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Modelling Bicycle Usage on a National Cycle Network

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Abstract. This paper describes the methodology and results from the 1999-2002 Veloland Schweiz surveys of the Swiss national cycle network, using an intercept survey technique, supplemented by cyclist counts and track-side interviews, to obtain information on the magnitude and characteristics of cyclist flows on the Veloland Schweiz National Cycling Routes. The project uses a method of weighting and expanding the sample data obtained from the survey sites to obtain estimates of annual trips and kilometres travelled for catchment areas around each survey site and for the network as a whole. These expansion weights account for the response to the survey, and to the spatial and temporal sampling involved in the survey. They also account for the weather conditions on the days on which the sample surveys were conducted, compared to the average weather during the survey year. Finally, estimates are made of cycling-related expenditure associated with trips made on the national network. While this method has been developed in the context of a national network of cycle routes, it is clearly applicable at other geographic scales including regional and city-wide cycle networks. The survey techniques and the weighting and expansion methods are useful in estimating usage at any comparable geographic scale.

INTRODUCTION

The Veloland Schweiz National Cycling Route system was introduced in May 1998 to encourage and promote cycling in Switzerland. The system consists of nine routes covering all the major cycling areas, as shown in Figure 1.

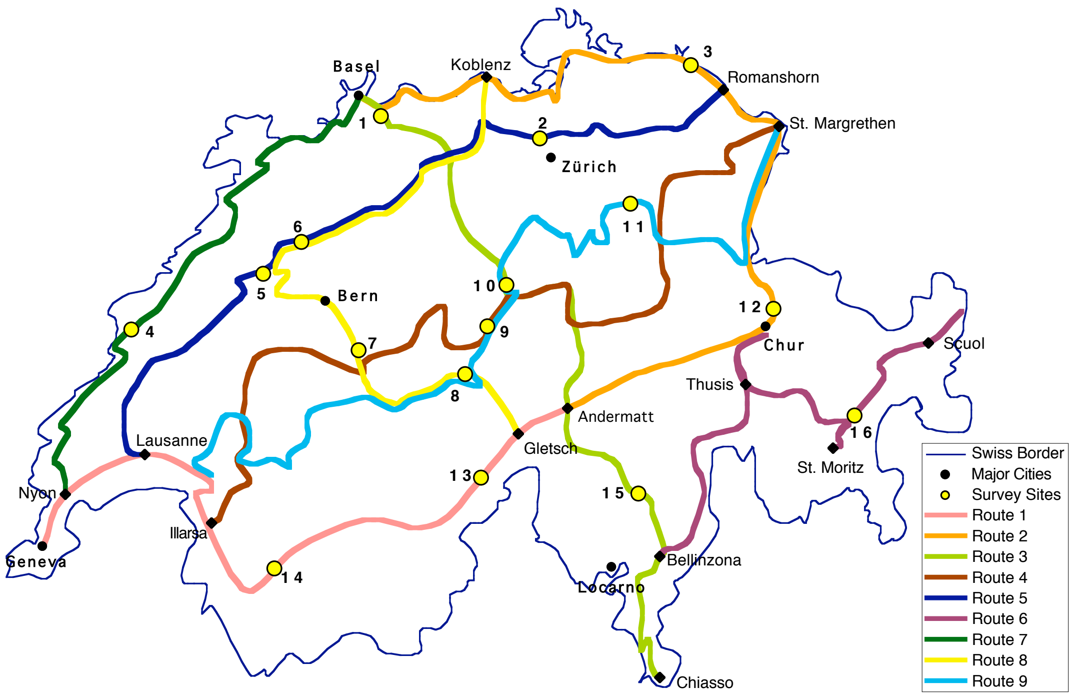

FIGURE 1 The Veloland Schweiz National Cycling Network

Following the introduction of these routes, Veloland Schweiz wanted to undertake user surveys to ascertain the level of usage of these routes by various types of cyclists. They also wanted to get demographic and geographic descriptions of the users and, given the tourism orientation of Veloland Schweiz (a division of Swiss Tourism), an indication of the amount of money spent on bicycle-related activities while using these routes. The surveys were also intended to provide a means of monitoring the changes in usage of the network over time.

