





GESS DISCIPLINE MARKETING PROFILE

ADVANCING AS BUILT DOCUMENTATION FOREVER









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1. Reverse Engineering the Intelligent Way

GESS utilise Laser Scanning Technologies in the form of:



These technologies are used to capture 3D spatially correct infrastructure and then utilising 3D modelling software to reverse engineer the infrastructure models to a client specification, such that the client can instantly start their project without the need for data manipulation which is prone to errors due to interpretation in the conversions.

General Survey services utilised as required on these projects are:



GESS has over the past 22 years developed software solutions in the built infrastructure environment ranging from Wayleave solutions, Fleet Management solutions, Survey Open Pit solutions and various cloud and web based solutions customised specifically to our client's requirements.



Software Development



2. Disciplines, Projects & Examples

GESS capture the 3D spatial assets for various disciplines that cover a wide variety of business sectors and for very different business benefits across the entire enterprise. This is not your typical survey of an infrastructure asset which is used only by engineers, design consultants and architects.

Due to the methods utilised and the variable deliverable products, clients, consultants, public and parastatals can utilise the 3D spatial information for planning, design, management and maintenance, financial, safety, asset management and operational usage.

A. Plant & Process Engineering

One of the most successful parts of our business is reverse engineering process plants in mining, oil and in the processing plant arenas.

Utilising Terrestrial scanners we have developed in house skills to optimise field works in terms of scanning and building (registering) the individual point clouds into a completed 3D point cloud of the plant. We have scanned entire dms plant in under 10 hours of site works and delivered associated 3D intelligent structure models and 3D spatially correct equipment and piping models in under 7 weeks.

We utilise normal surveying skills to coordinate and survey targets which are placed whilst scanning the plant.

In some plant we are requested to supplement the terrestrial scanning with Mobile scanning. The vehicle is driven around the plant at 30km/h collecting laser points which we can use for access control of abnormal loads, scheduling and planning for removal of equipment, etc.

We have on certain plants utilised LiDAR survey using our Gyro and Helicopter aerial platforms to capture the ground surfaces typically for drainage within the plant battery limits.

We have the skills to reverse engineer the Scanned #d data into Digital Twins both unintelligent 3D models and intelligent Plant, Civil and BIM models.



Coal Plant DMS Building



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Coal Plant: DMS Building



GESS



Transfer House





Debswana Orapa Plants 2016 – Piping Scanning & Reverse Engineering





B. Hydro and Water Engineering

GESS have scanned and reverse engineered dozens of dam walls, water capture areas, pump houses and Hydro plants for various clients for dam safety, raising of dam walls, hydro gates design and refurbishment.

The dam areas have in some cases been LiDAR surveyed to determine catchment areas, flood analysis cross sections models, dam footprints and impact to environment, and volume calculations. The LiDAR data is converted into 3D DTM's, contours and is usually supplied with Ortho Photos. We have utilised fix wing, helicopter and our Gyro copter aerial platforms depending on the size of the area required.

Sonar and hydraulic surveys have been carried out to determine underwater ground profiles, siltation levels and current volume of water calculations.

Dam walls and surrounding infrastructure is typically scanned using terrestrial scanners. These point clouds are utilised to build 3D models of the existing wall, pump stations, galleries, aprons and overflow areas.

ClanWilliam Dam 2015



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Phalaborwa Barrage Dam 2015





Client comment: "The laser scan and modelling of Hazelmere Dam is amazing, almost magic, when one considers that technology can create a "picture" of the structure which can be converted to an intelligent model with actual dimensions and reduced levels. This has truly revolutionized the concept of an "as built drawing" of a structure" : A.J. (Tony) Moore (Pr. Eng.), Chief Engineer: Betterment Capital Projects, Department of Water Affairs



Albasini 2013



C. Mining above Ground

Mining above ground involves everything we do for our mining clients excluding the process plant reverse engineering which has already been covered. This section covers conveyor belts, hoppers, structures, equipment and services.

