Documentation for the
Global Roads Open Access Data Set, Version 1 (gROADSv1)

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Data Set Description

The Global Roads Open Access Data Set, Version 1 (gROADSv1) was developed under the auspices of the CODATA Global Roads Data Development Task Group. The data set combines the best available public domain roads data by country into a global roads coverage, using the UN Spatial Data Infrastructure Transport (UNSDI-T) version 2 as a common data model. All country road networks have been joined topologically at the borders, and many countries have been edited for internal topology. Source data as a percentage of the total road network for each country are provided in the documentation, and users are encouraged to refer to the table below for use constraints that apply to a small number of countries. Because the data are compiled from multiple sources, the date range for road network representations is from the 1980s to 2010 depending on the country (most countries have no confirmed date), and spatial accuracy varies. The baseline global data set was compiled by the Information Technology Outreach Services (ITOS) of the University of Georgia's Carl Vinson Institute of Government as a contribution to the Geographic Information Support Team (GIST) with funding from the U.S. Agency for International Development (USAID). Updated data for 27 countries and 6 smaller geographic entities were assembled by Columbia University's Center for International Earth Science Information Network (CIESIN), with a focus largely on developing countries with the poorest data coverage. Additional data were downloaded through the International Steering Committee for Global Mapping (ISCGM) website.

Figure 1 shows the portions of the world covered by Vector Smart Map Level 0 (VMAP0) versus other sources. Vector Smart Map Level 0 (VMap0), Edition 5, is an updated and improved version of the National Imagery and Mapping Agency's (NIMA; now known as the National Geospatial-Intelligence Agency or NGA) Digital Chart of the World (DCW) (Nelson et al. 2006). Since the 1990s VMAP0 has been one of the only public domain roads data sets, but it is generally of low spatial accuracy and has incomplete roads coverage. The CODATA roads project assessed the horizontal spatial accuracy of a number of candidate data sets in terms of root mean square error (RMSE), which is a measure of the average deviation or distance of points in a candidate road data set from their known positions on the

ground.[1] The candidate data sets were compared to roads found in Google Earth imagery, which was used as the standard of comparison (i.e., "ground truth").[2] Out of 11 VMAP0 country data sets for Africa, the average RMSE was 900m. The worst accuracy was 1,265m and the best was 530m. This compares to 30m-500m accuracy of most of the data sets used to replace the VMAP0 data.

Acknowledgments

The CODATA Global Roads Data Development Task Group greatly appreciates the contributions of CIESIN, GIST, ITOS, USAID, and ISCGM to this first release of the gROADS data set. Development of this data set was supported by NASA Contract NNG08HZ11C for the continued operation of the Socioeconomic Data and Applications Center (SEDAC), which is managed by CIESIN. Additional support for the development of Ethiopia roads data was provided through the "Roads Data Development in East Africa" project funded by NASA's Expansion of Regional Visualization & monitoring System (SERVIR) to other Geographic Areas including the Dominican Republic, Gulf of Mexico, Africa, Asia, and South America project, and the "Roads Data Development in Ethiopia" project funded by the AGCommons initiative of the Bill & Melinda Gates Foundation.

This data set would not have been possible without the considerable efforts on the part of a large team led by Alex de Sherbinin, chairperson of the CODATA Roads Task Group and deputy manager of SEDAC. The team included: CIESIN Geospatial Division staff members Greg Yetman, who oversaw implementation of the data model and contributed his expertise to the AGCommons project, Tricia Chai-Onn, and Linda Pistolesi; other CIESIN staff members Branko Djapic and Paola Kim-Blanco; research assistants Steffan Foerster, who provided invaluable assistance in the early stages setting up and documenting methodologies, and Elijah Ferrari and Valeryia Fiodarava; and visiting scholar Taro Ubukawa, whose expertise in geospatial processing methods helped to bring the project to conclusion.