Intercept surveys of users of the network were conducted in 1999 through 2002 at 16 sites on the network (see Figure 1), with an estimate of annual network-wide usage being based on an extensive set of weighting factors for the site surveys. This paper describes the methodology employed in the surveys and network analysis, and provides examples of some of the results obtained from the modelling analysis. A full version of the project report (*1*) is available for download from the internet.

THE INTERCEPT SURVEYS

The intercept survey process consisted of four basic steps for the interviewers:

- Counting cycle riders and pedestrians
- Sampling cycle riders
- Conducting a track-side interview
- Handing out the questionnaire

The Interviewer Control Sheet

All the information about the survey was recorded on an Interviewer Control Sheet by the surveyors. In particular, the Interviewer Control Sheet recorded all the counts and the results of the Track-side Interview (see below). Before beginning the survey, surveyors recorded the Survey Location, the Route, the Direction of travel that they were recording, and the Date of the survey at the top of every control sheet. They then checked the Identification Numbers on each questionnaire form that they had, and recorded them on the Interviewer Control Sheet in the ID-Number column in the order in which they intended to give them out (preferably in ascending numerical order).

Surveys were conducted on two weekdays and two weekend days each year (in July through September) at each of the 16 sites. At twelve of the sixteen survey sites on weekend days, and five of the sixteen sites on weekdays, there were two surveyors (one doing each direction), while at the other lower flow sites there was only one surveyor doing both directions.

Counting Riders

At the two-surveyor sites, each surveyor was responsible for one direction of travel on the route, but could assist the other surveyor if the workload was unbalanced between directions at any time. Each surveyor was to count ALL riders travelling in their assigned direction and record this count on the Interviewer Control Sheet using a tally-count procedure. At the one-surveyor sites, the surveyor had to record cyclist flow in both directions, and record them in the appropriate column.

Sampling Riders

It was important that riders were selected randomly for the survey. To ensure this, surveyors were instructed that they MUST select every n^{th} rider passing in their direction (where n was specified for each site in the interviewer instructions). This rider may have been by themselves, at the head of a group, in the middle of a group or at the rear of a group. When the n^{th} rider arrived and the surveyor had recorded this in the cyclist count column, they were then to record the time at which they arrived (to the nearest minute) on the Interviewer Control Sheet, together with their estimate of the cyclist's age, their sex and the size of the group in which they were riding. The surveyor would then request this rider to stop to receive a survey. If the selected rider refused to stop, this was to be recorded on the Interviewer Control Sheet by ticking the NO box in the Survey Accepted column.

The Track-side Interview

In addition to the information about the selected rider that surveyors had already recorded on the Interviewer Control Sheet, an initial Track-side Interview was conducted with every n^{th} rider to record the following information on the Interviewer Control Sheet:

- "Where do you currently live?"
  (Town and Postcode, or Country for non-Swiss-residents)
- "Has this bicycle journey included an overnight stay?"

The information from the Track-side Interview was used to provide an overall picture of cyclists' characteristics that were later used to investigate whether those who returned the questionnaire are similar to all riders who were selected in the sample. It was estimated that the Track-side Interview should have taken a maximum of two minutes to complete.

The Questionnaire

Once the Track-side Interview was completed, the selected rider was given a questionnaire asking more detailed questions about their current trip. Questionnaires were to be taken away and returned by post after the end of the bicycle journey. This ensured that respondents were not guessing about the remainder of their journey (especially on multi-day trips). Surveyors were instructed that the questionnaires were not to be accepted back by surveyors at the survey location. If the rider wanted to complete it and give it back, surveyors were instructed to explain that we would prefer that they take it away and complete it after their journey so that we got the best possible information.

If a selected rider refused to accept a questionnaire, this was to be recorded on the Interviewer Control Sheet by ticking the NO box in the Survey Accepted column. Any questionnaires that were refused were retained by the surveyors after being noted on the Control Sheet as a refusal. In order to clearly identify refusals, these survey forms were NOT re-used for the next selected cyclist.