We utilise terrestrial scanners to scan mining infrastructure and capture the required 3D infrastructure and then reverse engineer the data for specific needs. This could be for dismantling and moving conveyor belts, to equipment scanning for failures, incident management, fatalities snapshots and investigation, structural audits and for clash detection assessment for equipment access.

We utilise normal surveying skills to coordinate and survey targets which are placed whilst scanning the plant.

Using the Point cloud we can model the 3D plant into Digital Twin.



Anglo American – Platinum Polokwane







Anglo American – Platinum Amandelbult





Anglo American – Platinum Mototolo











Anglo American – Platinum Mogalakwena







Anglo American – Platinum Mortimer







Anglo American – Kumba Iron Ore Kolomela



Anglo American – Kumba Iron Ore Sishen















Plant Reverse Engineering – Assmang 2014



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Construction audit – As Built – Petrochemical 2015



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D. Mining under Ground

Mining underground is a daily routine for our scanning resources. Utilising the underground survey control we scan underground infrastructure for a variety of reasons. This includes equipment deployment, conveyor designs, and construction audits – current excavation versus designs, incident management, shaft audits and for underground surface modelling.

We utilise terrestrial scanners to scan mining infrastructure and capture the required 3D infrastructure and then reverse engineer it for the specific needs.

We utilise normal surveying skills to coordinate and survey targets which are placed whilst scanning underground. We also utilise the existing mining survey pegs information for scan coordination and locations.

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Conveyor installation survey with clash detection



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Shaft Scanning – Petra Diamonds, Anglo Gold Ashanti 2015

E. Transportation

Utilising Terrestrial, Mobile, LiDAR and traditional Leveling surveys we have completed numerous road survey projects of national and urban roads. We can complete road surveys at half the cost and time of traditional methods, whilst increasing the accuracy and level of details for the client. This technology allows clients to do clash detection, drainage assessments, routing and asset management of lighting and other assets.

Terrestrial scanning is utilised to capture the culverts and bridge infrastructure in the road reserve.

Mobile scanning can be carried out driving the vehicle at 120km per hour. We would normally drive the route required in both directions as well as in all lanes. We would typically collect 1000 scanned points per m² which we thin using algorithms to obtain a usable DTM for our clients. We specialise in providing the information in the consultant's specified software so as to minimise start up time for them.

Since all existing surfaces are not visible when performing mobile scanning (top of banks, drainage channels, vegetation) we supplement the mobile and terrestrial scanning with LiDAR scanning. This is normally carried out using our gyro



aerial platform at low elevations. The added benefit of this is that we can then supply up to date Aerial Ortho photos since we activate the aerial camera solution whilst carrying out the LiDAR survey.

Traditional survey is carried out as per TMH11 to obtain elevations using levelling survey. This is normally the most time consuming services and is influenced by traffic accommodation whilst the other services have minimal or even no impact to traffic and are therefore far safer for all parties. All road surveys should be carried out utilising these technologies as the safety issue, frustration, impact to road users is significantly reduced. The fact that these surveys are far more detailed, accurate and cheaper should already be motivation enough to have it implemented.

N1/ N7 Survey 2015





N1 Survey 2015



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Jan Smuts Cape Town - 2015



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Urban Road – Knysna 20-15





F. Railways

______ Utilising Terrestrial, Mobile, LiDAR and traditional surveys we have been laser scanning and reverse engineering 3D rail infrastructure.

Terrestrial scanners have been utilised in rail tunnels, culverts, stations, platforms, bridges and maintenance workshops and running sheds reverse engineering projects. We have completed numerous projects by supplying 3D models and geo referenced point clouds of this infrastructure.

LiDAR technology have been utilised to capture rail line infrastructure including overhead power lines, turnouts, drainage, dtm's and rail ballast. We have used Lidar to identify all structural supports and supplemented this data with bridge and culvert terrestrial scan data.

