FINANCED BY: Nordic Development Funds	**Project Report**	

Project:	IMPLEMENTATION OF A CENTRAL LABORATORY AND AN AIR QUALITY MONITORING NETWORK IN DAKAR
Agreement:	No 003/C/FND/05

QADAK Mission 11 – GIS Component of Mission

GIS training and data preparation for AirQUIS

Scott Randall

Contents

Preface

Financed by the Nordic development Fund (NDF), the Norwegian Institute for Air Research (NILU) is supporting the Conseil Exécutif des Transports Urbains de Dakar (CETUD) in establishing a Central Laboratory with an Air Quality Management System for Dakar, Senegal. This project is part of the component entitled "Amelioration de la qualité de l'air en milieu urbain" (QADAK) of the "Programme d'Amélioration de la Mobilité Urbaine" (PAMU) operated by the Conseil Exécutif des Transports Urbains de Dakar (CETUD) in Senegal.

The 11th mission to Dakar for the QADAK project was undertaken from May 5-14, 2008. This report documents the smaller GIS component of this greater mission.

Summary

GIS part of QADAK Mission 11

This report focuses on the GIS tasks which occurred during Mission 11 in Dakar, from May 5-9 by Scott Randall. Mission 11 contained other tasks which ran from May 5-13, coordinated by Cristina Guerreiro, these will only be briefly discussed in this report, and some of this partial information can be seen in greater detail in Appendix A and Appendix B.

The purpose of this report is to state the specific procedures that were used for GIS preparation of Dakar traffic data for AirQUIS. This will be accomplished through an explanation of the training, describing performed exercises, and presenting the specific procedures and QA/QC controls initiated. Most of the detailed information pertaining to this will be presented in the form of the Appendices.

The specific GIS subtasks that where performed, and to be discussed are as follows:

1. Convert PDF to TIFF files
2. Georeference TIFF files in ArcGIS
3. Recreate road nodes from TIFF files as points in ArcGIS
4. QA/QC data and procedures
5. Training of importing finalized data into AirQUIS

1   Background

The traffic data received for Dakar was given in the desired Excel format, but location of road nodes was given as 7 PDF files taken as snapshots from EMME2, see example from "Secteur 201" below (with zoom of small segment in bottom left-hand corner showing road nodes as blue points). Point spatial data distributed in a locked format such as PDF gives the raw traffic data no digital spatial reference, and in addition, does not include the critical relevant metadata, making the data set inadequate for use in AirQUIS. It was determined that ArcGIS could handle the PDF files converted to TIF; so within ArcGIS there would have to be manual assignment of rode node points and node ID's using the TIF files, then the traffic data would have digital spatial reference, and potential use in AirQUIS.
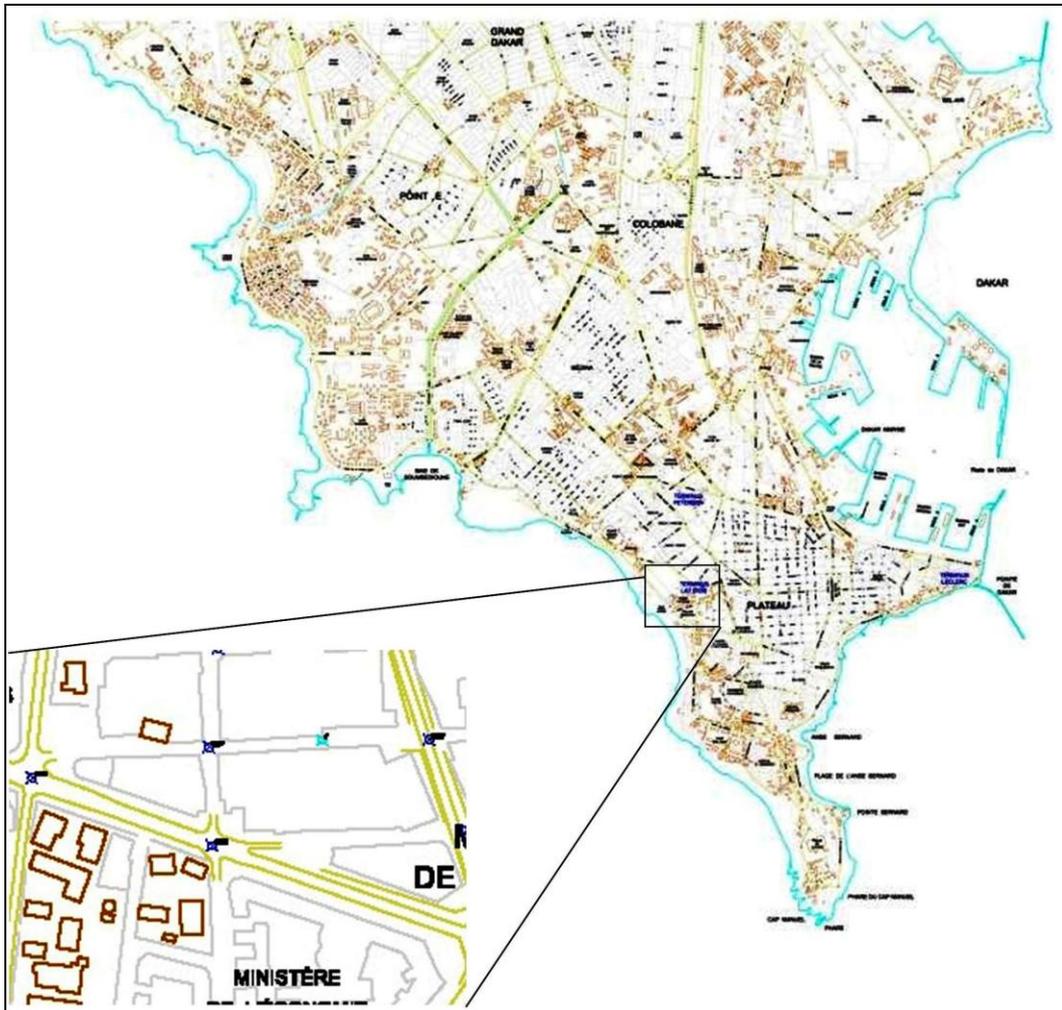
2 Traffic Data and GIS Training

