VGI Case Studies and Accuracy Investigations

Workshop: Voluntary geographic information for spatial data infrastructures?

Wageningen University

16 April 2010

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Important Additional Attributes

Addresses

Location

How can we reliably improve our data?

Currency

Proper Names

Time-Sensitive Changes

The Vision...

- Can we use "**the experience of the crowds**"...

  .... our customers, our users, our employees, our colleagues or our soldiers...

  ... to voluntarily update authoritative mapped information?

✓ Greater user involvement

✓ Faster updating cycles

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Focus of Current Research

To investigate and demonstrate how

.....volunteered contributions of geospatial data from both individual citizens *and* professional mapping organizations ....

...may be authenticated, processed and employed to populate new public, government and commercial map databases.

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Essential Questions

- What is the organization's rationale for considering VGI? What mission, objective or problem is being addressed?
- To what extent, if at all, should VGI be adopted?
- How may credible VGI contributors be qualified?
- How may incorrect, misleading or damaging contributions be identified and excluded?
- How much control over content and quality are such organizations prepared to relinquish? Who makes the final decisions regarding the reliability of a given update?
- Why would individuals want to contribute anyway (and what keeps them contributing)?

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3 Ideas Underpinning Web 2.0

1. Content creation is triggered by events.
2. User generated content is increasingly being consumed by the community.
3. The community could take on some of the functions of the editor.

from Mobile Web 2.0 [Jaokar and Fish, 2008]

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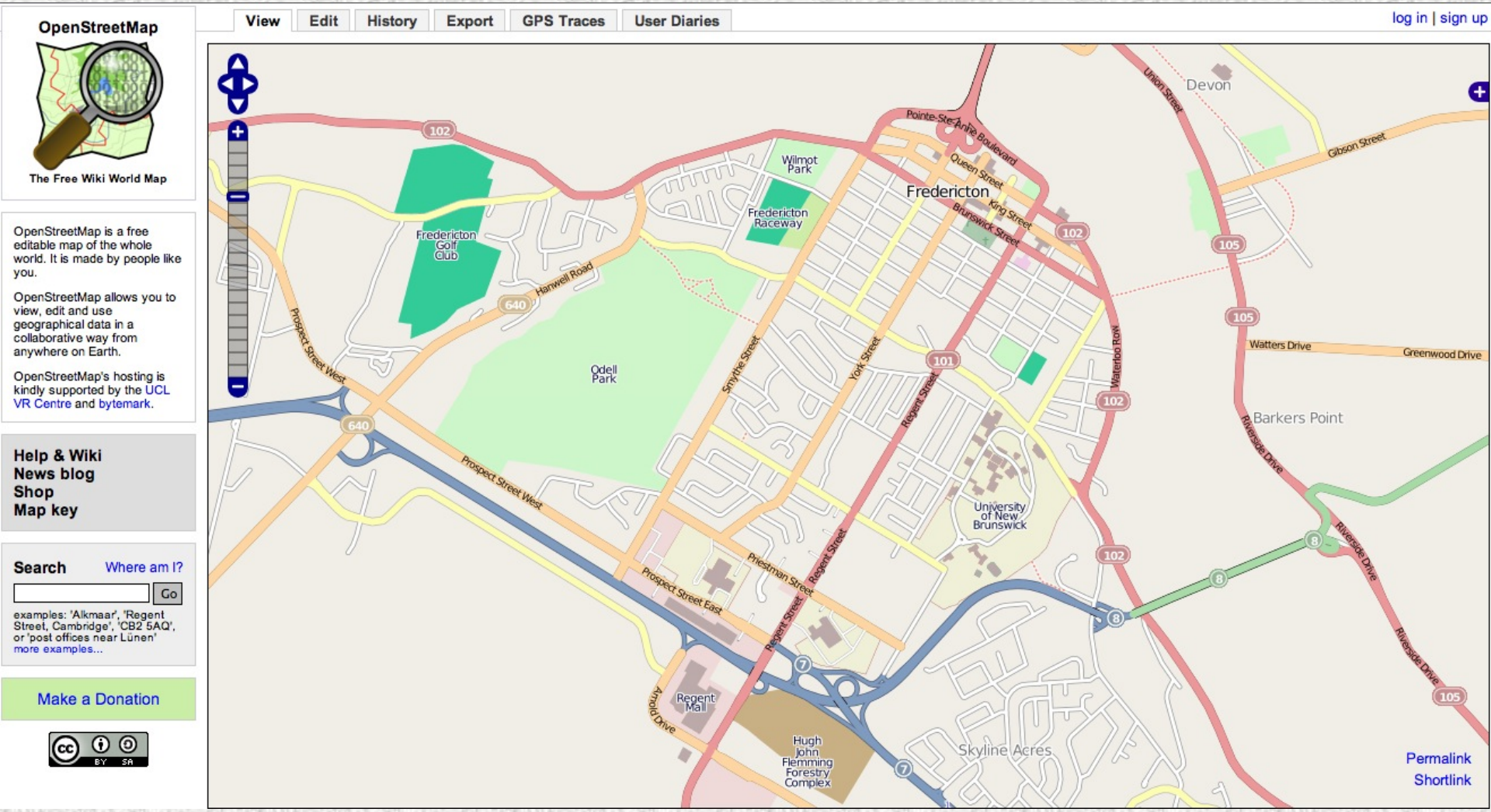
OpenStreetMap.org



