speed of a transit trip in the Kanton Zurich?

- How does this speed vary with mode, travel period, and type of origin/destination?

- How does this speed compare with the automobile mode?

Sample Definition

- Using disaggregate trips is more precise than zone-zone representative "trip" (e.g. assignment model)

- Microcensus contains representative trips at different times and on different days

- Self-estimated trip length/time are poorly reported in Microcensus

- *Base representative sample of transit trips on Microcensus but seek measure of travel time and speed from another source*

Method Overview

- Vehicle travel time obtained from timetable of ZVV using the program Hafas (HaCon)
- Vehicle travel distance is derived from table of transit stop locations and distance between stops (Kanton Zurich, VBZ)

- Representative sample of OD relations from Microcensus 2000

- 1.5 * Walk distance/time to and from transit stops derived from geocodes of Microcensus trips

- Analysis uses 3 nearest transit stops per O and D (up to 9 connections)

Elements of the Study

Trip Sample

Microcensus 2000 transit trips: OD and arrival time	Origin/destination coordinates (Jermann)	Microcensus tour mode (Chalasani)

Transit Connections

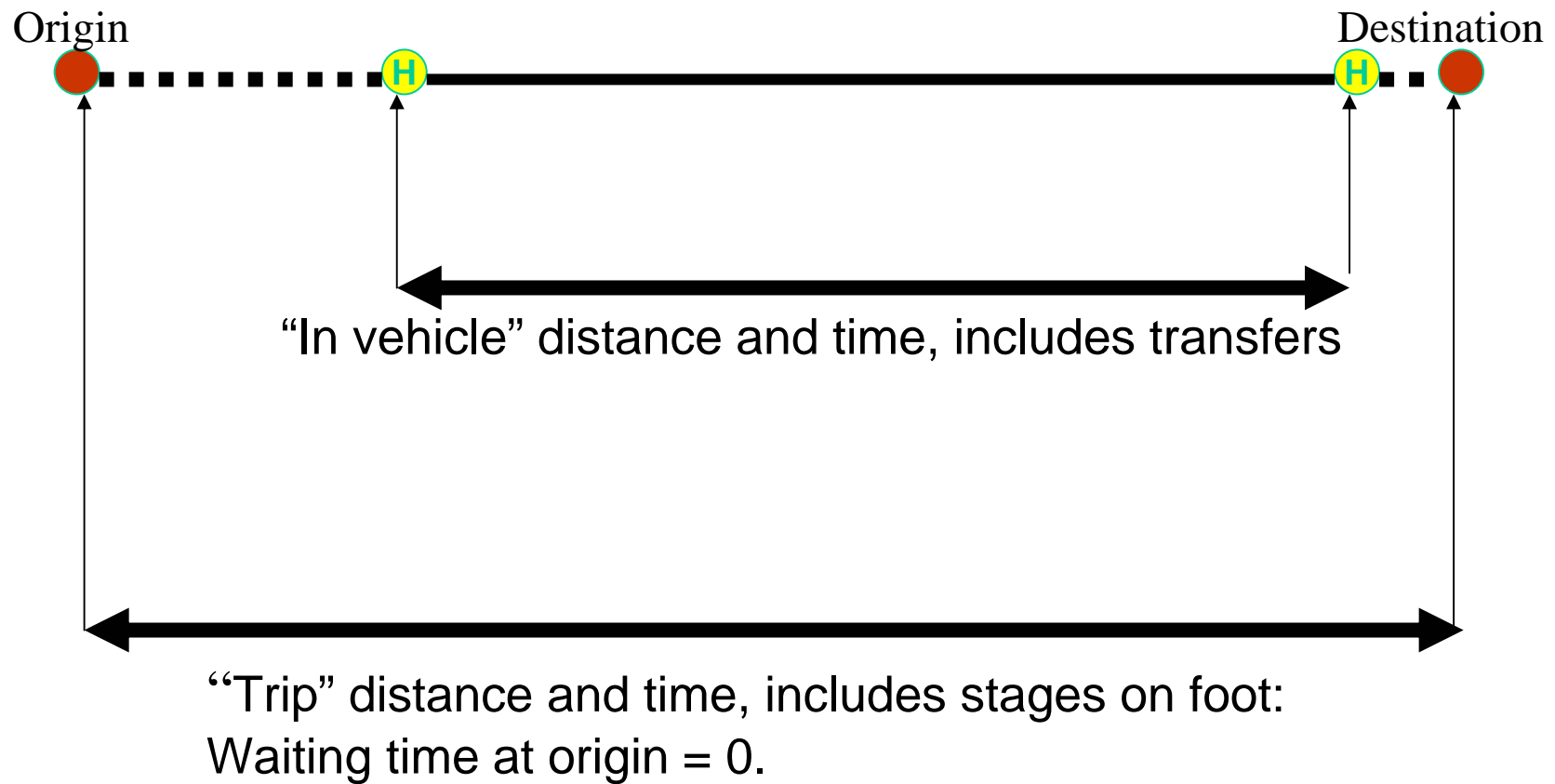|		
Hafas with ZVV timetable (VBZ)	Transit stop coordinates and distances between stops (VBZ)	ARE municipality type for OD (Beige)