The initial training was to orient CGQA on the raw traffic data in Excel, how this data relates to the PDF files, and the task ahead to join this data in ArcGIS for use in AirQUIS.

Training began with a demonstration of how to convert the PDF files to TIF files with Adobe software. This step was designated as the further responsibility of NILU since CGQA did not possess the necessary software. The remaining TIF files to be created would be transferred from NILU to CGQA through DVD's, or posting the files on the NILU FTP server (due to size of the files being around 2GB's).

The training continued by demonstrating how to georeference the created TIF files within ArcGIS. The files need to be georeferenced in order for the files to have the same spatial designation as the existing layers for Dakar. The Dakar road layer was used as a source file to use on top of the TIF file to match them up appropriately (georeference), when these were identical, randomly distributed points were used to lock the TIF file at the same spatial location as the source file.

With a georeferenced TIF file, road nodes can now be re-created from the file into ArcGIS. This is done by creating a new blank layer on top of the TIF file, find a road node on the TIF, and duplicate the node by placing a point right on top of it. Then the node ID would have to be read from the same point on the TIF file, and the newly created point road node would be labeled this same ID. This procedure would be performed for all of the road nodes on all 7 of the PDF files.

Appendix C gives additional information regarding this training, and from this, the specific procedures (<u>more detailed</u>) to complete the above tasks are systematically listed in Appendix D.

It was also determined that CGQA would need local assistance with this task, more information regarding this is contained in Appendix E. NILU would provide remote support for this task, but it was decided that additional local GIS knowledge would be beneficial to complete the task.

3 Traffic Data Exercises - AirQUIS

Once the above task was completed, this traffic data and corresponding road nodes could then be imported into AirQUIS. A brief training of this import process was given so CGQA could understand the outcome of the given GIS task. The detailed procedures presented during the training are outlined in Appendix F.

4 QA/QC Plan

Due to the volume of points and repetitiveness of the GIS task, QA/QC plans were developed to ensure data quality, as well as to ensure that the stated procedures were not deviated from during the evolution of the task. These specific procedures are listed in Appendix G.

5 Mission Conclusion

After the training was completed, the GIS task presented was started by CGQA as according to the outlined procedures and QA controls. There were no problems while the GIS tasks were being performed, and it was determined by NILU that CGQA fully understood the task, and was confident in completing it without local assistance from NILU.

To officially complete the GIS task portion of the mission, the following files were handed over to CGQA:

      a.   "Georeferencing and adding roadnodes.doc"
      b.   "Exporting ArcGIS to Excel to AirQUIS.doc"
            i.   "template airquis_traffic_working doc_CGQA.xls"
      c.   "DetailedPlanQAQCprelim.doc"
            i.   "List of all roadnode ID.xlsx"
           ii.   "QAQCresults.xlsx"

These files are the specific procedures to complete the task, and the Word documents listed are contained within the mentioned appendices to this report.

A chronological, day-by-day description of events is shown in Appendix H, which mainly refers to the relevant file/appendix that describes the days activity.