Sample Design

The overall design of the sample was a multi-stage process by which individual respondents were eventually selected. The sampling consisted of the following stages:

- Sampling over space
- Sampling over time
- Sampling within the population presented

The selection of survey sites on the network was the way by which the entire network was sampled over space to yield a sample of the network flows. Ideally, the selection of sites should be performed randomly, preferably with stratification of the network to ensure that all major parts of the network are represented in the sample. To the extent that the selection of survey locations was not random, the resulting sample of riders will be biased. For example, if too many sites are located near major population centres, then the sample will contain too many short-trip riders. On the other hand, if too many sites are located well away from major population centres, then the sample will contain too many long-trip riders. While the selection of sites was not entirely random, adjustments were later made to the survey results to account for any non-random placement of the survey sites.

The selection of times at which the survey was to be conducted was the way by which the entire network was sampled over time to yield a sample of the network flows. Once again, the selection of survey times should be performed randomly, preferably with stratification of the year to ensure that all major times of the year are represented in the sample. In most years, one survey was conducted on a Wednesday and one on a Sunday in Summer and Autumn of each year. Adjustments were made later for the days of the week and the times of the year when surveys were conducted.

Given the survey sites and the times of the survey, a specific population of riders will pass by the survey sites. The riders were sampled by selecting the n^{th} rider passing the site, where n was selected for each site based on an acceptable workload for the interviewers at each site.

Conduct of the Survey

The surveys were conducted at the 16 sites between 1000 and 1700 hours on a Wednesday and a Sunday in Summer and Autumn of each year. The number of interviews attempted each year rose from 3386 in 1999 to 6973 in 2002. Typically, the number of interviews was higher in Summer than in Autumn, and higher on Sundays than on Wednesdays.

OBSERVATIONS AT THE SURVEY SITES

Before cyclists are asked to accept and complete the take-away questionnaire, a number of observations were made by the surveyors, including:

- A count of all passing cyclists
- Categorisation of cyclists by age and gender
- Questions about country of residence and whether the cycle trip had an overnight stay

Table 1 shows the number of passing cyclists counted on each day surveyed. It can be seen that the number of cyclists counted increased substantially in 2002, from about 16,000 in the previous two years to over 21,000 in 2002 The 1999 count was low because the weather on Sunday 3rd October 1999 was particularly cool and very wet, and this led to very low cycle flows on that day. However, the weather conditions in 2002, when the cycle flows were very high, were not much different from the weather conditions in 2000 and 2001. Clearly, the increase in cycle flows in 2002 was not due to changes in weather on the survey days.

TABLE 1 Number of Cyclists Counted and Weather Conditions by Date of Survey

Survey Date	Cyclists Counted	Max. Temperature	Day Rain (mm)
Sunday 18 July 1999	6932	26	0.4
Wednesday 21 July 1999	3843	25	0.0
Wednesday 22 September 1999	1810	20	0.0
Sunday 3 October 1999	254	14	13.1
1999 Average day	3210	13	1.6
Wednesday 6 Sept 2000	2738	18	0.3
Sunday 10 Sept 2000	7956	21	0.1
Wednesday 13 Sept 2000	1654	24	0.0
Sunday 23 Sept 2000	4050	18	0.0
2000 Average Day	4100	14	1.3
Sunday 22 July 2001	8834	26	0.0
Wednesday 25 July 2001	4822	27	0.3
Wednesday 12 September 2001	1331	15	0.2
Sunday 30 September 2001	1802	17	1.7
2001 Average Day	4197	13	1.4
Wednesday 3 July 2002	3386	22	0.5
Sunday 7 July 2002	9306	23	1.4
Sunday 15 September 2002	5848	17	0.0
Wednesday 18 September 2002	3131	21	0.0
2002 Average Day	5418	14	1.6

The age and gender of cyclists selected for interview were recorded by the surveyor (by observation, not questioning). About 60% of cyclists on weekdays and weekends are male, with ages between 40 and 50 being most frequent for males, and ages between 30 and 40 being most frequent for females. Cyclists on weekends tended to be older than cyclists on weekdays.

Cyclists selected for the survey were asked for their country of residence and whether their current cycle trip included an overnight stay. Swiss residents dominated the day-trip category (95% of all day-trip cyclists observed), but German residents make up a substantial proportion of the overnight trip category (23%).

METHODOLOGICAL RESULTS FROM THE SURVEY

The survey process as described above had four stages by which cyclists could be included in the final database of returned questionnaires. Firstly, they had to be selected from all the passing cyclists; secondly, they had to stop for an interview; thirdly, they had to accept a questionnaire; and fourthly, they had to return a completed questionnaire. The percentage of "successes" at each stage of the survey in each year are shown in Table 2. It can be seen that of the 100% of cyclists counted in each year, about 31% were selected for inclusion in the sample, 65% of those sampled then stopped and accepted the questionnaire, and of these 40% returned the questionnaire.

