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Design of IAGBN station description using PerForm Pro software

Jacques Liard

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Geological Survey of Canada

2 May 1994

Design of IAGBN form

The International Absolute Gravity Base station Network (IAGBN) has come up with a standard absolute gravity station description format which we have tried to adhere to. Except for some minor details which have to be resolved with Prof. Gerd Boedecker chairman of the IAG Working Group II (1), the GSC description format is identical to the proposed version published in (2). The IAGBN description format differs from our (GSC) national gravity station description format on points of style and information provided. The style of presentation may not be important but the additional information covers such data as gravity value, latitude, longitude and height of station which are not part of our GSC format.

The Geological Survey of Canada has about 50 absolute gravity stations on file, three of which are part of the IAGBN set of stations. Normally, such a small number of stations would not warrant such an effort in automating form design and data entry, but since the requirements of this project have been expanded to include national absolute gravity stations, we felt that it would be more efficient to design a computer generated form instead of cutting and pasting drawings and photographs onto blank forms.

PerForm Pro software package

The author used a recently upgraded version (1992, to MS-Windows) of a form design package already in his possession, **PerForm Pro** from Delrina Technology Inc. The Windows version has been shown to be faster and easier to use in designing and filling forms. Initially in 1992, **Auto CAD** had been tried for this project but it had been found to be too unwieldy and too wasteful in disk usage for data entry of different types (texts, images, numbers, etc.). **PerForm Pro** was found to be more suited for this type of data entry, where text entries, data bases and image files can be accessed efficiently with great savings in disk space.

With this package, all data for new and existing station descriptions can be stored electronically, thus reducing the amount of paper that has to be kept on site. This in turn helps us issue new printouts of existing station descriptions only when customers request such information. Furthermore, new information for existing stations such as site drawings and photographs can be updated electronically without having to cut-and-paste on a new blank form which has been the standard procedure in the past.

The software package **PerForm Pro** comes in two parts, **Form Design** and **Form Filler**, both in a Windows environment. Once a form has been designed, filling a station description is simple and new personnel can be trained quickly in the use of this package. Each form is composed of a series of field entries which are filled one after another through a step by step process or through random access with a PC mouse. Either method is valid as long as all fields are filled. This is important if the form design has special built-in requirements.

Some fields can be done automatically such as date entry etc. Other fields can be computer text files, and graphics files such as bit-map images from scanned photographs. Some fields may also have a range of accepted values which cannot be exceeded by the user. For example, if an unacceptable value is entered, a prompt will notify the user of the accepted range of values. Each field can also have a help message that the user can access.

Form design[1]

A series of twelve fields have been identified in the IAGBN description form. Table 1 lists these fields and their characteristics. For example, each field has a **help** menu associated with it. Out of these twelve fields, two of them have a range of values restricting the type of entry and two other fields require bit-map file entries. The remaining fields can be typed in or text files can be used as input. Generally, text file entries require additional editing in order to fit the text into the form. The last field (i.e. the **date)** is valued automatically if the user does not enter a date different from the fill date generated by the computer program.

The GSC version of the IAGBN form differs from the official published version principally on one point, namely, the vertical gravity gradient. We feel that it is important to provide this information to the users so that gravity results can be transferred from observational height to the "official" height of 0.91 m as indicated on all forms, or to the ground. The gravity value entered into the **Gravity** field is also associated with this « official » height (GSC). The observation height mentioned here is nearly an integral part of the form since it is inserted into the ***Remarks*** field of each station description.

Additional lines have been added in as part of the form such as the accuracy of the gravity value entered in the **Gravity** field. We felt that users should have an idea of the accuracy of the information provided without having to refer to a separate table of numbers.

[1] In the following paragraphs, the words in bold and italics (ex: ***Country***) will represent the IAGBN headings while the words in bold alone (ex: **Station Pictures**) will identify the **PerForm** fields for this particular form.