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"Crowd

Google
Map Maker
Countries editable in Google Map Maker
POWERED BY
Google

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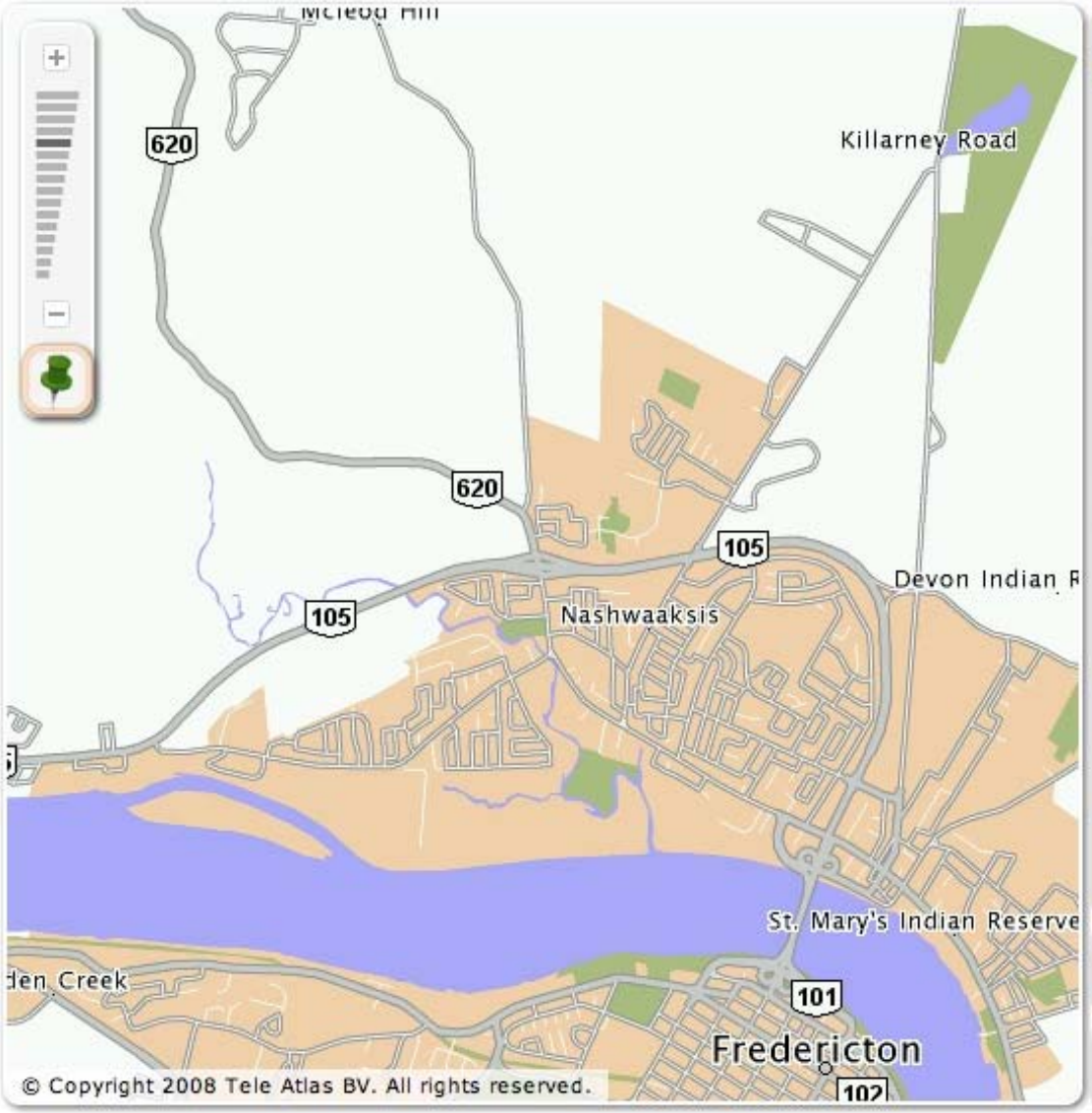
Thank You for submitting your report to Tele Atlas Map Insight.



Step 1 - Locate

Country: Canada

State/province: New Brunswick

Select an address:

Hwy 105, E3A, York County, NB

Hwy 105, E3A, York County, NB

Can't find your address in the list? →

or:

Locate by coordinates

Latitude: Longitude:

Use decimal degrees, e.g. -71.25

SEARCH

Step 2 - Describe

Step 3 - Submit

appreciate conscientious users like you who take the time to tell us where we might need

Please continue to help us by entering new issue reports at http://mapinsight.teleatlas.com them.

Thank you again for your feedback.

Who are the "Volunteers" in VGI

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What can we learn from other efforts on the Web?

Free / Open Source Software Development	Wikipedia
Contributor Rating and User Reputation (Expedia, Amazon, E-Bay & others)	OpenStreetMap and others
Customer map updates to TeleAtlas/TomTom, Nokia/ Navteq & others	LBS aspects of social networking sites & services
Emerging Range of User Contribution Systems (UCS)	

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Characterizing the Contributions

Constructive Contributions

- Legitimate New Content;
- Constructive amendments;
- Correction of damaging contributions;
- Minor Edits & Format Changes

Characterizing the Contributions

Damaging Contributions

Harder to Track

- Mass deletes
- Nonsense
- Spam
- Partial deletes
- Deliberate Misinformation
- Unintentional Misinformation

What Motivates People to make Constructive Contributions?

Examples:

1. Altruism
2. Part of existing job, mandate or personal project
3. Offer practical solution to a shared problem
4. Protect or enhance a personal investment
5. Enhanced Personal Reputation
6. Social Reward by being part of a larger network or virtual community
7. Pride of Place

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What Motivates People to make *Damaging* Contributions?