Appendix A

Arrival Meeting

Conseil Exécutif des Transports
Urbains de Dakar (CETUD)
Route de Front de Terre, B.P. 17 265 Dakar–Liberté
Tél. n°(221) 859 47 20 - Fax n°(221) 832 47 44
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P.O. Box 100, N-2027 Kjeller, Norvège
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FINANCEMENT: Fonds Nordique de Développement	**Meeting Minutes**	

Projet:	ASSISTANCE TECHNIQUE A LA MISE EN PLACE DU LABORATOIRE CENTRAL ET DES STATIONS DE MESURES POUR L'AMELIORATION DE LA QUALITÉ DE L'AIR EN MILIEU URBAIN DE DAKAR
Agreement:	PAMU/FND/C/08/04
Titre	Arrival meeting (Mission 11)
Date	Monday 5.May 2008, 1130-1615 hrs.
Participants	NILU: Cristina Guerreiro (CBG), Scott Randall (SR) Performances: Tidiane Dieng CETUD: Pascal Sagna DENV: Aïta Seck CGQA: Aminata Mbow, Mbodji Boubacar
Place	Dakar Air Quality Management (CGQA) office, moved to Performances office
Author	CBG and SR
Distribution	Mission 11 Report
Référence No	O-105010

Objectives and agenda for the meeting

The main objective of this meeting was to discuss the status of the project, and schedule for Mission 11.

We presented and discussed:

- PowerPoint presentation of status of the project
  (Presentation Title: Mission 11, May 2008)
- Detailed explanation of tasks remaining and task completed.
- Status of remaining components of many tasks (% complete), and results of those specific components completed.
- Introduction to the point, line, and regional source inputs for AirQUIS.
- AirQUIS presented for traffic data - line source inputs to be done during Mission 11.

Appendix B

Field Meeting – DEEC Mobile Monitoring Station

FINANCEMENT: **Fonds Nordique** **de Développement**	**Meeting Minutes**	

Projet:	ASSISTANCE TECHNIQUE A LA MISE EN PLACE DU LABORATOIRE CENTRAL ET DES STATIONS DE MESURES POUR L'AMELIORATION DE LA QUALITÉ DE L'AIR EN MILIEU URBAIN DE DAKAR
Agreement:	PAMU/FND/C/08/04

Titre	Field meeting – DEEC mobile station
Date	Monday 5.May 2008, 1645-1745 hrs.
Participants	NILU: Cristina Guerreiro (CBG), Scott Randall (SR) DENV: Aïta Seck, Charles
Place	Eastern Dakar, shipping yards port
Author	CBG and SR
Distribution	Mission 11 Report
Référence No	O-105010

Objectives and agenda for the meeting
This field meeting was requested by Aïta Seck in order to receive assistance on the location of the DENV mobile monitoring station, where they currently were interested in monitoring levels of the shipping traffic arriving and exiting the shipping port.

Discussions and conclusions
- The current location of the mobile station (see map below, green star indicating current location) was inadequate to monitor the effects of the shipping traffic because the station was placed in the WNW vicinity of the port. The traditional prevailing winds of N to NNW would ensure that the station was receiving effects for the large industrial area to the north, not the desired port to the south.
- The new location proposed was just south of the port near the main entrance, at the base of the large pier (see map below, red star indicated new proposed location). This location would ensure that the primarily northerly winds would carry the effects from the port traffic to the proposed station in the south. A specific location (next to the InGo shop) was selected and agreed upon by all present. This location had easy access to electricity, and was on the edge of the port activity (ie, not in the middle of activity where the station could be disturbed, or receive unwanted influence).

Current location of mobile station (green star), proposed location (red star)

DEEC Mobil station at current location

Appendix C

Traffic Data Training Report

FINANCEMENT: **Fonds Nordique de Développement**	**Training Report**	

Projet:	ASSISTANCE TECHNIQUE A LA MISE EN PLACE DU LABORATOIRE CENTRAL ET DES STATIONS DE MESURES POUR L'AMELIORATION DE LA QUALITÉ DE L'AIR EN MILIEU URBAIN DE DAKAR
Agreement:	PAMU/FND/C/08/04

Titre	Traffic Data Training
Date	Tuesday 6.May 2008, 0930-1700 hrs.
Participants	NILU: Cristina Guerreiro (CBG), Scott Randall (SR) CGQA: Aminata Mbow, Mbodji Boubacar
Place	CGQA office
Author	CBG and SR
Distribution	Mission 11 Report
Référence No	O-105010

Objectives and agenda for the training

The main objective of this training session was for SR to train Aminata on the procedures for establishing road nodes in ArcGIS based on the EMME2 data located in the seven PDF files. This also required converting the PDF files to .tif files so ArcMap could project this as a shape, secondly the new .tif files needed to be georeferenced so the corresponding inputted roadnode points could be attributed correct xy coordinates. This process was difficult since the created .tif files needed to be approximately 2 GB's in order to maintain resolution that is visible in ArcMap, and preparing theses files, as well as georeferencing them, was time consuming due to the large file size.