Table 1

Field entry summary

Field Number	Name	Format	Field Length	Filler Help	Range Lookup
1:	Location	General	Variable	Yes	No
2:	Country	General	Variable	Yes	No
3:	Latitude	General	Variable	Yes	No
4:	Longitude	General	Variable	Yes	No
5:	Height	General	Variable	Yes	No
6:	Gravity	General	Fixed 10	Yes	Yes (9.7 to 9.85)
7:	Description	General	Variable	Yes	No
8:	Details	General	Variable	Yes	No
9:	Gradient	Fixed	Variable	Yes	Yes (2.2 to 4.5)
10:	Station Pictures	Graphics (Windows .BMP file)	Variable	Yes	No
11:	Station Description	Graphics (Windows .BMP file)	Variable	Yes	No
12:	Date	Date	Variable	Yes	No

All Fill fields have spaces as fill characters (as opposed to default lines). Field 12 has automatic entry: date of filling form will be automatically inserted if user does not put in a different date.

Details

Most of the fields (Figure 1) are self explanatory such as ***Station Location, Country, Latitude & Longitude, etc.***. A few fields such as ***Gravity*** and ***Gradient*** have a range of valid values as mentioned above. The ***Overview*** (**Description**) is equivalent to a large extent to the text accompanying our regular national station description form. The only difference is in the organisation of the description: the method of describing how a user gets to the station starting far away and proceeding closer an closer to the site must be more detailed since these forms will be made available to people from outside agencies who are not familiar with our country.

The ***Remarks*** (**Details**) field contains such useful information as station ID as well as special requirements for the instrument at a particular site. Many of our sites are not located indoors nor do they have AC power available nearby.

The ***Detailed Sketch*** (**Station Picture & Station Description**) fields must be in MS-Windows bit-map file format (*.BMP). Furthermore, the dimensions must also be square (height equals width) or the image will be "stretched" on the final print-out. The user needs only to indicate the file names and directories where the images are stored, and the **Form Filler** will handle all the necessary data transfers and printing. Although we have tried to store the station photographs and sketches in a more compact file structure (such as *.PCX files) since *.BMP files do take a lot of disk space, we found that the overall system handled other image file formats poorly.