Examples:

1. Mischief
2. Malice or Criminal Intent
3. Social or Economic Agenda

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So what, Dave?

What have we learned from all this?

- Contributors want recognition for their contribution.
- They want to see their contribution (and quickly).
- There are established approaches and technologies to validate contributions *and* contributors.
- Graduated approaches *can* be accommodated.
- In-house responsibilities continue to evolve from *production* towards *intelligent filtering.*

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Land
.vic.gov.au

Victoria Department of Sustainability & Energy

http://www.land.vic.gov.au/Spatial

--> Notification and Editing Service

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DSE Notification & Edit System

Well-defined Roles, Allowable Operations and Database Access Privilege, and Timelines within the Updating Workflow

- NES User
- Notifier
- Custodian
- Maintainer
- System Adminstrator

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Change Request ID	Description	Notifier	Status	WF	Date Last Modified
341	Apiry Point Editing with UFI=346	Local Government Authority (Towong Shire)	SUBMITTED		8/09/2008 10:16:51 AM
340	Apiry Point Editing with UFI=346	Local Government Authority (Towong Shire)	SUBMITTED		8/09/2008 10:16:42 AM
339	Apiry Point Editing with UFI=707	Local Government Authority (Towong Shire)	SUBMITTED		8/09/2008 10:16:37 AM
338	Apiry Point Editing with UFI=707	Local Government Authority (Towong Shire)	SUBMITTED		8/09/2008 10:16:31 AM
337	Apiry Point Editing with UFI=2633	Local Government Authority (Towong Shire)	SUBMITTED		8/09/2008 10:16:22 AM
336	Apiry Point Editing with UFI=1563	Local Government Authority (Towong Shire)	SUBMITTED		8/09/2008 10:16:08 AM
334	road demo	NES General Public	CHANGE ACCEPTED		5/09/2008 3:03:00 PM
332	**Sept M1**	**Local Government Authority (Towong Shire)**	**SUBMITTED**		**3/09/2008 3:26:59 PM**
330	Road name demo 1	NES General Public	CHANGE ACCEPTED		3/09/2008 3:21:41 PM
325	test change parcel	NES General Public	CHANGE ACCEPTED		3/09/2008 12:30:45 PM
324	test change	NES General Public	CHANGE ACCEPTED		3/09/2008 11:30:24 AM
298	Deleted a property	NES Sample State Org	SUBMITTED		1/09/2008 9:05:17 AM
293	name to both	NES General Public	SENT TO ROAD & ADDRESS MAINTAINERS		29/08/2008 4:39:53 PM
292	name to 2	NES General Public	SENT TO ROAD MAINTAINER		29/08/2008 4:39:41 PM
291	name to 1	NES General Public	SENT TO ADDRESS MAINTAINER		29/08/2008 4:39:27 PM
288	road name dual -2	NES General Public	CHANGE ACCEPTED		29/08/2008 3:35:30 PM
287	road name dual -1	NES General Public	CHANGE ACCEPTED		29/08/2008 3:34:37 PM
285	Add Address (Testing Add Multi-Feature Function)	Local Government Authority (Wangaratta Rural City)	SUBMITTED		29/08/2008 12:22:27 PM
284	this is road name extent - other was road name	NES General Public	CHANGE ACCEPTED		29/08/2008 3:39:21 PM
283	road name extent	NES General Public	CHANGE ACCEPTED		29/08/2008 12:32:14 PM
280	Road 5	NES General Public	DECLINED		29/08/2008 10:49:34 AM

Web-Based Direct Collection

Image Background – Maximum Image Scale

USGS
science for a changing world

The National Map

USGS Home | Biology | Geography | Geology | Search USGS

PROGRAM SUSPENDED
FALL 2007
Pending Review

Volunteers Wanted!

The U.S. Geological Survey Web-based Data Collection Program Needs Volunteers

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Mapshare

- 20 million drivers using TomTom – the world's largest satellite navigation community.
- TomTom owns TeleAtlas – TeleAtlas' customers reporting over 15,000 map "errors" per month BUT can take 6-12 months to verify and fix.
- MapShare service introduced in mid-2007 to: (1) streamline the notification process; and (2) enable customers to use their own updates immediately.

