Geophysical Research Abstracts Vol. 15, EGU2013-7987, 2013 EGU General Assembly 2013 © Author(s) 2013. CC Attribution 3.0 License.



PropBase Query Layer: a single portal to UK subsurface physical property databases

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Until recently, the delivery of geological information for industry and public was achieved by geological mapping. Now pervasively available computers mean that 3D geological models can deliver realistic representations of the geometric location of geological units, represented as shells or volumes. The next phase of this process is to populate these with physical properties data that describe subsurface heterogeneity and its associated uncertainty. Achieving this requires capture and serving of physical, hydrological and other property information from diverse sources to populate these models.

The British Geological Survey (BGS) holds large volumes of subsurface property data, derived both from their own research data collection and also other, often commercially derived data sources. This can be voxelated to incorporate this data into the models to demonstrate property variation within the subsurface geometry. All property data held by BGS has for many years been stored in relational databases to ensure their long-term continuity. However these have, by necessity, complex structures; each database contains positional reference data and model information, and also metadata such as sample identification information and attributes that define the source and processing. Whilst this is critical to assessing these analyses, it also hugely complicates the understanding of variability of the property under assessment and requires multiple queries to study related datasets making extracting physical properties from these databases difficult.

Therefore the PropBase Query Layer has been created to allow simplified aggregation and extraction of all related data and its presentation of complex data in simple, mostly denormalized, tables which combine information from multiple databases into a single system. The structure from each relational database is denormalized in a generalised structure, so that each dataset can be viewed together in a common format using a simple interface. Data are re-engineered to facilitate easy loading. The query layer structure comprises tables, procedures, functions, triggers, views and materialised views. The structure contains a main table PRB_DATA which contains all of the data with the following attribution:

- a unique identifier
- the data source
- the unique identifier from the parent database for traceability
- the 3D location
- the property type
- the property value
- the units
- · necessary qualifiers
- precision information and an audit trail

Data sources, property type and units are constrained by dictionaries, a key component of the structure which defines what properties and inheritance hierarchies are to be coded and also guides the process as to what and how these are extracted from the structure.

Data types served by the Query Layer include site investigation derived geotechnical data, hydrogeology datasets, regional geochemistry, geophysical logs as well as lithological and borehole metadata. The size and complexity of the data sets with multiple parent structures requires a technically robust approach to keep the layer synchronised. This is achieved through Oracle procedures written in PL/SQL containing the logic required to carry out the data manipulation (inserts, updates, deletes) to keep the layer synchronised with the underlying

databases either as regular scheduled jobs (weekly, monthly etc) or invoked on demand.

The PropBase Query Layer's implementation has enabled rapid data discovery, visualisation and interpretation of geological data with greater ease, simplifying the parametrisation of 3D model volumes and facilitating the study of intra-unit heterogeneity.