Mobile scanning of rail infrastructure utilises our mobile solution mounted on rail car or locomotive. This is the fastest way to collect all the 3D rail infrastructure including clearance, signals and other impacting infrastructure.

LiDAR scanning survey of Railway Infrastructure including overhead lines





Mobile Railway Infrastructure Scanning



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Station Infrastructure Terrestrial Laser Scanning



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Running Sheds & Workshops: Intelligent 3D Terrestrial Scanning & Modelling Reverse Engineered



Bentley Awards Finalist Project 2013: Hilton Hotel London

H2NSJV Manganese Line **2016** – the expansion of the Transnet manganese railway line between the Hotazel mine and the Nqgura port – mobile rail scanning and LiDAR survey







Break Calliper Scanning and 3D Modelling





G. Tunnels

Tunnels are generally scanned using Terrestrial scanners with survey control points to minimise drift on the survey. In the mining industry we utilise survey pegs in the roof whilst in transportation tunnels we normal use existing survey control or we setup the control prior to scanning. Special technology is required and used to classify and extract sections, volumes and details from tunnel models.



H. Commercial

a) Reverse Engineering Intelligent Commercial Building

GESS scan and reverse engineer commercial buildings and houses using terrestrial scanners and utilise 3D modelling architectural and structural software to generate AutoDesk 3D Revit and 3D Bentley AECOsim intelligent models for clients.



Commercial office building



Commercial Warehouses



GESS





Commercial Office – Scanned & Reverse Engineering BIM

Holiday Resort- Rhemardo January 2016





I. Volume Audits

Utilising LiDAR off our Gyro Copter we laser scan open pits for volumetric and change management especially where block and cave mining procedures are being undertaken.

Control using standard survey methods is firstly carried out, followed by a planned flyover with the Light Detection and Radar solution capturing the surface from which we reverse engineer 3D CAD surfaces for the mine.

Volume with cross sections are extrapolated and a report given showing differences between LiDAR projects for that site. The goal of these services is to **fly today deliver tomorrow** but this is subject to the base station operating correctly whilst we fly.

Cullinan Open Pit Audit 2015





Finsch Open Pit & Stockpile Audit 2015



Jwaneng Annual Volume Audit Jan 2016





Stockpile Monthly Volume audits using LiDAR



Stockpile Monthly Volume Audits using Terrestrial Scanners



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J. Structural Assessments

We scan structural plants using Terrestrial Laser scanners and reverse engineer the structure into intelligent components. This allows users using hand held devices to work through plants and do structural audits on steel and concrete members. The models can be supplied in Revit, Bentley structures, Prosteel, Tekla, ISDM models, and file formats like SDNF.

Structure assessments and annual audit reports





3D Terrestrial laser scanning, intelligent structural models for Structure assessments and analysis integration



K. Silo Audits

Silo scanning and reverse engineering has become a focus since the Majuba silo collapse earlier this year. Scanning of silos to detect movement requires a base line scan such that comparisons can be run to check any variance or deflections in the silo on subsequent scans.

Cracks and deflections are measured against a best fit cylinder and then a report can be extracted to manage the condition of silos.



Silo deflection report



Silo Auditing showing significant cracks





L. Differential Audits

We are currently testing terrestrial scanning technology to identify and quantify geotechnical movements. An original Huguenot tunnel scan was carried out for the SANRAL expansion project in 2009 and was now rescanned in 2015 and a differential assessment carried out between the two different dated point clouds. Using software to find any differences within a 2mm tolerance, the only differences detected were open/closed doors, survey equipment, surveyors and tripods as detected initially, showing no movement on the rock surfaces in the area where the tests were carried out.



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M. Clash Detection Services

We carry out clash detection services against point clouds versus new design or access routes. This service can save the client significant returns due to easy deployment of equipment, no down time when these issues occur and optimising what infrastructure is required to be moved before proceeding with the installation. The same technology can be utilised to identify clearance for abnormal loads on roads or within plants. We also utilise this technology underground.