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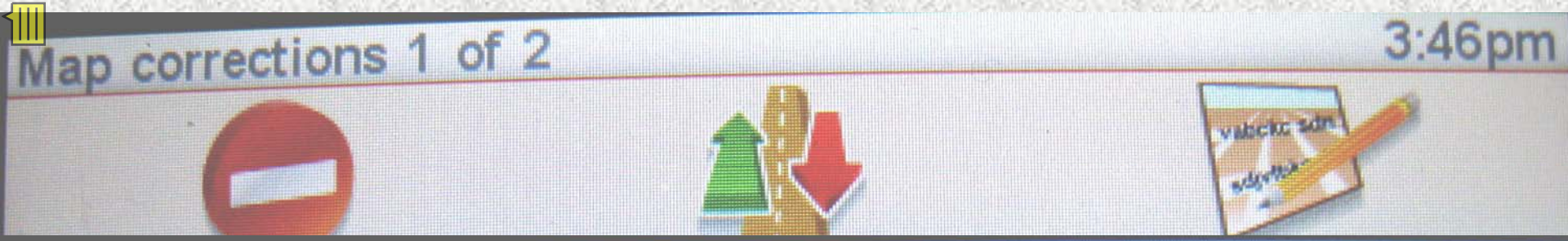
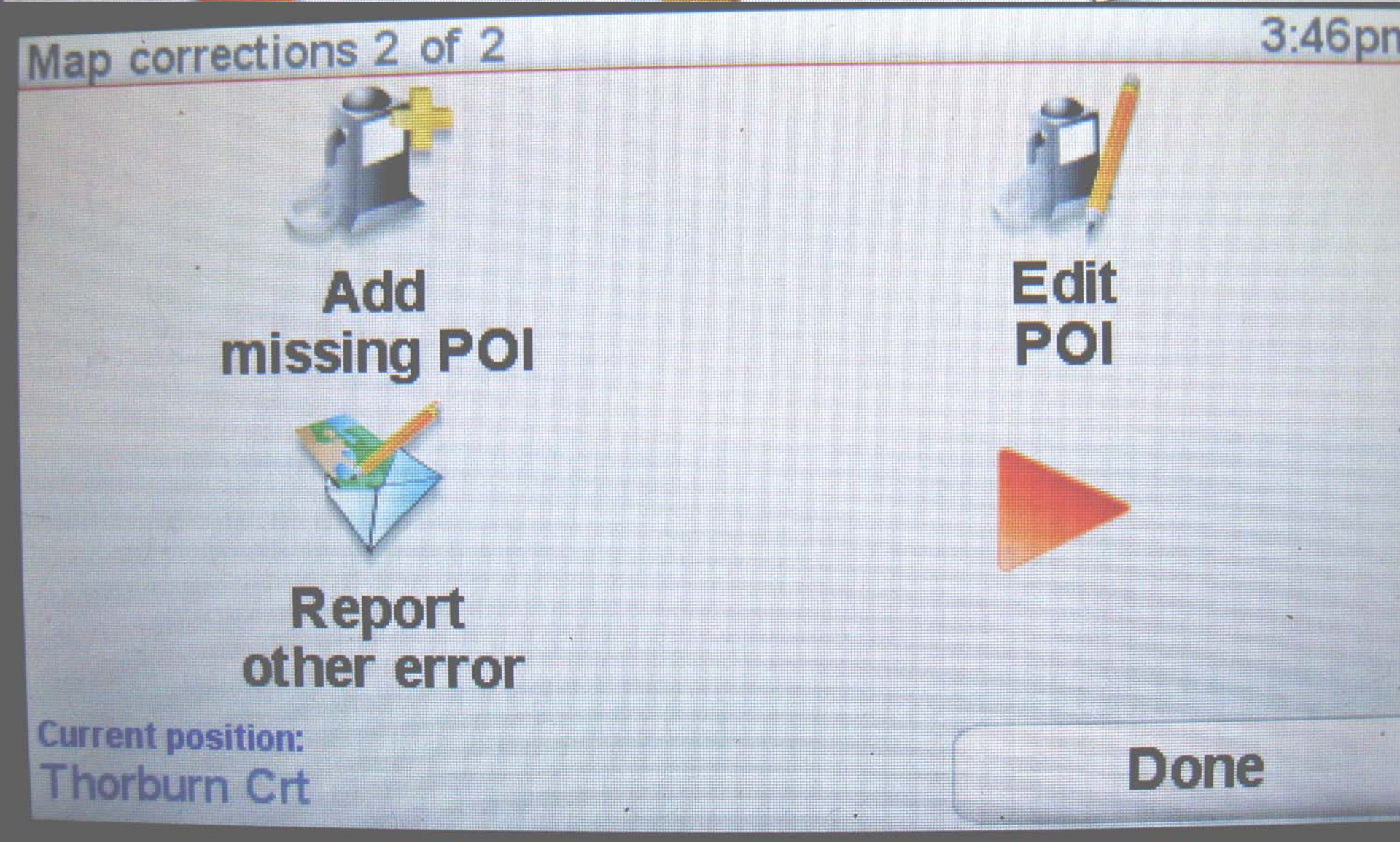
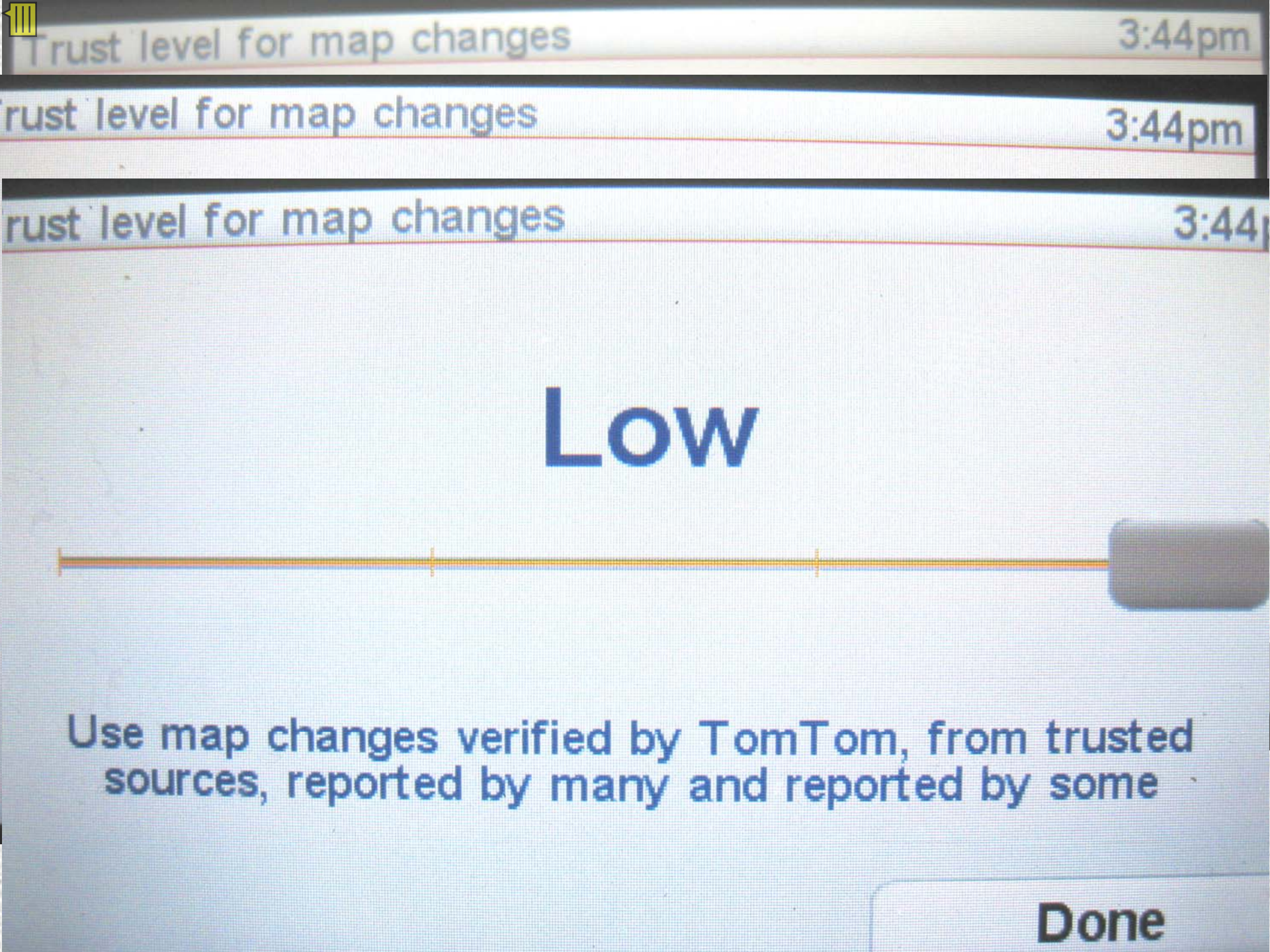