Software

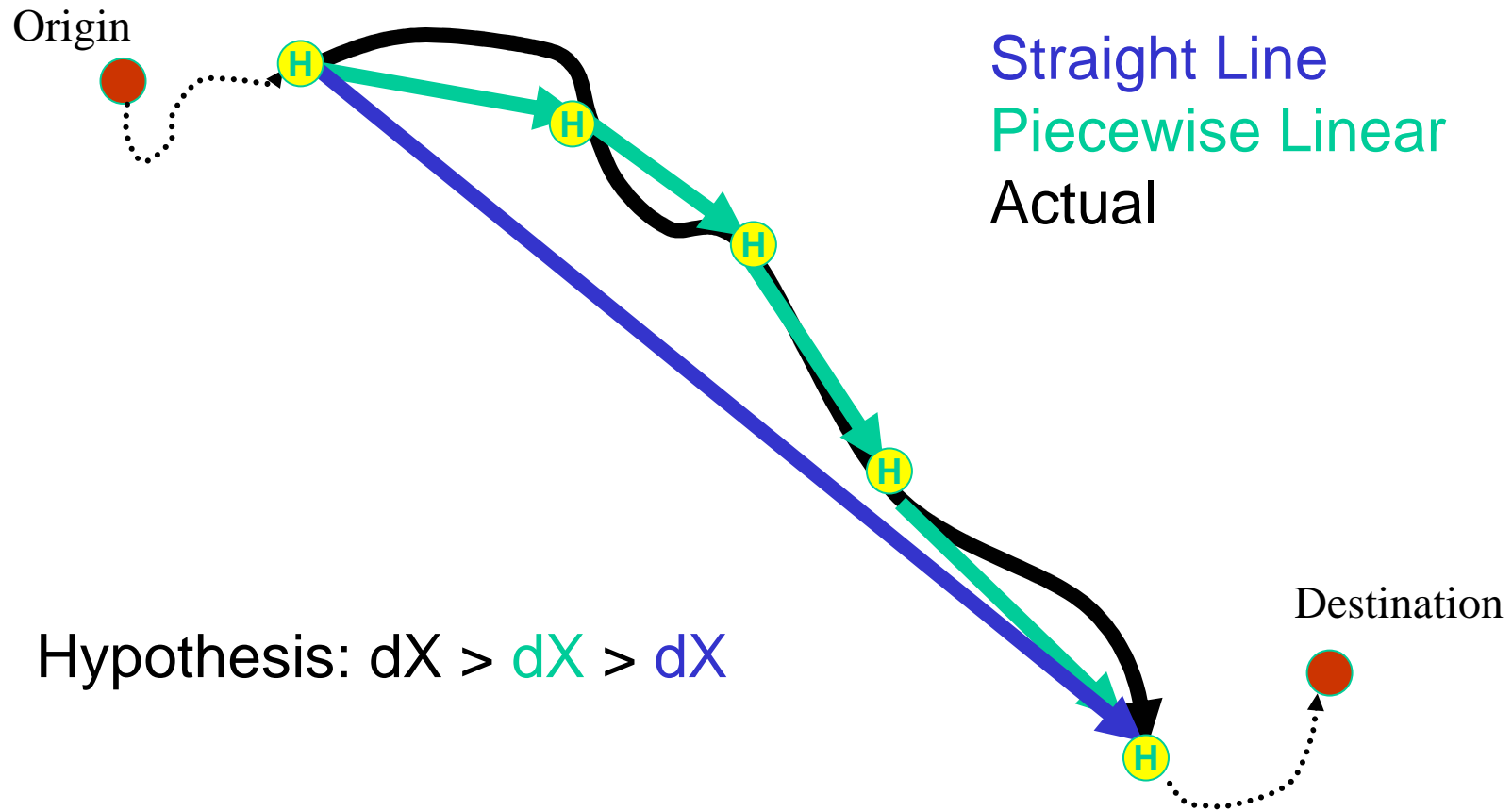|	
Program to read Hafas output (Buergle)	SAS and Excel analysis programs