TABLE 2 Percentage of Successes at each Stage of Survey

	Stage Percentages			
Year	**Counted**	**Selected**	**Accepted**	**Replied**
1999	100%	27%	67%	38%
2000	100%	31%	68%	40%
2001	100%	33%	64%	41%
2002	100%	32%	61%	40%

At the sampling stage of the survey, the age, gender and group size was observed for each sampled cyclist. By looking at the proportion who accepted and returned the questionnaires, it was observed that those riding in a group were more likely to respond than those riding alone, females responded more than males, while older cyclists responded more than younger cyclists.

DATA WEIGHTING AND EXPANSION

The Veloland Surveys, like all travel surveys, require weighting and expansion of the sample data before it can be assumed to represent the population from which it was drawn. Weighting and expansion, although often talked about together, actually refer to two distinctly different processes. Weighting is needed to correct for biases in the sample data, and requires a re-balancing of the proportions of various sub-groups within the sample (e.g. more males and less females to overcome an under-representation of males in the sample). Expansion, on the other hand, is needed to increase the total magnitude of the data so that the totals of various parameters (e.g. cycle trips per year) represent the population from which the sample is drawn rather than just the sample itself. Obtaining a true representation of the population usually requires both processes, and this combined weighting and expansion is often referred to by only one of the terms (weighting or expansion).

The intercept surveys conducted at the 16 sites collected information about the population of cyclists passing each site. This information was in the form of counts of passing cyclists, track-side interviews with selected cyclists, and data obtained from questionnaires completed by respondents who were given a questionnaire after the track-side interview.

The information collected at the survey sites is only a sample of the total information describing all trips on the Veloland network in a year. In fact, this sample of information does not represent cycling trips, but rather represents the distance travelled (the so-called exposure) on these cycling trips. The data collected at each survey site are measures of distance travelled because they are already weighted by the distance travelled by each member of the population. For example, if survey sites were distributed uniformly at 1km spacing along the Veloland network then a 20 km trip would be observed 20 times while a 2 km trip would only be observed twice. More generally, when survey sites are much less numerous, a 20 km trip would have ten times the chance of being observed as a 2 km trip (assuming a random distribution of survey sites). If the data is to be used to represent trips, then the observations of passing cyclists would have to be weighted by the inverse of the trip length to correct for this bias toward longer trips. However, if the survey is intended to measure distances travelled, then no weighting by trip length is required.

Even though the survey observations are measures of exposure, they are only measures of exposure of the sampled cyclists, at the survey sites and times where the surveys were conducted, who agreed to be interviewed. In addition, the questionnaire data only measures the travel behaviour and attitudes of those cyclists who chose to complete and return the questionnaire given to them at the survey site. In order to measure the Veloland cycling exposure of the total population, non-response, non-acceptance, cycle flow, site selection, temporal and spatial expansion factors must be applied. Just as the sampling procedure is a multi-stage sampling process, so the weighting process must also be a multi-stage weighting process (in the reverse order).

The total sampling process is a multi-stage process, whereby the total population is gradually broken down into smaller and smaller units until a final respondent is eventually reached. The sampling (and response) process proceeds through the following sequential steps:

- Site selection
- Day of year selection
- Time of day selection
- Cyclist selection
- Cyclist acceptance of interview
- Cyclist response to questionnaire

The data obtained from the surveys is obtained at four levels: firstly, some very limited information is obtained about all passing cyclists in terms of cycle flows at each site by direction by time of day; secondly, some further information is obtained from all sampled cyclists in terms of age, gender and group size; thirdly, some further information is obtained from those sampled cyclists who stop and complete the interview, in terms of place of residence and whether their trip included any overnight stays; and finally, much more detailed information is obtained from those sampled cyclists who accept, complete and return a questionnaire.

To obtain estimates of the behaviour of the population (the population in this case being defined as all cycle trips on the entire Veloland network in a year) from the data obtained in the sample survey, a series of weighting and expansion factors must be applied to the sample data in the reverse order to the stages in the sampling process.