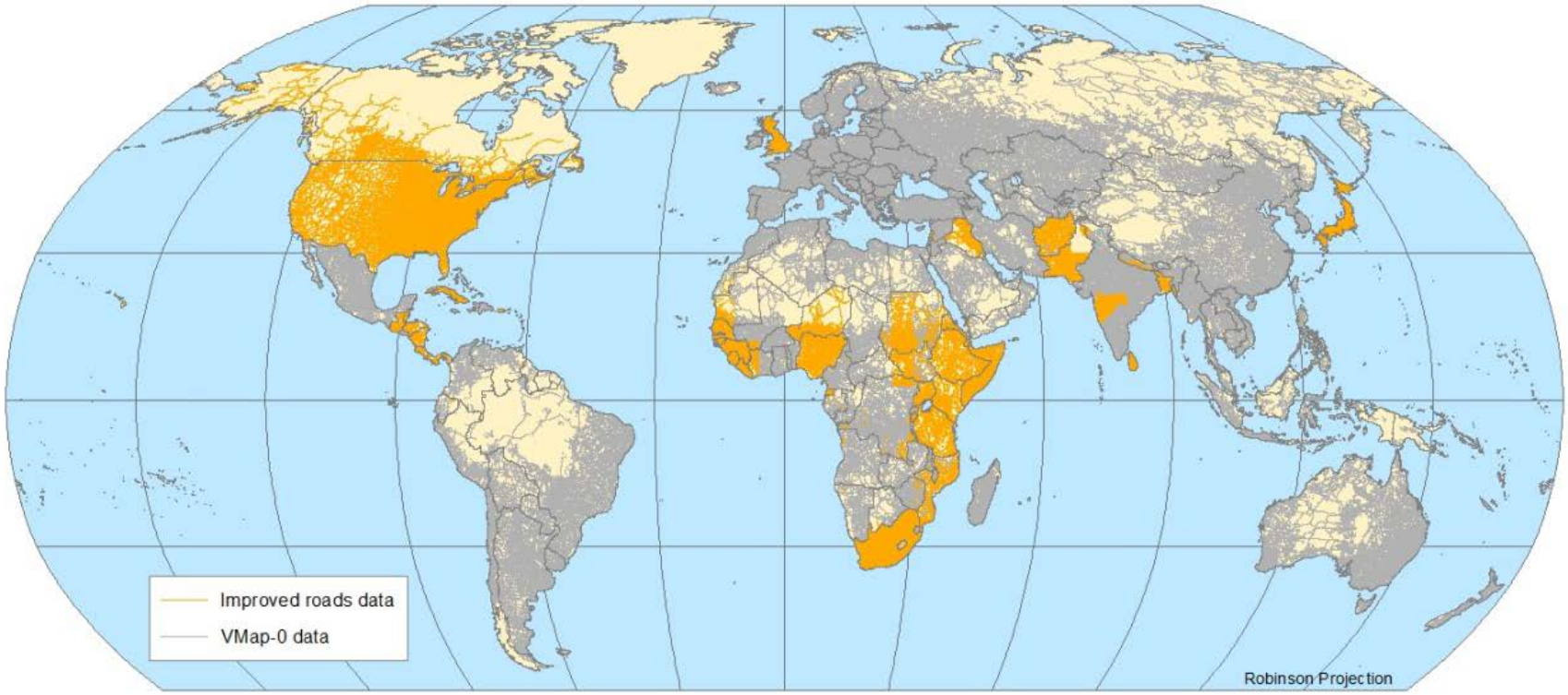
Suggested Citation

Center for International Earth Science Information Network (CIESIN)/Columbia University, and Information Technology Outreach Services (ITOS)/University of Georgia. 2013. Global Roads Open Access Data Set, Version 1 (gROADSv1). Palisades, NY: NASA Socioeconomic Data and Applications Center (SEDAC). Downloaded from http://sedac.ciesin.columbia.edu/data/set/groads-global-roads-open-access-v1 [DATE DOWNLOADED]

[1] Accuracy calculation methods are documented in the document "Methods Used in the Development of the Global Roads Open Access Data Set (gROADS), Version 1", downloadable from the "Documentation" tab of the gROADSv1 web site: http://sedac.ciesin.columbia.edu/data/set/groads-global-roads-data-v1.