Analyzing Connections

1. Search for connections in ZVV timetable with batch version of Hafas

2. Construct large dataset of demand matrix plus supply (e.g. result of search)

3. Merge coordinates for all transit stops and the distance between them

4. Summarize stop-to-stop Hafas output at trip-level

   a. Add distances and times between transit stops

   b. Add walking stages before and after transit stage

Definitions

Origin   Destination

"In vehicle" distance and time, includes transfers

"Trip" distance and time, includes stages on foot:
Waiting time at origin = 0.

Distance Estimates for Transit

Origin

Straight Line
Piecewise Linear
Actual

Destination

Hypothesis: dX > dX > dX
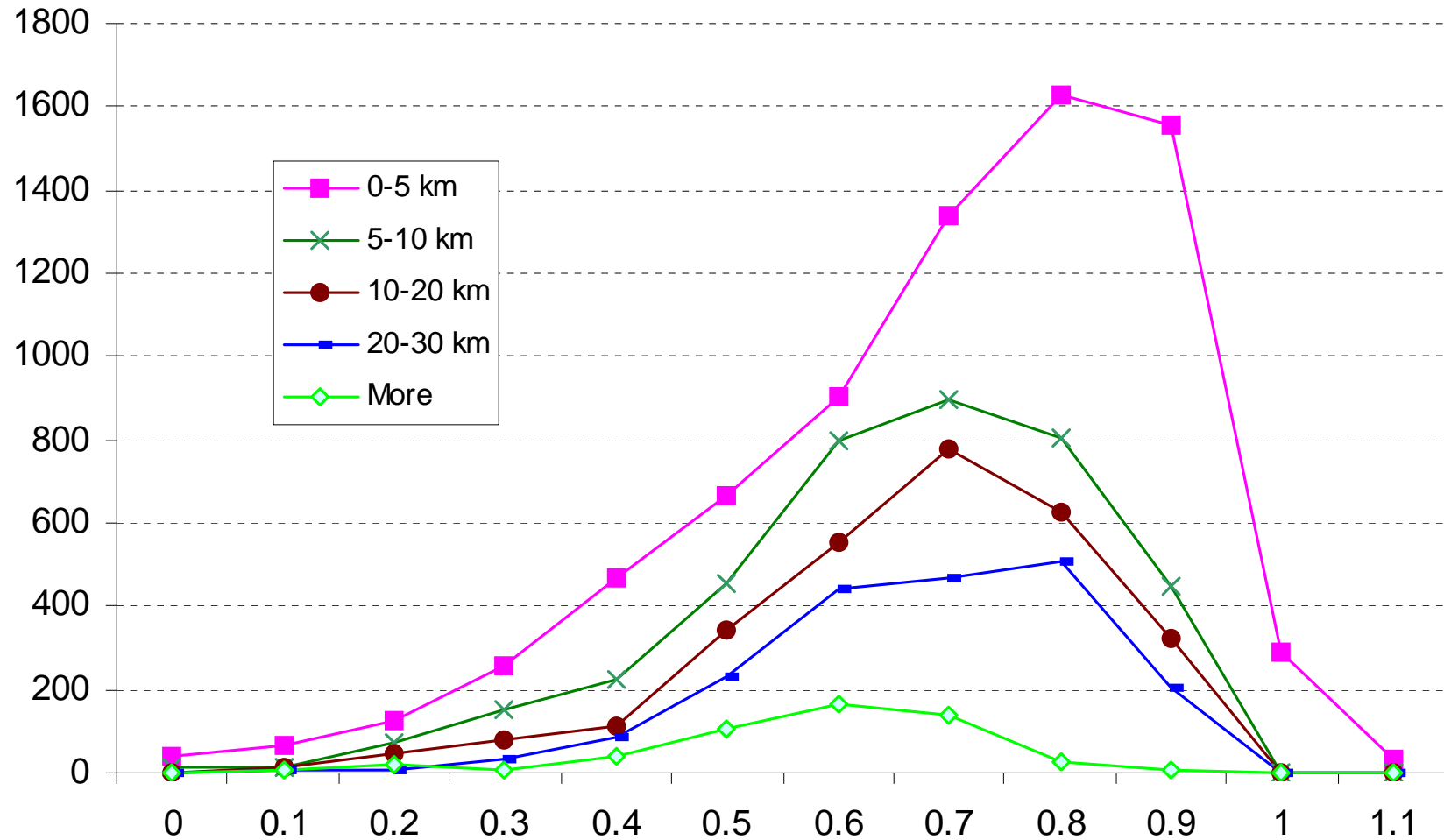
Piecewise Linear / Actual Dist.
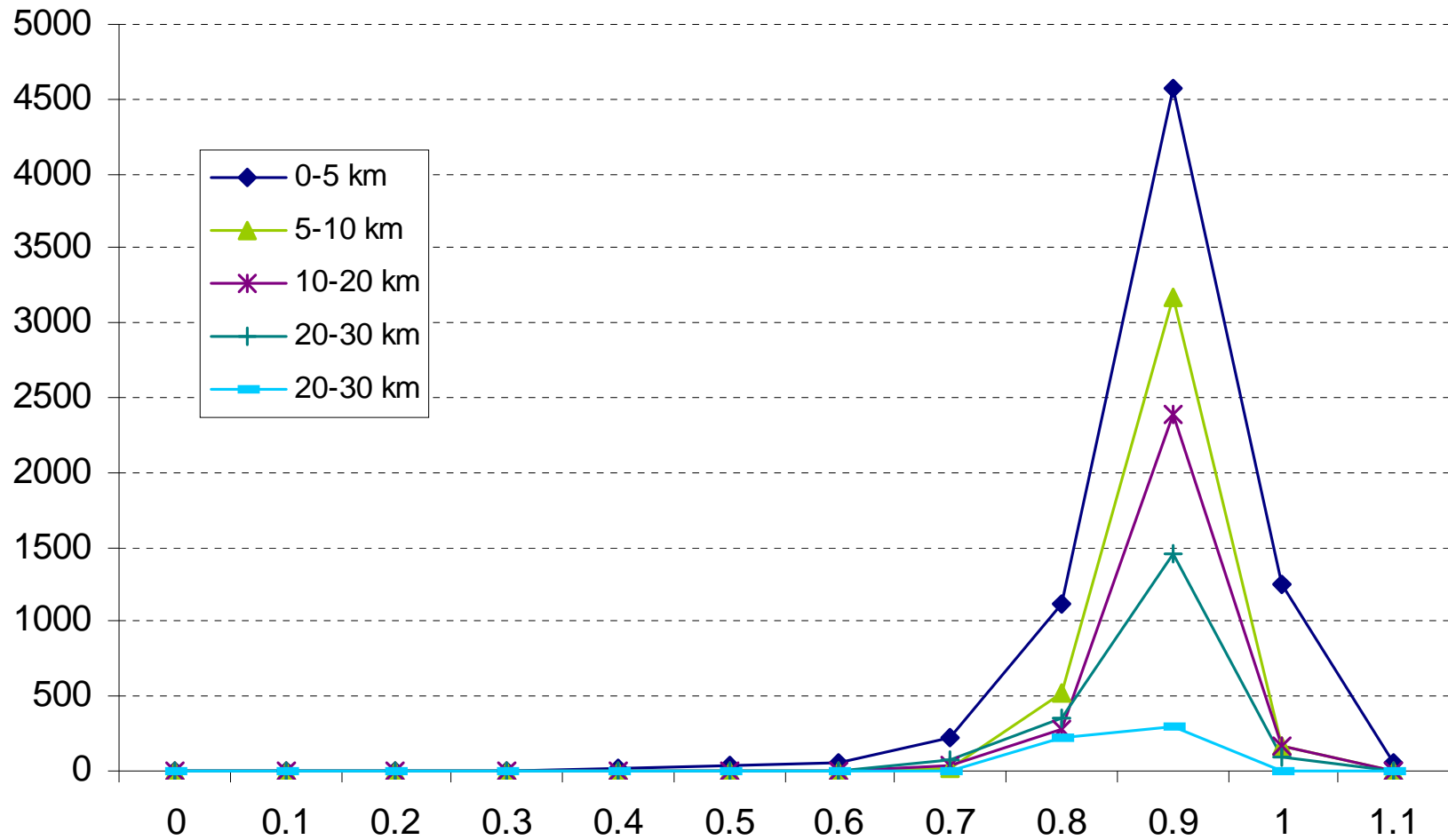
Straight Line / Actual Distance