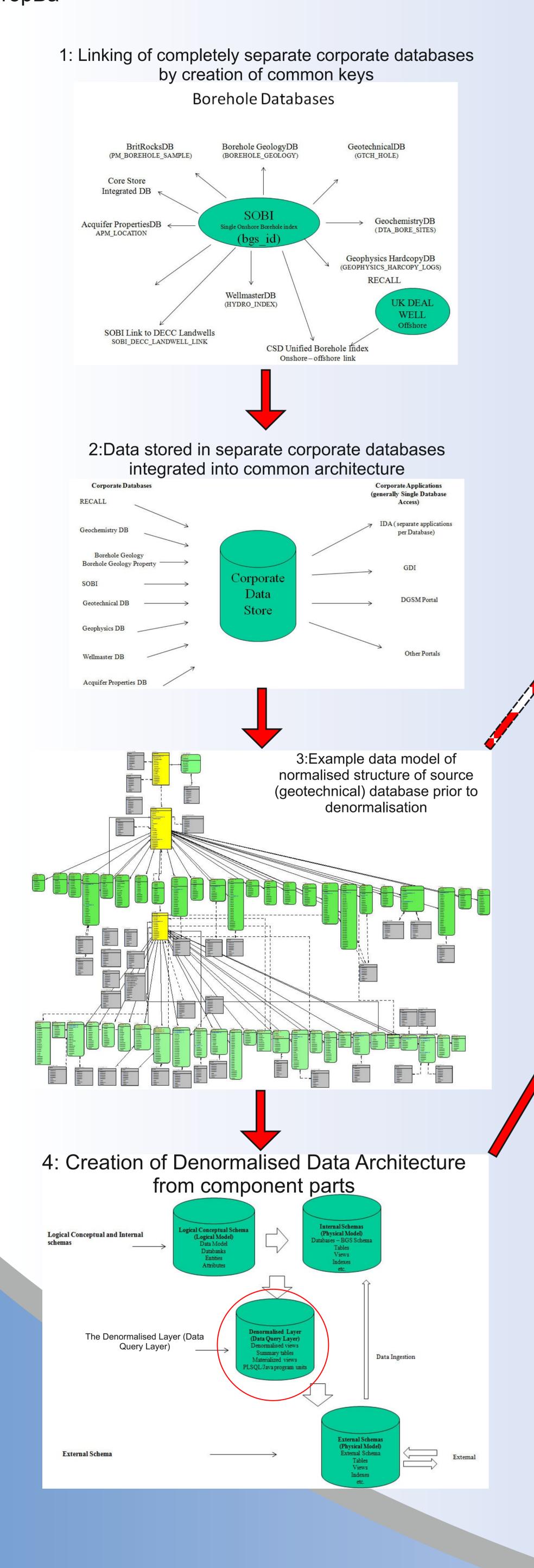


Geological Survey PropBase QueryLayer:

a single portal to UK physical property databases

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Until recently, the delivery of geological information for industry and public was achieved by geological mapping. Now pervasively available computers mean that 3D geological models can deliver realistic representations of the spatial location and geometry of geological units, represented as shells or volumes. The next phase of this process is to populate these with physical properties data that describe subsurface heterogeneity and its associated uncertainty. Achieving this requires capture and serving of physical, hydrological and other property information from diverse sources to populate these models. The PropBase QueryLayer seeks to achieve this by presenting a denormalised structure for a single access point of this diverse series of property data. PropBa