Response weights

These weights expand the sample of questionnaire responses up to total values for all cyclists who accepted a questionnaire.

Acceptance weights

These weights expand the sample of cyclists who accepted a questionnaire up to total values for all cyclists selected in the sample of passing cyclists.

Cycle Flow weights

These weights expand the sample of passing cyclists up to the total flow of passing cyclists during the survey hours on the survey days.

Out-of-Hours weights

The Out-of-Hours weights expand the flow of passing cyclists during the survey hours on the survey days up to the total flow of cyclists across the entire survey days. Since the survey was conducted only during the hours of 10am through 5pm on the survey days, the expansion of the sampled cyclists by means of the Cycle Flow weights will only estimate the cycle flow during the survey hours. However, there are cycle flows before 10am and after 5pm that must also be accounted for in the overall expansion process. The magnitude of these flows can be estimated by means of the responses to the questionnaire, wherein the times of starting and finishing the trip are recorded.

Site Location (and Network Expansion) weights

These weights adjust the flow of cyclists across the entire survey days at the selected survey sites to account for the non-random location of the survey sites in the network, and expand the site-adjusted flow of cyclists on the survey day up to the total flow of cyclists on the network on the survey days. The weights are made up of two components; the expansion to the total network and the adjustment for the location of the sites in relation to areas of population.

The expansion to the total network is handled by allocating lengths of the network to each of the survey sites. This was done by first dividing the entire network into 10km lengths. Each of these sections of the network was then allocated to the survey site that was nearest to that section. The allocation of these sections is shown by the catchment areas shown in Figure 2.

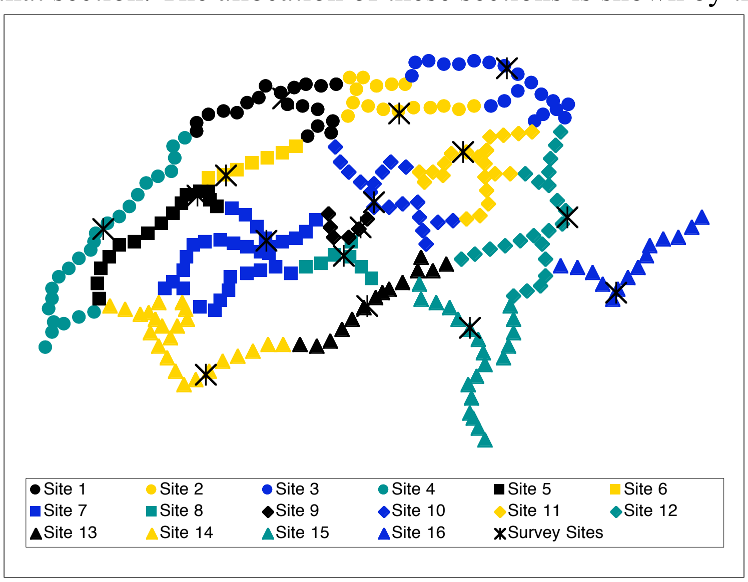

FIGURE 2 Catchment Areas for Survey Sites

The division of the network into catchment areas results in each of the survey sites being representative of a certain length of the network (in kms).

The adjustment for the location of the sites in relation to areas of population is handled by considering the relative nearness of each of the 10km sections of the network to the population of potential cyclists in Switzerland and Germany. Decay models were built for day-trip and overnight trip cyclists showing the rate at which the probability of observing cyclists at each survey site decreased with increasing distance from centres of population. A decay model of the form:

$$T=T_0 * d^n$$

was constructed, where

T = trips per capita at any distance d from a centre of population,

T_0 = the trips per capita for the lowest distance group,
d = distance from the survey site to a centre of population and
n = a decay parameter.

The optimum value of n was obtained for day-trips and overnight trips by reference to three criteria:

- The difference between the modelled and observed trips per capita at varying distances from centres of population
- The difference between the modelled and observed trips at varying distances from centres of population; and
- The difference between the total modelled and observed trips at all distances.

The optimum value of n for day-trips and overnight trips in each of the survey years was approximately 1.75 for day-trips and 0.80 for overnight trips. This implies that, as expected, day-trips are less likely than overnight trips to be observed at greater distances away from the home location (i.e. day-trips are more localised).