Map corrections 1 of 2
3:46pm


Map corrections 2 of 2
3:46pm
Add
missing POI
Edit
POI
Report
other error
Current position:
Thorburn Crt
Done


Trust level for map changes
3:44pm
rust level for map changes
3:44pm
rust level for map changes
3:44
Low
Use map changes verified by TomTom, from trusted sources, reported by many and reported by some
Done

By December 2008:
Within 12 Months of Launching Mapshare Service...

- According to TomTom: *"Number of Map Share community members increased* from 500k to 5 million";
- 5 million map improvements uploaded;
- 80% decrease in questions from customers regarding maps at TomTom's Customer Support Department

TOMTOM

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Contributor Motivations 1

MOTIVATION	Victoria DSE Notification and Editing Service	USGS National Map Corps	TomTom MapShare™
Altruism	???	Yes	Yes
Professional or Personal Interest	Yes: Professional	Yes: Personal	Yes: Either and sometimes Both
Intellectual Stimulation	???	Yes	Yes
Protection or enhancement of a personal investment	No	???	Yes

Contributor Motivations 2

MOTIVATION	Victoria DSE Notification and Editing Service	USGS National Map Corps	TomTom MapShare™
Social Reward	???	Yes	Limited
Enhanced Personal Reputation	???	Yes	???
Outlet for Self-Expression	No	No	No
Pride of Place	???	Yes	Yes

Returning to Fundamental Questions

- ***Should a Public Sector Mapping Organisation do this?***
  - Rationale? What problem(s) are we trying to address by doing something here?
  - What's our Vision?
  - Benefits?
  - Risks?
  - Culture changes required?
  - Institutional or organizational impediments?

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More Questions...

- ***Where do we start and how far do we take this?***
  - Keep it within our own organization or allow "real outsiders" to contribute?
  - Who holds the pencil? Full-edits, or just a tool for Update Notification and Prioritization?
  - Who makes the final decisions?
  - How do we sustain interest?
  - Do we risk alienating certain users or supporters?

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Culture Shift Implications for Mapping Organizations

- Moving from coverage-based to feature-based updating model;
- Accepting that "trusted outsiders" may be willing and able to make reliable contributions;
- Weighing the approaches to "Community–as–Editor" (practical and cultural);
- Accepting that such volunteered information will be "perpetually unfinished";
- Accounting for and balancing the respective rights of individual contributors, the produsage community and the mapping organization.

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Resourcing It Properly

- Quick and Easy Registration of contributors
- Immediate acknowledgement of receipt of updates and brief explanation of process.
- Rapid, but defensible and logical evaluation of contributions by custodians.
- Ability to incorporate valid updates *in some manner* within stated time limits.
- Ability to roll back to previous version(s) easily.
- Detailed Audit Trail
- Ability to rate and adjust the reputation of a given contributor over time (internally or externally governed?)

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Follow-on Research @UNB

- 3 VGI Case Studies completed to date
- Positional Accuracy Assessment of VGI Tools
- Critical comparison of different means of Assessing Credibility of Contributors and Reliability of their Contributions (e-Commerce & Social Networking examples)

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To the Future:
"Core Values" or "Evolving Paradigms"?

- Issues in "fairness" of coverage and contributions. (Social networks are not necessarily fair or democratic...)
- Is duplication still a "bad thing"? When do we stop "using something many times" and change it?
- Changing roles of providers: "professionals", "artists", "artisans", and "amateurs".
- Anecdotes of "critical" and "uncritical" users: Useful or not?