5: Creation of new denormalised data structures to produce simplified single access point for property data NUMBER (9,3) BH GEOLOGY PROPERTY PK ORILLED LENGTH DEPTH RELIABILITY START POINT TYPE VARCHAR2(6) START HEIGHT PRECIS DATE KNOWN NUMBER (4.0) VARCHAR2(2) NOT NULL VARCHAR2(2) DATE KNOWN TYPI BASE BED CODE ORILLING_METHOD VERIFICATION FLAG COMMENTS APPROVED INTERPRETAT TION FLAGCHAR(1) VARCHAR2(255) ORIGINAL NUMBER NUMBER (8,0) LOCATION VARCHAR2(6) DATE UPDATED DATA MANAGEMEN NOT NULL TRANSLATION VARCHAR2(80) NOT NULL ABBREVIATION VARCHAR2(15) NULL BGS_ID (FK) NUMBER (38.0) NOT NULL PEPSG CODE VARCHAR2(20) DATE ENTERED NOT NULL VARCHAR2(20) NOT NULL DESCRIPTION VARCHAR2(500) NOT NULL BOREHOLE_GEOLOGY_PA **USER_ENTERED** STARGET UOM CODE (FK) BOREHOLE GEOLOGY NU4 TRANSLATION VARCHAR2(50) NOT NULL (A CONV FACTOR NUMERATOR NUMBER BOREHOLE GEOLOGY NUE **USER UPDATED** VARCHAR2(10) CONV FACTOR DENOMINATOR NUMBER BOREHOLE_GEOLOGY_NU3 SUSER ENTERED VARCHAR2(10) NOT NULL BOREHOLE GEOLOGY NU DATE UPDATED DATE ORIG INFORMATION SOURCE VARCHAR2(255) NULL JUSER UPDATED VARCHAR2(10) BOREHOLE GEOLOGY NU5 VARCHAR2(10) BDIC DATETIME RELPOS PK DIC_DATETIME_RELPOS_U1 (AK1) VARCHAR2(10) NOT NULL DIC_DATETIME_RELPOS_U2 (AK2) SOBI_PK DIC UNIT OF MEASURE PK SOBI NU CODE (PK) VARCHAR2(2) NOT NULL SOBI NU2 DIC_UNIT_OF_MEASURE_U2 (AK2) DIC UNIT OF MEASURE NU1 (AK) SOBI NU3 DATE ENTERED DATE VARCHAR2(100) NOT NULI USER UPDATED VARCHAR2(10) NULL VARCHAR2(20) NOT NULI NUMBER NOT NULL TRANSLATION VARCHAR2(50) NOT NULL STATUS CHAR(1) NOT NULL 'C' VARCHAR2(20) NOT NULL BDIC DATE ACCURACY PK SOURCE TABLE VARCHAR2(100) NOT NULL TDIC DATE ACCURACY U1 (AK1 DIC_DATE_ACCURACY_U2 (AK2) VARCHAR2(4000) NOT NULL VARCHAR2(10) NOT NULL VARCHAR2(200) NOT NULI VARCHAR2(50) NOT NULL DATE_REPORTED DATE RANSLATION VARCHAR2(20) NULI MEAS VALUE DATE DATA SOURCE VARCHAR2(20) NOT NULL MEAS VALUE DATE PRCN (FK) VARCHAR2(2) NOT NULL DATE RESOLVED DATE VARCHAR2(40) NOT NULL MEAS VALUE DATE RPOS (FK) VARCHAR2(6) NOT NULL 'EQUAL DATE_ENTERED DATE VARCHAR2(5) NOT NULL DATUM TRANS VARCHAR2(80) DATE ENTERED /ARCHAR2(30) NOT NULL (AK3 DATE UPDATED DATE DATUM ELLIPSOID VARCHAR2(80) VARCHAR2(10) NOT NULL USER ENTERED DESCRIPTION VARCHAR2(2000) NOT NULL USER_UPDATED VARCHAR2(10) **TRANSLATION** VARCHAR2(50) NOT NULL PRIME MERIDIAN VARCHAR2(80) VARCHAR2(10) NULL PRB ERROR LOG PK MAREA OF USE DETAILS VARCHAR2(500) PRB_ERROR_LOG_TG2 AREA OF USE GROUP VARCHAR2(10) NOT NULL PARENT ISO CODE (FK) VARCHAR2(5) PRB ERROR LOG PK MUNIT OF MEASURE CODE (FK) VARCHAR2(20) VARCHAR2(10) NOT NULL PRB ERROR LOG TG DATE UPDATED DATE ENTERED DATE UPDATED DIC MET ACCESSUSE RESTRIC PK USER UPDATED VARCHAR2(10) DIC PRB MEAS TYPE HIEF TDIC MET ACCESSUSE RESTRIC U1 (AK1) DIC_MET_ACCESSUSE_RESTRIC_U3 (AK3) MDIC_CRS_HORIZ_CS_PK PRB DATA TG USER ENTERED VARCHAR2(10) NOT NUL DATE ENTERED DATE_UPDATED DIC_PRB_MEAS_TYPE_HIER_PK TRANSLATION VARCHAR2(50) NOT NULL (AK1 DIC PRB MEAS TYPE HIER AUD CHAR(1) NOT NULL 'C VARCHAR2(200) NOT NULL **TRANSLATION** VARCHAR2(80) NOT NULL PEPSG CODE VARCHAR2(20) NULL DATA_SOURCE VARCHAR2(20) NOT NULI VERT DATUM CODE VARCHAR2(20) NULI SUSER_ENTERED VERT DATUM TRANS VARCHAR2(80) NOT NULI DATE_UPDATED ARCHAR2(30) NOT NULL VARCHAR2(10) **JUSER UPDATED** DIC PRB MEAS TYPE PK WAREA_OF_USE_DETAILS VARCHAR2(500) NUL DESCRIPTION VARCHAR2(250) NOT NULL (AK TIPDIC PRB MEAS TYPE U2 (AK1 MAREA OF USE GROUP VARCHAR2(10) NOT NULL PRB GROUND REFERENCE PK RANSLATION VARCHAR2(50) NOT NULL NUMBER SUNIT OF MEASURE CODE (FK) VARCHAR2(20) PRB GROUND REFERENCE PK NUMBER NOT NU PRB_GROUND_REFERENCE_AUD TDIC_PRB_MEAS_TYPE_U4 **DATE ENTERED** VARCHAR2(20) NOT NU USER ENTERED VARCHAR2(10) NOT NULL DIC_PRB_MEAS_TYPE_PKX DIC_PRB_MEAS_TYPE_AUD USER ENTERED VARCHAR2(10) NOT NULL DATE UPDATED DATE UPDATED DATE USER ENTERED VARCHAR2(10) NOT NUL DIC PRB DATA SOURCE PH BDIC_CRS_VERT_CS_PK DIC PRB DATA SOURCE U2 (AK1 USER_UPDATED DIC_CRS_VERT_CS_U2 (AK2) DATE OF PROCEDURE LAST_RUN PRB_DATA_COORD_PK DIC PRB DATA SOURCE PK PRB_DATA_COORD_NU3 NUMBER PRB_DATA_COORD_PKX PRB_DATA_COORD_AUD DATASOURCE_PRIMARYKEYVARCHAR2(100) NULL 9:Property data output in CSV for 6: Simplified Data portal for easy property searching easy manipulation in EXCEL Search Item Lis OSGB 1936 / British National Grid 7: All data outputs in standard formats simplifying data extraction and loading into other applications 10: Property data output in Google Earth. for easy visualisation Geochemical GBASE Soil Overburden Analytes 606319.0, 271695.0, 0.0 381453|145337 $= 3.7801524 \pm 0$ 381455|145337 381456 145337 381457|145337 381458 145337 381459|145337 Outputs in a set of standard output formats Google Earth 8: Example of single row with full metadata 10: Property data outputs visualised in GOCAD® from original normalised datasets fully retained

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The PropBase Query Layer's implementation has enabled rapid data discovery, visualisation and interpretation of geological data with greater ease. Data is now available in common outputs format for easy parameterisation of 3D model volumes and facilitating the study of intra-unit heterogeneity.