A second object of this training session was for CGB to present Mbodji Boubacar the procedures for programming a Fortran application to prepare the Excel traffic data. One large component was to develop an application to eliminate duplicate entries (representing two way traffic), in order to possess just one entry per a designated road link.

Appendix D

Report: Traffic Data Excercise – GIS

FINANCEMENT: **Fonds Nordique de Développement**	**Exercise Report**	

Projet:	ASSISTANCE TECHNIQUE A LA MISE EN PLACE DU LABORATOIRE CENTRAL ET DES STATIONS DE MESURES POUR L'AMELIORATION DE LA QUALITÉ DE L'AIR EN MILIEU URBAIN DE DAKAR
Agreement:	PAMU/FND/C/08/04
Titre	Traffic Data Excercise (ArcGIS)
Date	Wednesday 7.May 2008, 0915-1715 hrs.
Participants	NILU: Scott Randall (SR) CGQA: Aminata Mbow
Place	CGQA office
Author	CBG and SR
Distribution	Mission 11 Report
Référence No	O-105010
NOTE:	This information also found in the file "Georeferencing and adding roadnodes.doc"

Objectives for the excercise (Georeferencing and Roadnodes)

The main objective of this session was for Aminata to begin exercising on the traffic data training from the previous day. The excercise began by georeferencing the .tif files (EMME2 data on PDF files) and projecting this newly created shapefile. Then new points (roadnodes) could be created and saved in a shapefile (pdfroadnodes.shp) based on the existing data. These new points are assigned the representative ID, and XY coordinates are calculated. Once all roadnodes are selected, theis data is transferred to AirQUIS (the excersise for next day).

Below is a detailed description of how to perform this excersise. This description was written and distributed to Aminata so she can easily perform the excercise after Mission 11.

Procedures for Georeferencing and Adding Roadnodes (ArcGIS)

Georeferencing:

1. Open ArcCatalog and find the .tif file (file converted from PDF document). These files will be labelled as sector101.tif, sector102.tif, sector103.tif, sector104.tif, sector105.tif, sector106.tif, or sector107.tif. Right click the .tif file, go to properties, and then scroll to Spatial Reference. Click edit, then select, and then Projected Coordinate System, UTM, WGS1984, and the select the file WGS_1984_UTM_Zone_28N. Then click apply, ok, and then apply, ok.

2. Open ArcMap, and open the project you are working on (project with RteUrb shapfile, and Roadnodes shapfile) and select Add Data, and select the .tif file that you just corrected in ArcCatalog, and click add. You may be asked to build Pyramids, select yes here so it is easier to display the data. This corrected file will then be added to the project, but projected off of the screen.

3. Open Georeferencing by right clicking on a blank grey area of the toolbar at the top, and scroll down and select Georeferencing, this will open the Georeferencing toolbar.

4. In this Georeferencing tool bar make sure that the appropriate layer is selected (for example sector202.tif), and then select Georeferencing, and then "fit to display", this will bring the .tif file into view. Now you must play with the .tif file and the road network (RteUrb) to get them to match up as close as you can (in scale and location), you can use the "shift" feature in the tool bar to move the .tif file, and the Pan to move also - you may even have to remove the .tif file and then shift the road shapefile to the desired location, and then add the .tif file again.

5. Once the two files are matched up as close as manually possible, you must georeference. This is done by adding "control points" from the Georeferencing toolbar, so select "control points" and place the first X on a reference point on the .tif file (use a numbered roadnode as this reference point), and the second X on a reference point on the road network. For this it is best to select obvious places that can match up and that are exactly the same place, for example, road crossings (so the road crossing on the .tif file, must be the same exact road crossing on the road shapefile). Do this for at least 6 or 7 places, preferably at all corners of the .tif, and a few in the middle also. You can check the control points that you have selected by viewing the "link table" on the Georeferencing toolbar, and when you have selected 6 or 7 points, click "save" in this "link table", and then go to "Georeferencing", and select "Update Georeferencing". The .tif file will now be georeferenced to the road network, and they should match up perfectly when viewed.

Adding Road Nodes:

1. Make sure the "pdfroadnodes.shp" shapefile is selected, this is the file that the road nodes are added to.

2. Open the Editor Toolbar by right clicking on a blank grey area of the toolbar at the top, and scroll down and select Editor.

3. Click "Editor" and "start editing", make sure that in this toolbar that the "target" is "pdfroadnodes.shp", and that the "task" is "create new feature".