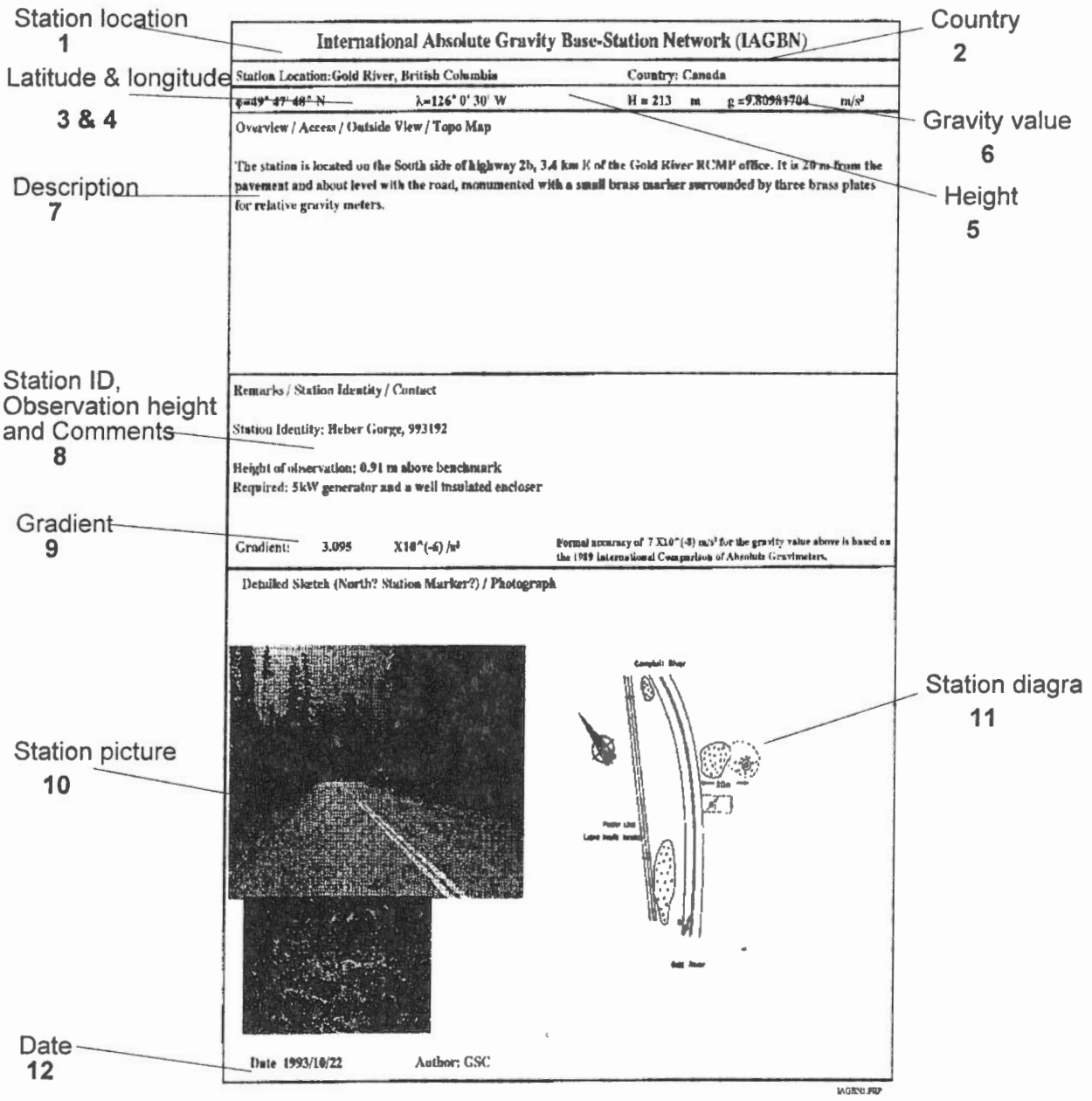

Figure 1

Example of IAGBN form with identified fields for operator to fill. Numbers show the sequence of data input.

The digital image files were "touched up" in order to fit them into the appropriate fields. A freeware software **LView 3.1** (for Windows) was used to cut, change the shading, and paste multiple photographs together (see Figure 2). This type of image editing was also applied to the **station diagrams** for clean-up and sizing.