Using the values of n for day-trips and overnight trips obtained above, the attractiveness of each point within the catchment length of each survey site was then calculated, and the average of the attractiveness of these points was compared to the attractiveness of the survey site itself. This resulted in a relative attractiveness weight for each survey site, compared to their catchment lengths, for day-trips and overnight trips. The final Location Weights are obtained for each site by multiplying the attractiveness weights by the catchment lengths.

Seasonal (weather) weights

The Seasonal weights account for weather conditions on the days of the survey to adjust the flow of cyclists on the network on the survey days to an average weekday or weekend day during the year. The Seasonal weights were calculated by comparing the weather (maximum temperature and day rainfall) on the survey days to the average weather during the year at each of the survey sites. For each survey site for each survey day and the yearly average day, a temperature factor and a rainfall factor were calculated, and a weather factor calculated as the product of these two factors. The weather weight was then calculated as the ratio of the survey day factor to the yearly average factor. This process was then repeated for overnight trips, recreational day-trips and everyday utilitarian trips.

The average weather conditions observed on each survey day (averaged across all 16 survey sites) were shown in Table 1. Sunday 3rd October 1999 stands out as having had particularly bad weather on the survey day (compared to that time of year in other years). Table 1 also includes the yearly average weather conditions in each of the survey years. It can be seen that, except for Sunday 3rd October 1999, the weather on survey days was better than the annual average weather. Therefore, since good weather encourages higher levels of cycling, the results obtained on the survey days will generally have to be scaled down in order to represent cycling conditions on an annual average day.

The effects of weather variations on cycle flows are shown in Figures 3 and 4, for temperature and rainfall effects respectively. These relationships are based on results obtained from continuous counts in Switzerland and from more extensive research in Australia.

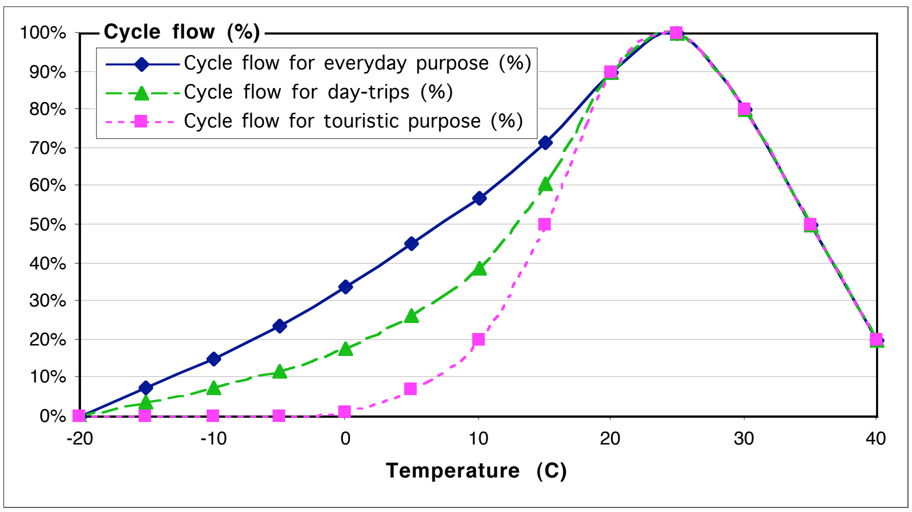

FIGURE 3 Effect of Temperature on Cycle Flows

Figure 3 shows that cycle flows are maximised at a temperature of about 25°C, and decrease with higher or lower temperatures. This effect is more pronounced for overnight tourism trips and less pronounced for everyday utilitarian trips. Figure 4 shows that cycle flows are maximised at zero rainfall, and decrease with higher levels of rainfall. This effect is more pronounced for overnight tourism trips and less pronounced for everyday utilitarian trips.