4. Click on the pencil icon, and then find a roadnode on the .tif file, and add a point on top of the roadnode using the pencil (will be a blue dot) by clicking on the roadnode. After placing the point, then open the attribute table (icon on editor toolbar) and enter the appropriate ID number from the roadnode in the attribute table next to "ID". Leave the attribute table open as you add more points so you can easily enter the ID after you place each point. Occasionally it is smart to save edits by clicking "editor" on the editor toolbar, and then selecting "save edits", and when you are done editing it is smart to "stop edits".

5. You can also edit points (for example if there is a mistake where you placed a point) by going to the "editor" toolbar, and next to "task", click "modify features", here you can use the "edit tool" (arrow looking icon) to select existing points and edit or delete.

6. To calculate XY coordinates for the points (roadnodes) created in ArcMap run "Command Center" (click icon next to toolbox), and type the command "addxy_management pdfroadnodes" and then click enter. This must be run everytime you want to update the XY coordinates.

Appendix E

Meeting Minutes: GIS and Traffic Data

FINANCEMENT: **Fonds Nordique de Développement**	**Minutes from meeting**	

Projet:	ASSISTANCE TECHNIQUE A LA MISE EN PLACE DU LABORATOIRE CENTRAL ET DES STATIONS DE MESURES POUR L'AMELIORATION DE LA QUALITÉ DE L'AIR EN MILIEU URBAIN DE DAKAR
Agreement:	PAMU/FND/C/08/04
Titre	GIS and Traffic Data Meeting
Date	Wednesday 7. May 2008, 1600-1815 hrs.
Participants	NILU: Cristina Guerreiro (CBG), Scott Randall (SR) CGQA: Aminata Mbow University: Aminata Guèye
Author	SR and CBG
Distribution	Mission 11 report
Référence No	O-105010

Objectives and agenda for the meeting

The objectives for this meeting were to solicit GIS support from Aminata Guèye who has done extensive research in Dakar on traffic issues while utilizing GIS. During the meeting it became obvious that Aminata Guèye would be an important resource while building the Dakar traffic inventory due to her GIS knowledge and individual research that went into her PhD work. It was decided that Aminata Guèye would assist CGQA (especially Aminata Mbow) on a limited basis (set number of hours) as a local GIS support help and resource.

Mbow Cheikh will also perform an external QA/QC check on all data.

Summary of tasks assigned are outlined in email from Aminata Guèye:

Dear Aminata,

Thank you for a good summary of the discussions yesterday!

Please see my correction in your e-mail, where you have written 12 heures instead of 12 demi-journees.

I just want to remind you to include the help you should give Aminata M. on getting the topography data into a grid (to be defined by me) as part of your suppert these first 3 months.

In terms of the work you have done for your thesis that could be interesting for the CGQA (and I could consider paying for instead of the "12 demi-journees" that will be left after the next 3 months), we will have to discuss that more in concrete, and Aminata M. and Mbodji should also be included in that decision. One of the things I thing it would be interesting is to the the statistiques on type of vehicules for 2007 that you have.

Best regards,

Cristina

2008/5/8 Aminata GUEYE <gueyeniaye@hotmail.com>:

Bonjour,

Suite à l'appel de Christina, je suis allée hier au laboratoire qualité de l'air pour aider Aminata Mbow dans son travail sur le SIG. La rencontre a finalement été une réunion avec Christina, Aminata, Scot et moi-même. Nous avons discuté de l'appui technique qu'on doit fournir et défini un calendrier d'exécution. Selon Christina, il nous restait 75 heures à dispenser. Elle a fait la proposition suivante :

- pour Cheikh 16 heures de contrôle qualité du travail de Aminat Mbow réparties sur un calendrier de deux mois en raison d'une demi journée toutes les deux semaines ;

- pour Aminata Gueye, 58 heures d'appui technique à Aminata Mbow, sur trois mois, une demi journée par semaine. Il restera alors 12 heures à répartir ultérieurement.

Cristina: Correction! Il restera 12 demi-journees (ou 48 heures) à répartir ultérieurement.

L'appui technique va consister à l'aide dans certains éléments du SIG comme la construction des routes (nœuds et liens), la délimitation des différentes unités administratives, la vérification de la conformité des shapefiles de la base de donnée DTGC. Les discussions ont également porté sur mes travaux de recherche et il se trouve j'ai déjà fait l'essentiel du travail que doit réaliser le labo, aussi Christina a émis la possibilité qu'on puisse leur vendre certains de mes résultats, chose qu'on devra discuter à votre retour.

Voila j'ai essayer de résumer les discussions qu'on a tenu, si j'ai oublié quelque chose vous pouvez compléter.