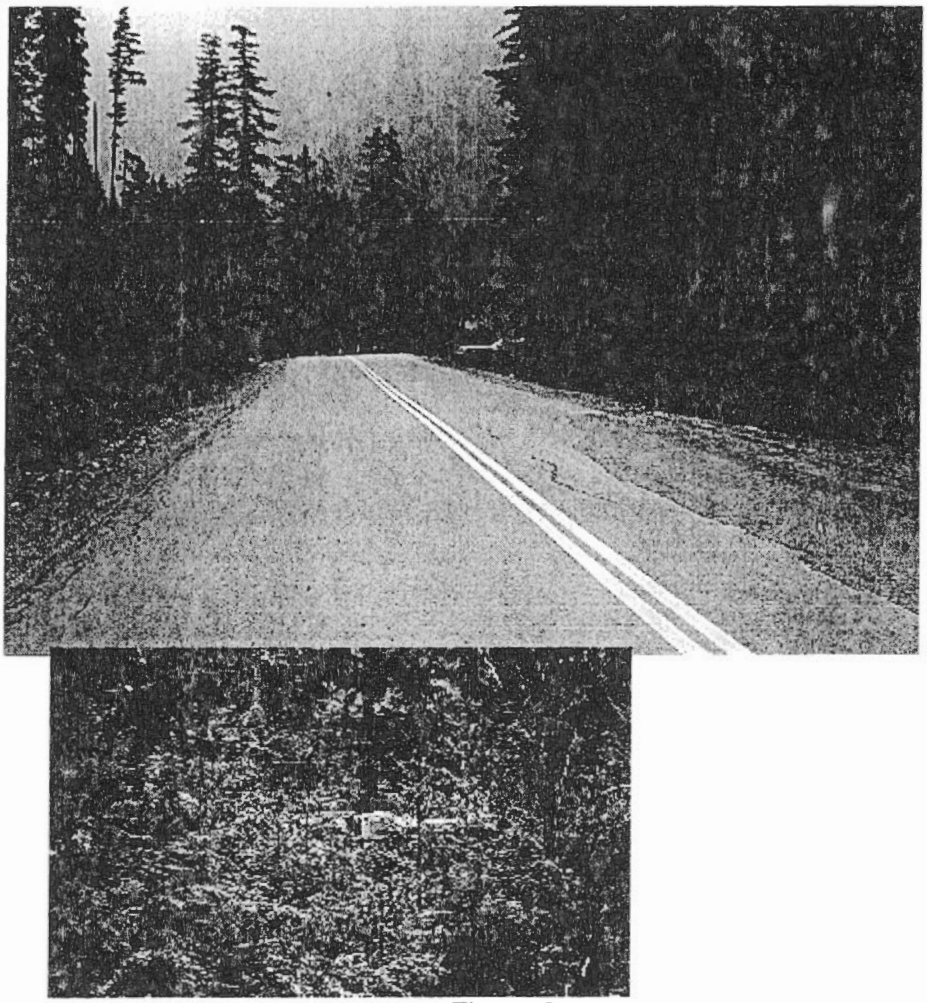

Figure 2
Example of multiple picture editing (gamma correction, pasting and cutting, etc.).

Once a station description is completed, the form can be saved into a file with the *.FIL extension. Alternatively, the description can be added to an existing *.FIL file since a file of a particular design can contain many filled forms. In this way, the descriptions can be organised like a portfolio and the user can "leaf" through them for corrections, printing and modifications. New forms can also be added.

The form design itself is saved as a *.FRP file and need not be retouched once the design has been tested and completed.

The form design for this particular project has been saved as **IAGBN1.FRP** on the GD-AGG network disk drive W:, under the directory \ABSG-GRV\FORMS\ (see Appendix I for the summary).

The station description bit-map files (*.BMP) are stored in \ABSG-GRV\DRWS\ while scanned photographs for the stations are located in \ABSG-GRV\IMAGES\.

Preliminary text files are stored as ASCII files in \ABSG-GRV\DESCR\.

Furthermore, early description sketches done on a CAD package (**Generic CAD**) are stored as *.GCD files under \ABSG-GRV\CADDSTUF\.

Finally, since it is more efficient to organise everything into a single file, the description forms are stored into **ALLABSG.FIL** in the \ABSG-GRV\FORMS\ directory.

Station descriptions

A total of 39 stations were organised and prepared in 1993. This involved a minimum of 39 bit-map files for diagrams and nearly twice as many files for scanned photographs. The photographs were digitised using **PhotoFinish** (**Windows** application) which first acquires images using a Hewlett Packard Scanjet IIc colour scanner and then processes and stores the information into a bit-map file.

The digital image files stored in the W:\ABSG-GRV\IMAGES\ directory are usually combinations of two sub-files since regular station descriptions have two photographs pasted onto each sheet. These files and sub-files are named using the station numbering system with a "**I**" prefix and a letter suffix for sub-files. Taking as an example the station used in Figures 1 and 2 (station 9931-92), the file for the IAGBN form is called "I993192.BMP" while the two sub-files for the two images are located in "I993192A.BMP" and "I993192B.BMP". Each of these sub-files had to be cut, scaled, contrast adjusted, and colour balanced before being combined into the final digital image file. All files and sub-files are kept on the disk in case re-editing is needed for any form.