Ratio of Distance Estimates

| Distance band	Real/ piecewise linear	Real/ Straight line	N
0-5 km	1.05	1.29	7363
5-10 km	1.06	1.38	3879
10-20 km	1.05	1.39	1984
20-30 km	1.07	1.37	1984
30 km plus	1.10	1.58	520
All	1.06	1.35	16614

Speed Calculation

- Space mean speed

  - Classify trips according to desired characteristics (e.g. by time period)

  - Sum distances of all trips in each class

  - Sum time of all trips in each class

- Divide total distance by total time

- Error term is the square root of the proportional variance, times the mean

Results: General

- Direct trip has longer distance and duration than time-shortest trip: same speed

- Average trip speed is 13.3(0.3) km/h

- Average vehicle speed is 19.8(0.5) km/h

- Train is faster than bus/tram (17.8(0.8) vs. 11.6(0.3) km/h)

- Speed is invariant in time
  - Even if analyzed by mode

Trip Speed vs. "In Vehicle" Speed
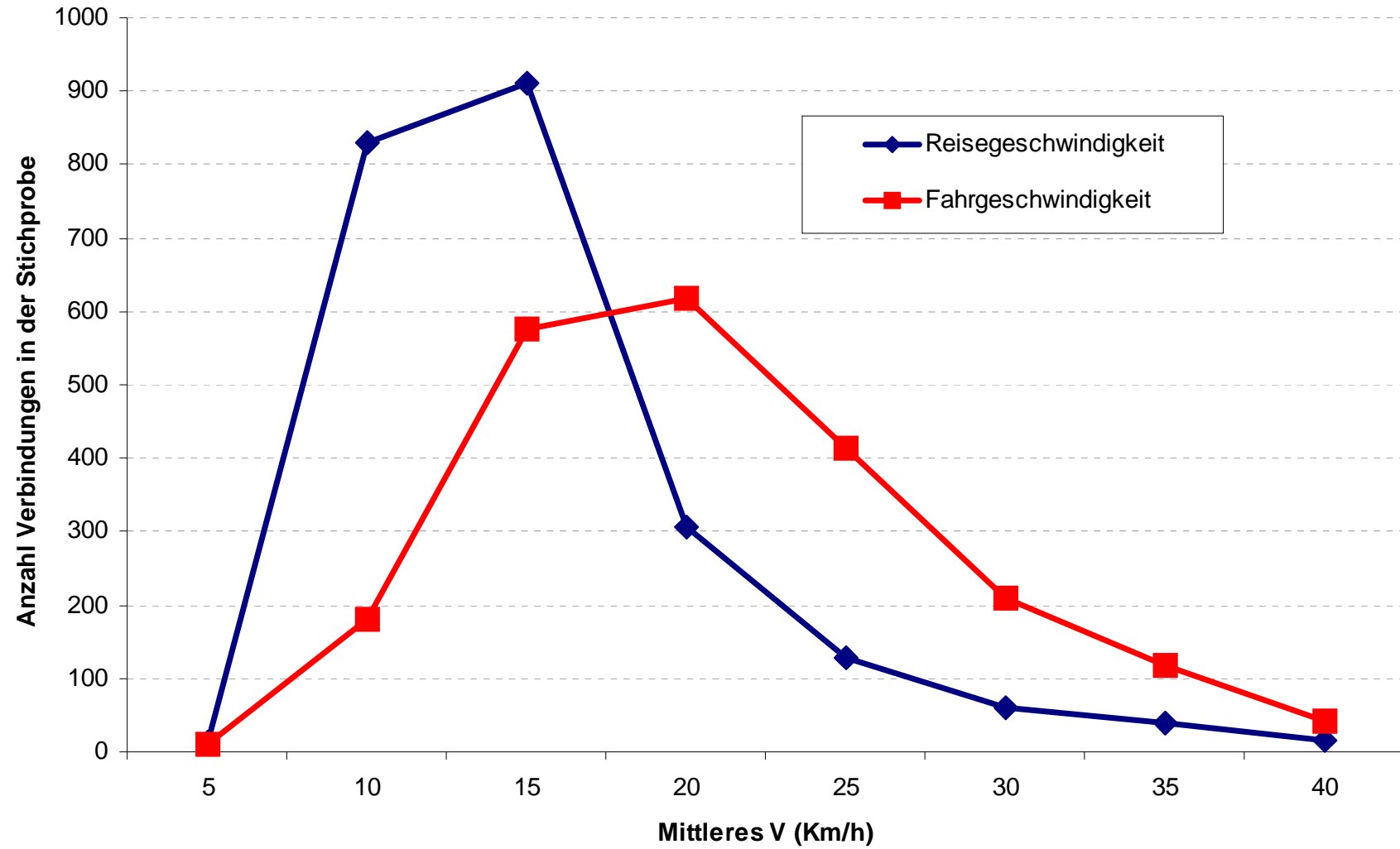
Results: Community Type