Ps : ma demi journée d'hier a été comptabilisé

Appendix F

Report: Traffic Data Excercise - AirQUIS

FINANCEMENT: **Fonds Nordique de Développement**	**Detailed Plan**	

Projet:	ASSISTANCE TECHNIQUE A LA MISE EN PLACE DU LABORATOIRE CENTRAL ET DES STATIONS DE MESURES POUR L'AMELIORATION DE LA QUALITÉ DE L'AIR EN MILIEU URBAIN DE DAKAR
Agreement:	PAMU/FND/C/08/04
Titre	Traffic Data Excercise AirQUIS
Date	Thursday 8. May 2008
Participants	NILU: Scott Randall (SR), Cristina Guerreiro (CBG), CGQA: Aminata Mbow, Mbodji Boubacar
Author	SR and CBG
Distribution	Mission 11 report
Référence No	O-105010
NOTE	This memo includes information from the file: "How_to_prepare_traffic_data_for_AirQUIS_from_EMME2_cbg.doc" and from the file: "Exporting ArcGIS to Excel to AirQUIS.doc"

Procedures for exporting data to Excel template and to AirQUIS

Procedure Description

The procedures below are to explain how to export the road node point information (pdfroadnodes.dbf) which includes the FID, ID, and XY coordinates. This information is first exported into the Excel template, and then "drag and dropped" into AirQUIS.

ArcGIS attributes:

1. Once the last roadnode is entered into the pdfroadnodes.shp file in ArcGIS, and the QC procedures are followed and all errors are corrected, the data is ready for export to the Excel template holding file ("template airquis_traffic_working doc_CGQA.xls").

Excel Template:

2. Open the file "template airquis_traffic_working doc_CGQA.xls", and import the pdfroadnodes.dbf into the "roadnodes" sheet. The imported data should be prepared to match the columns in the sheet.

AirQUIS:

3. Logon in AirQUIS, and open the appropriate project.
4. Go to "emission inventory", then to "line emission", then to "road nodes".
5. Now switch to the open "roadnodes" sheet in excel and make the window smaller and on top of the AirQUIS window. Select all of the appropriate data in the excel sheet, and "drag and drop" this data into the open "road nodes" window (into the grey area) in AirQUIS. Note: one must be careful when completing this step, it can be very tricky to accurately select all of the data and physically drag it into AirQUIS.
6. Right click on the imported data in the "road nodes" window in AirQUIS, and then "save imported data".
7. The road nodes are now entered into AirQUIS, and can be projected by clicking the "GIS" icon and then select "road nodes" on the bottom left hand corner of the screen.
8. NOTE: Remember to make a regular copy (backup) of AirQUIS database. Administration -> Project Management -> Right click AirQUIS Projects -> New Project -> Create copy.

How to prepare traffic data for AirQUIS from EMME2

AirQUIS Traffic Data = template airquis_traffic_working doc.xls
EMME2 Data = Dakar 2003_2015 projected peak period trafic_30042008.xls
EMME2 PDF = 1026%20Noeuds%20R%E9seau%20Dakar%20secteur%201.pdf 201-207

Road Nodes
1) We need to identify the coordinates for all road nodes from EMME2, from the EMME2 PDF files. This has to be done by using ArcGIS, with example of Roadnodes.mxd (pdfroadnodes.shp).

   From the ArcGIS file you can prepare the "Road nodes" sheet in the AirQUIS Traffic Data, which is the node label from the EMME2 PDF files, and the coordinates calculated from ArcGIS. Note: to calculate XY in ArcMap run Command Center command "addxy_management pdfroadnodes", which must

be run everytime to update the XY coordinates, also note that these are different XY than what is listed in the attribute table, maybe a correction is needed in Excel?

Static Traffic Data

2) A unique road link ID, start and end nodes from PDF, and the correct road name should be identified by using ArcGIS, with example of Roadnodes.mxd (pdfline2.shp). This shapefile did not work in AirQUIS!!??
***Can points 1 and 2 (roads nodes and static traffic shapfiles) be created at the same time in ArcView, with one shapefile? – See email from Geodata.

Copy the unique ID, the road name, and also the start and end nodes to the "Static traffic data_example " sheet in the AirQUIS Traffic Data. Please, remember that you will add one row for a road in AirQUIS (not two as in EMME2 data), e.g., the road identified as From =1 and To =1347 and as From=1347 and To=1 in the data, add only one combination for AirQUIS. So the "2003 peak period traffic data" sheet in the EMME2 Data will need to be prepared to delete these "combination duplicates" before added to the "Static traffic data_example " sheet in the AirQUIS Traffic Data.

3) The Road Classes (Road Classes sheet) in the AirQUIS Traffic Data comes from the "Type" sheet in the EMME2 Data. So, "ID" in the AirQUIS Traffic Data Road Classes is the "type" in the EMME2 Data, which is a combination of road and area type, as a <u>matrix</u>.

4) The EMME2 Data has length in km, so the length has been multiplied by 1000 to convert these data from km to m for the AirQUIS Data "Static Traffic Data" sheet.