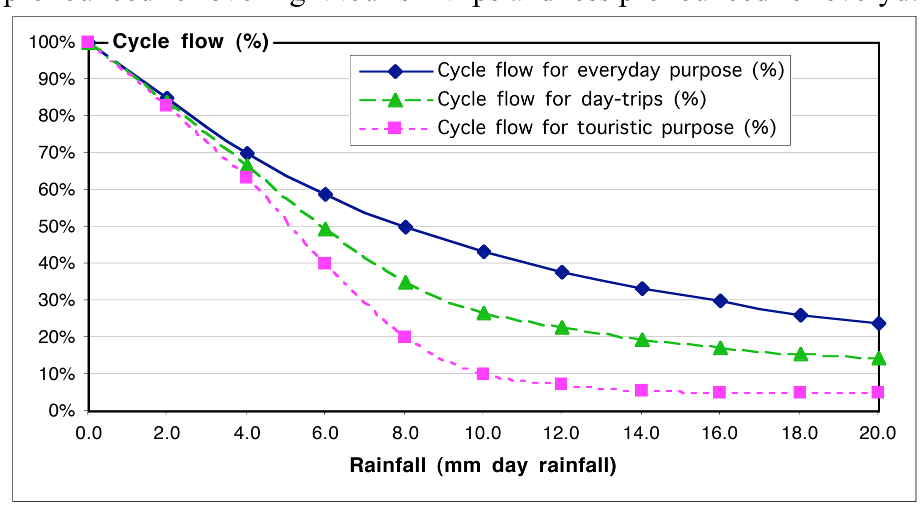

FIGURE 4 Effect of Rainfall on Cycle Flows

For each site and each day, a temperature factor is obtained from Figure 3 and a rainfall factor obtained from Figure 4. A weather factor is then calculated as the product of the temperature and rainfall factors, for Overnight Tourism trips, Recreational Day-Trips and Everyday Day-Trips.

Day-of-Week (and Annual Expansion) weights

These weights allow for two processes. Firstly, they adjust the flow of cyclists on the network on an average weekday or weekend day to account for the distribution of flows over the days of the week and secondly they expand the average weekly flows to obtain the flow of cyclists on the network in an entire year. It is assumed that the Wednesday survey flows are representative of all weekday flows, while the Sunday survey flows are representative of all weekend flows. Since there are two Wednesday surveys and two Sunday surveys in each year, the weights are 130 (=52*5/2) for Wednesday surveys and 52 (=52*2/2) for Sunday surveys.

Trip Length weights

These weights convert the flow of cyclists (measured in kilometres of travel) into the number of trips on the network in an entire year. It is recognised that those cyclists who ride longer distances have a higher probability of being included in the sample, because they are more likely to pass one of the survey sites. Allowance must be made for this bias towards longer trips by means of Trip Length weights in order to obtain an unbiased estimate of trips on the network. The Trip length weights are simply equal to the inverse of the trip length. Use of these weights converts the observations at the survey sites into estimates of trips. If an estimate is required of the distance travelled by these trips, then the trip length weights should not be used.

The overall Trip Weights (to convert the questionnaire results into an estimate of the annual total of trips on the entire Veloland network) are obtained by multiplying all the previously derived weights (i.e. the Response weight, the Cycle Flow weight, the Out-of-Hours weight, the Day-of-Week weight, the Location weight, the Seasonal weight and the Distance weight).

Multiplication of several weights, as described above, can give rise to some very high and some very low weights because of the chance multiplication of several high or low individual weights. A common technique for reducing the effect of outliers in the distribution of weights is that of "trimming". In this process, the top x% of weights are constrained to be equal to the (100-x)th percentile of the distribution while the bottom x% are constrained to the xth percentile. A common value of x is 5%, thereby constraining the distribution of weights to the 5^{th} and 95^{th} percentiles of the distribution of weights. To avoid distorting the mean value of the weights, the trimmed weights are re-scaled such that the mean of the trimmed trip weight is equal to the product of the means of the individual component weights.

A summary of all the weights in the four survey years is shown in Table 3.

TABLE 3 Summary of All Weights by Year of Survey

	1999	2000	2001	2002
Response Weight	4.90	3.56	3.82	4.03
Cycle Flow Weight	3.68	3.21	3.05	3.24
Out-of-Hours Weight	1.26	1.26	1.25	1.24
Location Weight	163	179	176	186
Seasonal Weight	0.59	0.58	0.49	0.54
Trip Length Weight	0.043	0.043	0.037	0.045
5%-trimmed Trip Weight	9131	4919	3983	5649
5%-trimmed Kilometre Weight	214446	113633	108324	126538

ANNUAL ESTIMATES OF NETWORK USAGE AND EXPENDITURES

The preceding section has summarised the derivation of weights which will convert the results obtained from the sample survey into estimates of total network usage. This section estimates the total usage in each of the catchment areas around the survey sites and for the network as a whole, and then estimates the total expenditure on cycling-related activities on the network.