The time required to perform a full image processing for one station can be broken down into: image scanning, 5 minutes; cutting, scaling and contrast adjustment, about 15 minutes; image combination (two images combined), 2 minutes; and finally, image insertion into a form, about 1 minute. This total time estimate of about 25 minutes assumes that access to a scanner is assured and that the user is familiar with the set of routines to follow.

The same file organisation is used for the station diagrams in W:\ABSG-GRV\DRWS\ except that the prefix is either "**E**" or "**D**". Some files take a lot of disk space simply because they were scanned from large diagrams on paper. Unfortunately, once an image is in digital form, the process of scaling down usually creates data loss which degrades image quality on the final form. However, many bit-map files are not the result of two sub-files so there are fewer sub-files in this directory.

As mentioned earlier, the W:\ABSG-GRV\DESCR\ directory contains the preliminary ASCII text files for the ***Overview*** part of the form. These files are used only as draft inputs to this field because final editing is usually needed on the form before final print-out. The files follow the

same organisation as mentioned above with a "**S**" prefix and an "ASC" extension. Their usefulness is mainly as a method of quickly entering the text of each station description with any simple text editor.

All other data entered in the appropriate fields (**Gravity, Gradient** etc.) originates from the latest values on the absolute gravity data file maintained by the author. Accuracies of position for instance vary because they can come from UTM maps or GPS measurements. The values for gradients usually have errors around the third decimal place while those for gravity are good to about 3 μGal.

Since values are displayed in SI units, care must be given to the exponents used. By design, the form assumes that gradients are entered as units of microgals/cm but are displayed as "**/s^2**" with the appropriate exponent. Gravity must be entered in units of "**m/s^2**" so the user has to insert 8 digits after the decimal point. Latitudes and longitudes are self evident as long as the letters for the quadrant are indicated (N, S, E, and W).

Forms issued

The 39 IAGBN forms were printed on a laser jet printer (HP-IIID) which is accessible through the network. They were sent to Prof. Gerd Boedecker in Germany. Once the IAGBN system is fully in place, we expect that IAGBN station descriptions will be distributed through the BGI in Toulouse, France. For now, we await the next report from the chairman on the progress of this project.

Appendix I

File structure

Files for these station description forms are located on the **W:** drive of the GSC/GD-AGG Banyan Vines network. The main directory is **W:\ABSG-GRV** with the sub-directories:

Directory	Number of files	File types	Size (Mb)	Average file size (kb)	Descriptions
W:\ABSG-GRV\DESCR	53	*.ASC	0.03	0.5	ASCII texts for station descriptions
W:\ABSG-GRV\DRWS	74	E*.BMP & D*.BMP	24.24	327	Bit-map files of station drawings
W:\ABSG-GRV\FORMS	90	*.FIL & *.FRP	0.11	1	PerForm files of each station and PerForm forms
W:\ABSG-GRV\IMAGES	89	I*.BMP	18.28	205	Bit-map files of station photographs
Total disk usage (**Mb**)			**43.11**	**0.53**	

All the individual *.FIL files have been merged into a single file **ALLABSG.FIL** for easy retrieval by **PerForm Fill**. Individual station forms within this file can be accessed, modified, updated and printed without having to re-print the whole set.

A back-up of these files has been done on a 44Mb Bernoulli removable cartridge disk with the same directory structure.

Acknowledgement

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Software used:

LVIEW for Windows Version 3.1 Freeware from **Leonardo Haddad Loureio** (Copyright 1993)

PerFORM PRO Form Design & Form Filler from Delrina Technology Inc. (Copyright 1992).

PhotoFinish for **Windows** Version 2.0 from **ZSoft Corp.** (Copyright 1992)

Windows Version 3.1 from **Microsoft Corp.** (Copyright 1992)