5) The direction has to be identified by checking the EMME2 Data, e.g. if 2 rows in the file have the same combination of nodes, than this is a two way road. For example: From =1 and To =1347 is one row and a second row is From1347 and To=1 in the data, this means a two way road. In the AirQUIS Data (Static Traffic Data Example sheet) the direction should be identified by 3.   If not, this is a one way road and the direction in AirQUIS templates should be 1 (we don't care about direction).

6) Determining of Road width for the AirQUIS Data (Static Traffic Data Example sheet). The data we need for this calculation is given in "lanes" in the EMME2 Data. So to determine Road width 1 and Road width 2 in Static Traffic data sheet do as follows:
A)
1. IF lanes < 9 and direction=3 THEN

Road width 1 = lanes x 3.5m for one direction (example from above: From =1 and To =1347) and

Road width 2 = lanes x 3.5m for the other direction (example from above: From =1347 and To =1)

2. IF lanes < 9 and direction=1 THEN

Road width 1 = lanes x 3.5m that direction and

Road width 2 = 0

3. IF lanes =9 THEN

Road width 1 = 3.5m and

Road width 2 = 0

7) IN the AirQUIS Data (Static Traffic Data example sheet), road gradient is always 0 (because Dakar is relatively flat and we do not have emission factors for road gradients).

8) Registered Vehicle Classes (RVC) comes from the "Vehicle Classes" sheet in the AirQUIS Traffic Data workbook.

Dynamic traffic data

1) The road link ID's for the AirQUIS Data (Dynamic Traffic data example sheet) are the same IDs prepared in the AirQUIS Data Static traffic data sheet. If direction is defined as 3 in Static traffic data sheet, data for each direction must be identified (e.g. road link ID 1 and direction 1 for one direction and road link ID 1 and direction 2 for the other direction). If a one way road, then only one row for each road should be defined (e.g. road link ID 2 and direction 1).

2) For the AirQUIS data (Dyn. Traffic Data sheet), the "annual daily traffic" is the "AutoVol" taken from the EMME2 Data, multiplied by a conversion factor (CBG)

3) The free flow speed in the AirQUIS data (Dyn. Traffic Data Sheet) is the same as speed from the EMME2 data, but it should be assessed how representative the speed in EMME2 is as free flow speed as an average value over the day. The free flow speed is determined by the "road class ID" given in the sheet "static traffic data" and by using speed given in the matrix in file "classification of roads and veh speed.xls" (CBG)

4) Validity period – 2003 if using the 2003 data from EMME2.

*Remember to make a regular copy (BK) of AirQUIS database. Administration -> Project Management -> Right click AirQUIS Projects -> New Project -> Create copy.

Appendix G

Detailed QA/QC Plan

FINANCEMENT: **Fonds Nordique** **de Développement**	**Detailed Plan**	QA DAK

Projet:	ASSISTANCE TECHNIQUE A LA MISE EN PLACE DU LABORATOIRE CENTRAL ET DES STATIONS DE MESURES POUR L'AMELIORATION DE LA QUALITÉ DE L'AIR EN MILIEU URBAIN DE DAKAR
Agreement:	PAMU/FND/C/08/04
Titre	Preliminary QA/QC Plan for GIS Traffic Data
Date	Thursday 8. May 2008
Author	SR and CBG
Distribution	Mission 11 report
Référence No	O-105010
NOTE:	This information also found in the file "DetailedPlanQAQCprelim.doc"

Plan Description

A detailed QA/QC plan is necessary during georeferencing of the EMME2 data, and during the establishment of road nodes in GIS. Since there are 1576 road nodes to be entered in GIS, as well as 7 files to be georeferenced, there is the possibility of data errors, and repetition of errors by the operator. Thus a detailed plan is outlined below to assist Aminata Mbow in limiting the number of errors produced. This plan is labelled preliminary because an external QA/QC will also be performed on her work; this preliminary plan is solely for CGQA (primarily Aminata) to personally follow during her GIS entry of road nodes.

Georeferencing QA/QC Plan Details

1. After each .tif file is georeferenced, a QC test should be performed. This test is performed by picking 10 random areas throughout the whole map (thus all four corners, and 6 points in between). At each of these areas, zoom in tight (approximately 1:400 scale) to a road intersection and measure the distance (using the measure tool on the toolbar, where the measurement is displayed in the bottom left-hand corner of the screen) from the intersection on the .tif file to the intersection on the reference file (RteUrb.shp). At any of these locations, if the distance is greater than 6 meters, this is an error (see NOTE section below, point #1), and the georeferenced shapefile should be moved to within less than 4 meters of the intersection used on the spatially reference shapefile (RteUrb.shp).