[2] The Google Earth imagery accuracy compared to absolute positional location ("ground truth") has been evaluated at approximately +/- 50m (Potere 2008, and Ubukawa *forthcoming*).

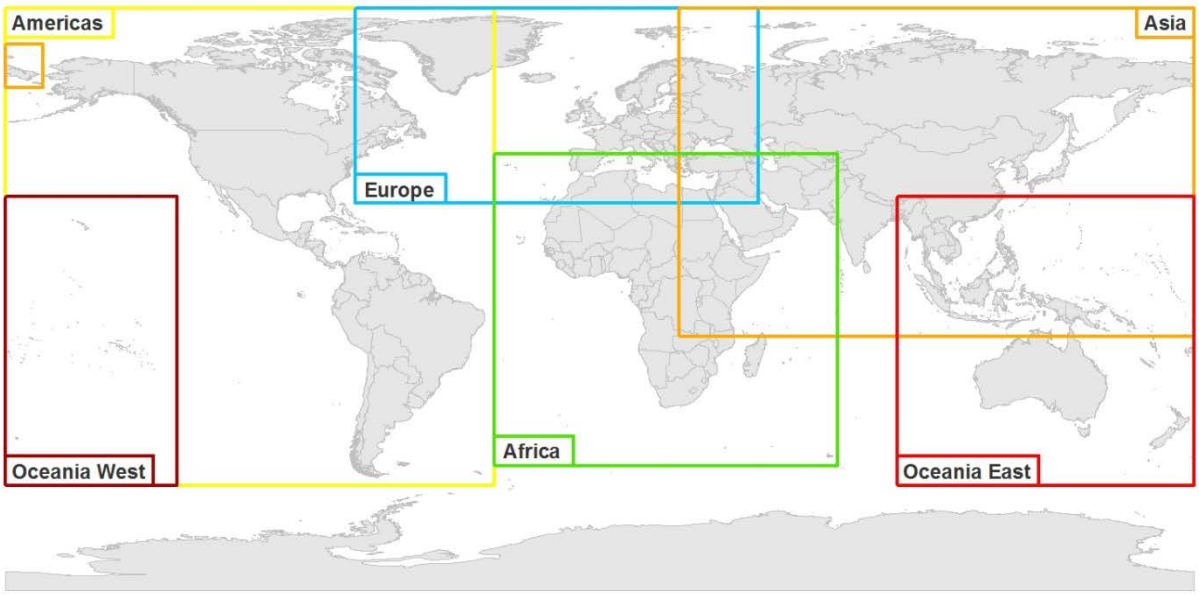
Figure 1. gROADSv1 source coverage: VMAP0 versus other sources



Data Download Instructions

Data may be downloaded as zip archives of ESRI file geodatabases or shapefiles from the Data Download tab on the gROADSv1 website: http://sedac.ciesin.columbia.edu/data/set/groads-global-roads-data-v1

Archives contain either the global or continental gROADSv1 vector data. The continental data are provided as per the extents shown on the map below.



Extents of Regional tiles.

Region	lonW	lonE	latN	latS
Africa	-32	72	42	-52
Americas	-180	-32	86	-58
Asia (multipart polygon)				
AsiaWest	-180	-168.5	75	62
AsiaEast	24	180	86	-13
Europe	-74	48	86	27
OceaniaWest	-180	-128	29	-58
OceaniaEast	90	180	29	-58

Additional Credits and Restrictions

Most of the data in gROADS v1 is in the public domain or providers have indicated that they can be re-disseminated without restrictions. For a small number of country data sets, providers stipulate that those who use the data set need to credit the original provider. In other cases, modest restrictions apply. Users wishing to use data for the following countries in their products or applications, whether they acquire entire gROADS data set or some regional tile or a specific country, will need to extend the following credits or adhere to the following restrictions:

Countries	Data Policy	Citation/Credit/Restrictions
Canada	Data for Canada were derived from OpenStreetMap data. A procedure was used to generalize the data. Only the roads classified as motorway, primary, secondary and trunk were used, and divided highways were reduced to single line representations to conform with data included in gROADS from other countries.	OpenStreetMap is open data, licensed under the Open Data Commons Open Database License (ODbL). Users are free to copy, distribute, transmit and adapt OpenStreetMap data, as long as they credit OpenStreetMap and its contributors. Thus, data for this country, even when modified by the user, may only be redistributed under the same ODbL license. For more information, visit: http://www.openstreetmap.org/copyright.
Japan	The data for Japan were obtained from ISCGM/Global Map. These data were developed by Geospatial Information Authority of Japan (GSI). Users of gROADS v1 who include Japan in their research analysis or as part of a global or regional map should include the acknowledgment, "Roads data for Japan are from the Global Map Japan developed by the Geospatial Information Authority of Japan". Commercial users who plan to incorporate these data in a commercial product must obtain permission from GSI. Contact GSI at (chikyuchizu@gsi.go.jp) for inquiries about the application procedure.	Global Map Japan ©Geospatial Information Authority of Japan
Nicaragua	Global Map data for Nicaragua are free of charge for any purpose. However, if you intend to use the data for commercial purposes, you will need to show the credit that appears at right, and send a copy of the application to ineterds@ibw.com.ni along with your contact information and noting the use of the roads data and the purpose for the use.	Global Map of Nicaragua ©ISCGM/INETER
United Kingdom	These data are from the UK Ordinance Survey. They are distributed under an open data license but require attribution.	UK roads data were obtained from the Ordinance Survey. Users of gROADS who include the UK in maps or products must include the following attribution: "Contains Ordnance Survey data © Crown copyright and database right 2011." For further information visit https://www.ordnancesurvey.co.uk/oswebsite/docs/licences/os-opendata-licence.pdf

Countries	Data Policy	Citation/Credit/Restrictions
United States	U.S. roads data were obtained via the ISCGM, with original data coming from the U.S. Geological Survey (USGS). These data are in the public domain, and do not require citation, but users are encouraged to cite the original source in applications focused on the United States.	U.S. Geological Survey, *National Atlas of the United States*, http://nationalatlas.gov/.
Tuvalu, Seychelles, Pitcairn Island, Jersey Island, Gibraltar, and Andorra	Data for these small islands, overseas territories and principalities were derived from OpenStreetMap data.	OpenStreetMap is open data, licensed under the Open Data Commons Open Database License (ODbL). Users are free to copy, distribute, transmit and adapt OpenStreetMap data, as long as they credit OpenStreetMap and its contributors. Thus, data for this country, even when modified by the user, may only be redistributed under the same ODbL license. For more information, visit: http://www.openstreetmap.org/copyright
Belize, Costa Rica, Guatemala, Honduras, Panama	The "Vector de Carreteras y Vías de Mesoamérica" data set was downloaded from the SERVIR data catalog and there are no restrictions on use. The information is freely available. The user is only asked to cite the source: CCAD-Banco Mundial 2003.	Source: CCAD-Banco Mundial 2003.

References

Nelson, A., de Sherbinin, A., and Pozzi, F. (2006) Towards development of a high quality public domain global roads database, *CODATA Data Science Journal*, 5, 223-265

Potere, D. 2008. Horizontal Positional Accuracy of Google Earth's High-Resolution Imagery Archive. *Sensors*, 8: 7973-7981; DOI: 10.3390/s8127973

Ubukawa, T., A. de Sherbinin, K. Payne, and A. Nelson. *Forthcoming*. An Assessment of the State of the art in Roads Data Development Methodologies.

Annex 1. UNSDI-T Attribute Code Book

The following fields are part of the full UN Spatial Data Infrastructure Transport (UNSDI-T) version 2 data model. Note that for most data sets included in gROADS v1, there are few if any attributes available for road segments.