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To the Future:
SDI vs. sdi
Public vs. Enterprise vs. Personal

- "Institution" focus versus "usability and culture" focus
- Influence of organizational survival (public and private)
- Expanded interoperability
- Evolving and increasing levels of expectation and (sometimes) accountability

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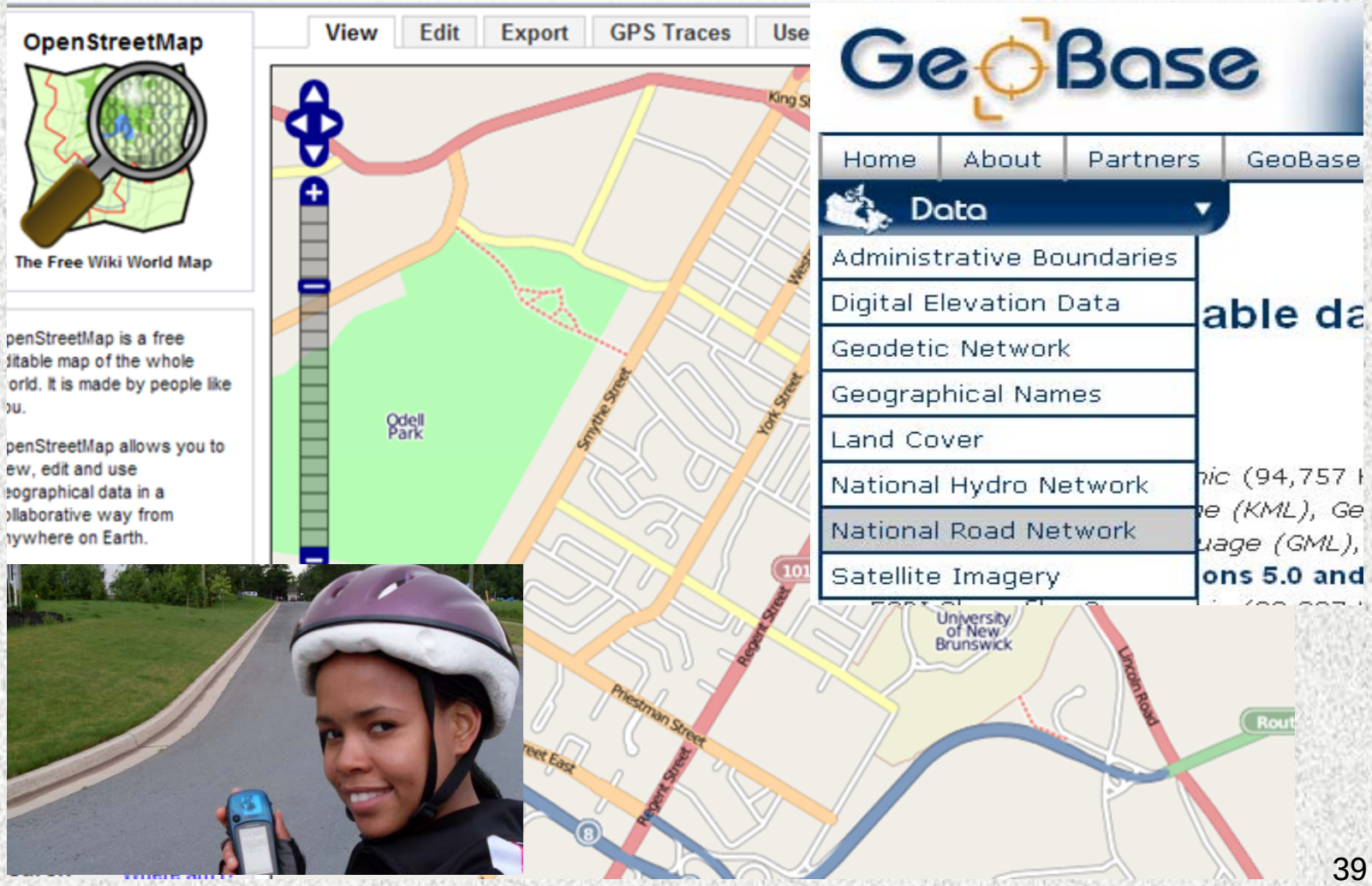
Data Collection and Processing

Data Collection



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Evaluating VGI

- Criteria used to evaluate VGI
  - Positional Accuracy: Planimetric Accuracy of VGI must be ± 10m for roads and ± 30m for other features.

Positional Accuracy Evaluation Methods	
Buffer Comparison (Hunter and Goodchild, 1997)	Manual Comparison Hunter and Goodchild, 1997)
Datasets: • OSM • iPhone • eTrex GPS • GPSMAP GPS	Datasets: • OSM • iPhone • eTrex GPS •POI