- Speeds within/between major centers (ZH, WT) are close to average
    - Sample heavily weighted toward these trips

- Speeds from periphery into centers are faster than vice versa
    - Choice of connection is better

- Speeds between peripheral centers is fastest

Community Type and Transit Speed

From	V1	V2	V3	V4	V5	Alle
V1	12.6(0.4)		11.5(0.9)	11.7(0.8)		12.4(0.3)
V2						13.6(4.8)
V3	14.9(1.6)		18.1(2.3)	18.9(3.0)		16.8(1.2)
V4	14.8(1.1)		17.6(2.7)	13.4(1.3)		14.7(0.8)
V5						12.4(1.6)
Alle	13.1(0.3)	11.4(2.6)	15.2(1.1)	13.1(0.7)	14.7(2.2)	13.3(0.3)

Empty Field = Sample Size smaller than 25 Trips

Results: Walk Stages

Access time/distance is statistically significantly shorter than egress

- Density of transit stops

- Shorter distance to departure station than arrival station

Summary and next Steps

- Transit is slower than automobile: this needn't mean lower travel time
  - Average automobile link speed is 51.4 km/h
  - More calculation is necessary to compare apples with apples

- Calculate automobile speed from door to door using existing dataset

- Use new calibrated demand matrix for public transport for new sample selection and new calculation of transit speed

A1: Definition of Travel Period

Time		From (>=)	To (<)	From (>=)	To (<)
SA	Saturday	0.00-24.00 (Measurement time 06.00-21.00)			
HVZ	Peak Period	6:30	8:30	16:30	18:30
NVZ	Shoulder Period	8:30	16:30	18:30	20:30
RVZ	Off-peak Period	0:00	6:30	20:30	24:00

A2: ARE community types (ARE, 2002)

V1: Major centers or centers near the major centers (Winterthur, Zurich)

V2: Inner/outer beltway of the agglomeration of the major centers

V3: Medium centers

V4: Inner/outer beltway of the further agglomeration

V5: Small centers, bedroom communities, industrial and tertiary communities, semi-agrarian communities, agrarian communities, tourism-centered communities

A3. Community Type and Transit Speed: Sample size

Von \ Nach	V1	V2	V3	V4	V5	Alle
V1	1291	3	101	216	19	1630
V2	6	0	0	2	3	11
V3	111	0	60	51	10	232
V4	225	2	51	114	10	402
V5	18	3	10	11	14	56
Alle	1630	11	232	402	56	2331