UNSDIT_V2_Field	Full Name	Type	Coding
OBJECTID		Object ID	
Shape		Geometry	
SourceID	Source ID	String	
Picture	Picture	Blob	
Exs	Existence Category	Long Integer	1=Definite, 2=Doubtful, 0=Unspecified
Notes	Notes	String	
RoadID	Road ID	String	
ONme	Official Road Name	String	
RteNme	Route Name	String	
NtlClass	National Inventory Road Class	String	
FClass	Functional Class	Long Integer	1=Highway, 2=Primary, 3=Secondary, 4=Tertiary, 5=Local/ Urban, 6=Trail, 7=Private, 0=Unspecified
Crgway	Carriageways	Long Integer	1=Single, 2=Dual, 0=Unspecified
NumLanes	Number of lanes	Long Integer	
LneWidthM	Lane Width (m)	Double	
RdWidthM	Road Width (m)	Double	
AxleLoadMT	Maximum Axle Loading (MT)	Double	
TotLoadMT	Maxium Total Loading (MT)	Double	
SrfTpe	Surface Type	Long Integer	1=Paved, 2=Gravel, 3=Dirt/Sand, 4=Steel, 5=Wood, 6=Grass, 0=Unspecified
SrfCond	Surface Condition	Long Integer	1=Rough (<40kph), 2=Smooth (>40kph), 3=Snow/Ice, 4=Mud, 0=Unspecified
SrfPrep	Surface Preparation	Long Integer	1=Natural Compaction, 2=Traffic Compaction, 3=Engineered Compaction, 4=Uncompacted, 0=Unspecified
IsSeasonal	Affected by Season	Long Integer	1=Yes, 2=No, 0=Unspecified
CurntPrac	Current Road Practicability	Long Integer	1=Non-motorized, 2=Motorbike, 3=4WD <3.5MT, 4=Light Truck <10MT, 5=Heavy Truck <20MT, 6 Truck + Trailer >20MT, 0=Unspecified
GdWthrPrac	Good Weather Road Practicability	Long Integer	1=Non-motorized, 2=Motorbike, 3=4WD <3.5MT, 4=Light Truck <10MT, 5=Heavy Truck <20MT, 6 Truck + Trailer >20MT, 0=Unspecified

UNSDIT_V2_Field	Full Name	Type	Coding
BdWthrPrac	Bad Weather Road Practicability	Long Integer	1=Non-motorized, 2=Motorbike, 3=4WD <3.5MT, 4=Light Truck <10MT, 5=Heavy Truck <20MT, 6 Truck + Trailer >20MT, 0=Unspecified
SpeedLimit	Speed Limit (Km/hr)	Long Integer	
CurntSpeed	Current Average Speed	Long Integer	
GnralSpeed	General Average Speed	Long Integer	
IsUndrCstr	Is under Construction / Repairs	Long Integer	1=Yes, 2=No, 0=Unspecified
CstWrkETC	Construction Work Est Completion Date	Date	
GradDeg	Gradient (degrees)	Double	
Sec	Road Security Category	Long Integer	1=Category A (low risk), 2=Category B (low to medium risk), 3=Category C (medium to high risk), 4=Category D (high risk), 5=Category E (critical risk), 0=Unspecified
HasShouldr	Has Shoulder	Long Integer	1=Yes, 2=No, 0=Unspecified
HasSidewalk	Has Sidewalk	Long Integer	1=Yes, 2=No, 0=Unspecified
DrivSide	Driving Side	Long Integer	1=Left, 2=Right, 0=Unspecified
IsElevated	Is elevated / suspended above ground/water	Long Integer	1=Yes, 2=No, 0=Unspecified
HasMedian	Has Median	Long Integer	1=Yes, 2=No, 0=Unspecified
OpStatus	Operational Status	Long Integer	1=Open, 2=Restricted, 3=Closed, 4=Abandonned/Disused, 0=Unspecified
Shape_Length	Length of segment	Double	
Length_KM	Length of segment in kilometers	Double	Length_KM