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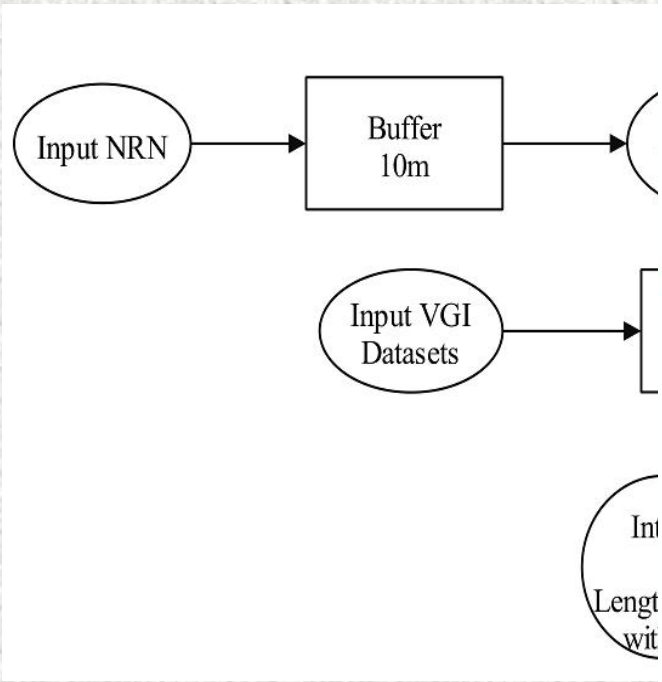
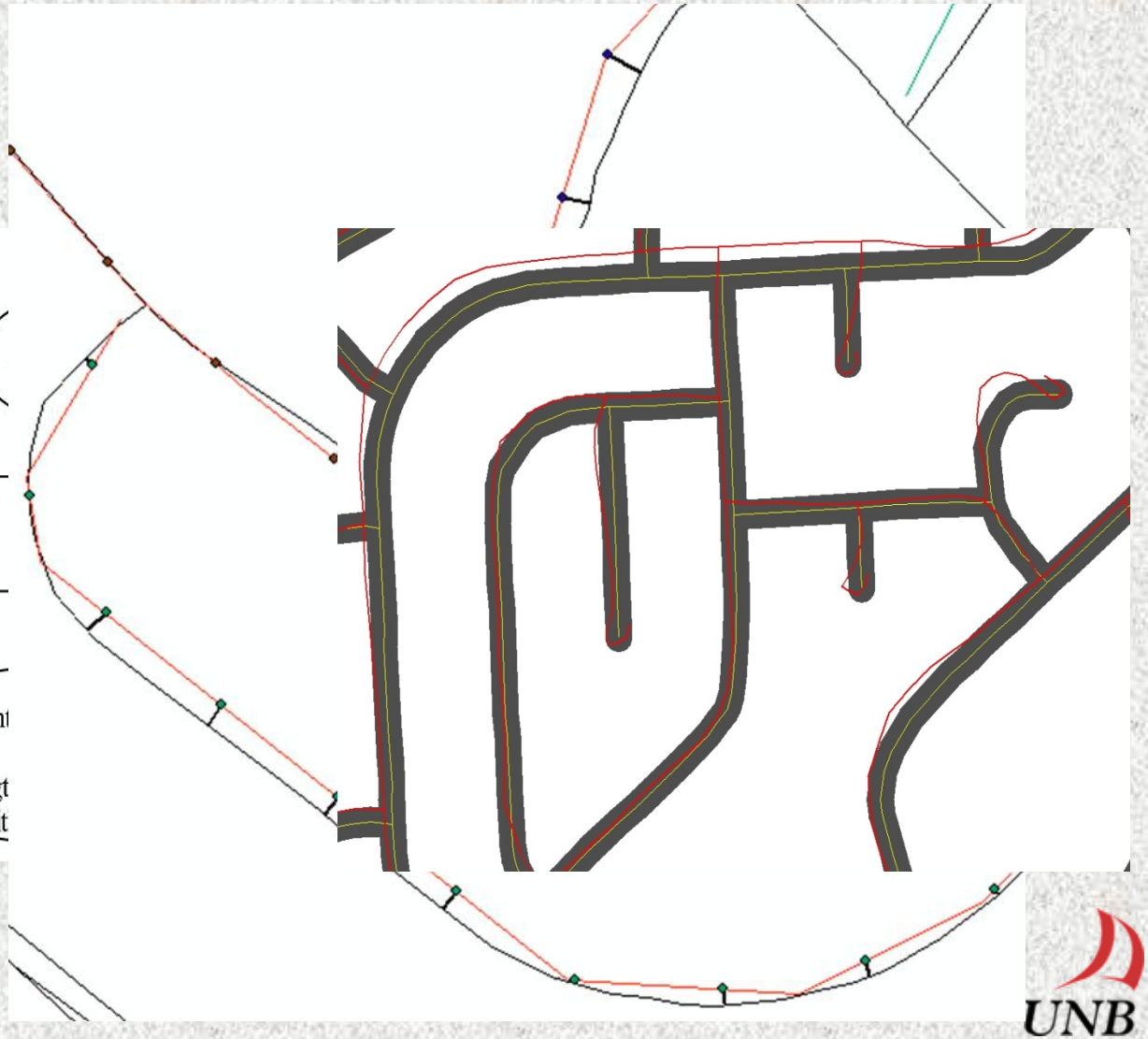
Evaluating VGI

Manual Comparison

Buffer Comparison





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Results: Positional Accuracy

- ± 10m for roads & ± 30m for other features

Buffer comparison Results:

Table 1: Percentage of VGI streets within 10m of NRN streets

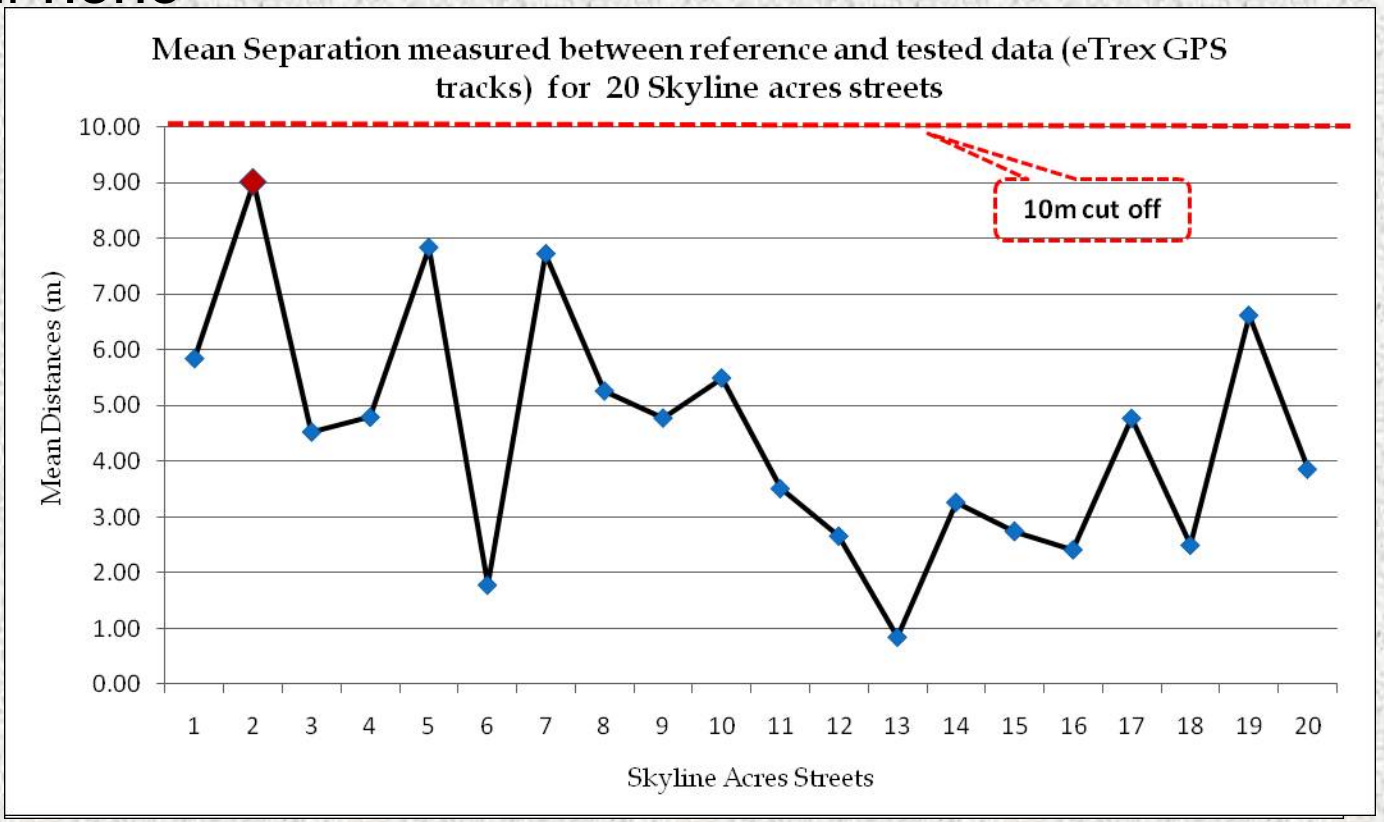
VGI Street Centerline Data Source	Percentage Within 10m
iPhone	82.86%
OpenStreetMap	94.04%
Garmin eTrex	90.47%
Garmin GPSMAP 76CSx (Edited)	89.81%
Garmin GPSMAP 76CSx (Unedited)	90.37%

42

Results: Positional Accuracy

- Manual Comparison Method

eTrex
iPhone



From [Sabone, 2009]

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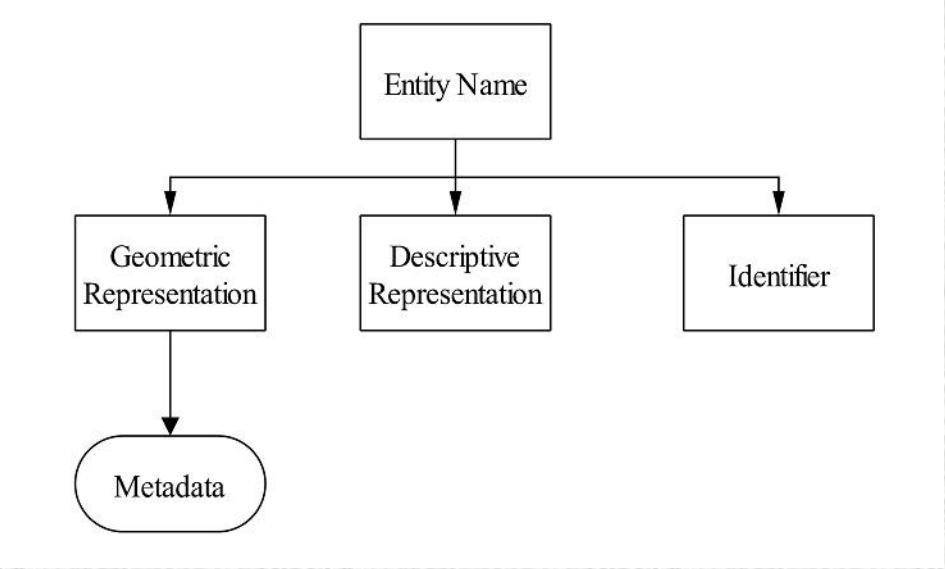
Results: Attribute Accuracy & Data Structure

- Attribute Accuracy: identifier + correct attributes
  - VGI street data attributes and NRN attributes NOT THE SAME – cannot be compared



No Metadata regarding geometric representation for VGI data

From [Sabone, 2009]

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Results

- **Uncertainty:**
  - Maximum acceptable proportion of attribute classification errors <= 5%
    - Could not compare VGI attributes
  - Maximum acceptable proportion of positional errors <= 10%
    - iPhone streets dataset not suitable (17. 14% error)
    - POI planimetric accuracy < 10m (6.234m)