Road Node QA/QC Plan Details

1. For the first .tif file (Sector 201), after every 100th road node entered, a QC test should be performed. This test is performed by zooming out to full extent and opening the attribute table for the shapefile (right click on pdfroadnodes.shp),
    a. Scan (scroll) through the recently entered data to notice any anomalies (for example, a "0" in the "ID" field means that the ID was inadvertently not entered). Correct any errors found and make a note of this (see NOTE section below, point #1)
    b. Then randomly select an ID from the previous 100 points entered (click on the grey area before the FID cell), and zoom into this selected point on the map. Verify that the road node ID entered in GIS matches the road node ID on the .tif file.
    c. With this same selected point, measure the distance (using the measure tool on the toolbar, where the measurement is displayed in the bottom left-hand corner of the screen) from the created roadnode point to the point on the .tif file, and if it is more than 6 meters, this is an error (see NOTE section below, point #1), and the created roadnode should be moved to within less than 4 meters of the roadnode on the .tif file.
2. For the remaining .tif files (Sectors 202-207), the test mentioned above in #1 should be performed after every 200th road node entered, and then 1b above will change from "100" to "200".
3. For every 300 points entered, export the previous 300 points entered (or open the pdfroadnodes.dbf file) into a blank Excel sheet and sort by ID.   Run a search for duplicate ID's, and investigate any duplicates, and delete when necessary. Also, check that all ID's are under the number 3008 (3008 is the last point in the EMME2 data).
4. When all points are entered, the final QC check will be to export the pdfroadnodes.dbf file into "List of all roadnode ID.xlsx" file. Column A of this file lists all of the unique ID's (1576), and in Column B should be exported all of the entered ID's from the dbf file. These columns should match up perfectly! Scroll through the entire document to find anomalies, and check every 100th entry to make sure that both columns match. If there are irregularities, it must be deduced if an ID is missing or additional, and then you must go into ArcGIS to correct the error.

NOTE:

1. Any errors found while performing the above test should be immediately corrected and noted in a separate Excel file (QAQCresults.xls workbook, "corrected road nodes" sheet).
2. Road node ID's that are illegible on the .tif file should be found on the original PDF file to see if the resolution is better and that the ID can be read. If the ID is still illegible, than this point should be noted in a separate Excel file (QAQCresults.xls, "illegible road nodes" sheet) so it may be deduced later by running a cross reference from the road link data.

Appendix H

Mission Notes

QADAK Mission 11 – GIS Report Notes:

Monday, May 5th, 2008:
1. See "*Appendix A MeetingMinutesArrivalMeeting.doc*" draft memo
2. See "*Appendix B MeetingMinutesDENVmobilstation.doc*" draft memo

Tuesday, May 6th, 2008:
1. See "*Appendix C MeetingMinutesTrafficDataTraining.doc*" draft memo

Wednesday, May 7th 2008:
1. See "*Appendix D MeetingMinutesTrafficDataExcerciseArcGIS.doc*" draft memo.
    a. This memo includes the following procedures listed in "*georeferencing and adding roadnodes.doc*" document.
2. See "*Appendix E MeetingMinutesGISandTrafficDatameeting.doc*" draft memo.

Thursday, May 8th 2008:
1. See "*Appendix F MeetingMinutesTrafficDataExcerciseAirQUIS.doc* " draft memo.
    a. This memo includes the file "*Exporting ArcGIS to Excel to AirQUIS.doc*".
        i. This file references the file "*template airquis_traffic_working doc_CGQA.xls*"
2. See "Appendix G DetailedPlanQAQC.doc" draft memo.
    a. This memo includes the file "*DetailedPlanQAQCprelim.doc*".
        i. This file references the file "*QAQCresults.xlsx*".
        ii. This file also reference the file "*List of all roadnode ID.xlsx*".

Friday, May 9th 2008:
2. Submitted and discussed the following files to Aminata Mbow:
    a. "Georeferencing and adding roadnodes.doc"
    b. "Exporting ArcGIS to Excel to AirQUIS.doc"
        i. "template airquis_traffic_working doc_CGQA.xls"
    c. "DetailedPlanQAQCprelim.doc"
        i. "List of all roadnode ID.xlsx"
        ii. "QAQCresults.xlsx"
3. Remaining 6 PDF files will be converted to .tif and sent to CGQA by end of the day Thursday May 15th.

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ABSTRACT

This report focuses on the GIS tasks which occurred during Mission 11, from May 5-9 by Scott Randall. Mission 11 contained other tasks which ran from May 5-13, coordinated by Cristina Guerreiro, these will only be briefly discussed in this report.

The purpose of this report is to state the specific procedures that were used for GIS preparation of Dakar traffic data for AirQUIS. This will be accomplished through an explanation of the training, describing performed exercises, and presenting the specific procedures and QA/QC controls initiated. Most of this detailed information will be presented in the form of the Appendices.