The estimated annual results are summarised in Table 4 for each survey year, together with the average values across all four years. Several features of these results are important. Firstly, in terms of trips, day trips vastly outnumber overnight trips, with overnight trips comprising only 5% of all trips. However, because of their much longer average length, overnight trips make up 27% of the trip-kilometres on the network. The second major feature is the order of magnitude of the results. There are about 7.2 million day-trips made on the network annually covering about 170 million kilometres, and about 350,000 overnight trips covering about 50 million kilometres. The average day-trip length is about 23 kilometres while the average overnight trip length is about 130 kilometres. The variations across the years are primarily due to sampling variability, since it must be remembered that we are estimating total annual network usage based on a relatively small sample size at a limited number of sites on only four days of the year. More reliance can be placed on the average results across the four years than on the specific results for any one year.

TABLE 4 Estimated Annual Trips and Trip-Kilometres on Veloland Network

	Day-trips	Overnight Trips	% Overnight Trips	Day-trip Kms	Overnight Trip Kms	% Overnight Trip Kms	Kms per Day-Trip	Kms per Overnight Trip
1999	7,540,774	421,418	5%	168,436,448	66,312,093	28%	22	157
2000	6,374,129	428,289	6%	142,590,795	35,101,377	20%	22	82
2001	5,507,319	279,955	5%	129,592,933	43,959,066	25%	24	157
2002	9,410,123	271,440	3%	234,087,120	39,780,497	15%	25	147
Ave.	7,208,086	350,276	5%	168,676,824	46,288,258	27%	23	132

The annual expenditure by cyclists on these trips can be estimated by applying the average expenditure per trip by day-trippers and overnight tripmakers, as calculated from the Veloland questionnaire survey, to the annual number of trips. The average expenditures per trip are approximately SFr15 for day-trips and SFr420 for overnight trips (including food, accommodation and other transport costs). The total annual expenditure of cyclists using the Veloland network on trip-related items is approximately 220 Million Swiss Francs. This amount is split relatively evenly between day trips and overnight trips. Although overnight trips have far higher expenditures per trip, the sheer number of day trips means that the total expenditure on day trips is comparable to the total expenditure on overnight trips.

A useful index of expenditure can be obtained by dividing the total expenditures by the total trip-kilometres for each type of trip, which shows that day trips have an expenditure rate of about SFr.0.65 per kilometre, while overnight trips have an expenditure rate of about SFr.3.00 per kilometre travelled.

CONCLUSION

This paper has summarised the methodology and results from the 1999-2002 Veloland Schweiz surveys, using an intercept survey technique, supplemented by cyclist counts and track-side interviews, to obtain information on the magnitude and characteristics of cyclist flows on the Veloland Schweiz National Cycling Routes. The project has used a method of weighting and expanding the sample data obtained from the survey sites to obtain estimates of annual trips and kilometres travelled for catchment areas around each survey site and for the network as a whole.

The analysis has shown that day trips vastly outnumber overnight trips, with overnight trips comprising only 5% of all trips. However, because of their much longer average length, overnight trips make up 27% of the trip-kilometres on the network. There are about 7.2 million day-trips made on the network annually, and about 350,000 overnight trips. These trips generate a total of about 200 million kilometres of travel.

It has been estimated that the total annual expenditure of cyclists using the Veloland network on trip-related items is approximately 220 Million Swiss Francs. This amount is split relatively evenly between day trips and overnight trips. Although overnight trips have far higher expenditures per trip, the sheer number of day trips means that the total expenditure on day trips is comparable to the total expenditure on overnight trips. A useful index of expenditure can be obtained by dividing the total expenditures by the total trip-kilometres for each type of trip, and this shows that day trips have an expenditure rate of about SFr.0.65 per kilometre, while overnight trips have an expenditure rate of about SFr.3.00 per kilometre travelled.

While this method has been developed in the context of a national network of cycle routes, it is clearly applicable at other geographic scales including regional and city-wide cycle networks. The survey techniques and the weighting and expansion methods are useful in estimating usage at any comparable geographic scale.

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