Underground deployment of new sub station



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Client Comments: The scanning of 116 level was identified as an ideal project to ensure that the clearances down the haulage when transporting the transformer to the sub-station would be adequate. This was a success from the point of view in identifying potential areas where the transformer might have clashed with either the sidewalls of the haulage or the hanging wall or possibly even closed up areas.

There were some areas where the hanging wall was too low and the sidewalls, or width of the haulage, too narrow. These areas had to be "sliped" in order to obtain the correct clearances. One area was identified where it was totally closed up and this would have had a significant effect on the transporting of the transformer had it not been identified up front. By scanning the haulage before transporting the transformer to the sub-station resulted in some significant savings to the project.

In addition to this the final "mesh and lacing" of the haulage was completed only after the affected areas were rectified also resulting in potential cost savings



Equipment Scheduling, planning & clash detection



N. Aviation Reverse Engineering

GESS has scanned and modelled various items and objects including aircraft for clients using terrestrial scanners. We have in-house specialists that can model detailed items for manufacturing or design analysis requirements from the scanned data.





O. Equipment Audits

GESS has terrestrial scanned and reverse engineered numerous pieces of mining equipment, earth moving equipment, cabs of vehicles for equipment fitting, etc. over the past few years.

Mining equipment that keeps failing is scanned and reverse engineered to allow the client to run fem analysis to identify why the equipment is failing and adapting their designs to counter such failures.



Scoop Terrestrial Laser Scan, 3D Model and dimensioning

Fem Analysis Model on Failing Equipment- Terrestrial Scan, 3D Model and fem Model of Surfaces





P. Incident Management & Fatality Forensic Audits

We have been involved in many instances where forensic type scanning and reverse engineering has been requested. The purpose of these scans is to capture the as-is information in 3D, allowing the designers and assessors to visualise and measure the current status on site.

These have included murder scenes, fatal incidences, general plant failures and collapsed built infrastructure. The earlier we get on site to scan these instances, the less contamination will occur and the more accurate the information for investigation will be. This service also shortens the time to become operational again as all parties have an accurate record in 3D on the incident scene.





Q. Urban Auto Development & Growth Identification Solution using LiDAR

Using LiDAR technology, we have developed a utility to identify and quantify urban sprawling between different dated LiDAR scans. This has been successfully utilised in identify growth in low cost housing, informal settlements and can also be used to identify changes in urban and city development to compare developments against planned and approved expansions.

This technology is 3D technology where volumetric differences can be identified.



R. Mining Software Solutions

GESS was appointed to automate the month end volumes at Kumba Iron Ore mines replacing traditional survey instruments with Terrestrial laser scanners and then optimising and automating the workflows to increase production, improve accuracy (volumes) and reduce turnaround times while striving to obtain real time up to date data of the actual mine spatial dataset.

This is being integrated with survey, planning and geotechnical divisions to create a single source of truth with all parties having access to the correct actual data model.



The project has been expanded to include a single block planning database from which all resources can be extracted and their data updated as well as a drill blast hole solution.







S. Wayleave Solutions

In March 2012, GESS won a tender to implement our Electronic Wayleave Management System called WayleaveCENTRAL for the City of Tshwane (CoT).

Other in-use and previous version deployments of WayleaveCentral includes deployment of the system to the Botswana Transport Department on a National Level as well as to Gautrans Department of Roads and Transport, Gauteng.

The ultimate purpose of WayleaveCentral is to streamline operations, improve communication and transparency and to have a positive impact on key performance areas which ultimately increase the bottom line of both municipalities and services companies, through better business process management.

WayleaveCentral automates processing of Wayleave Applications and includes the following features:

- Online Wayleave Application
 - Open to the public for Consulting Engineers to submit and track applications
 - Automated Application Pre-Submission Checks
 - Automated Service Inquiry Process
 - TRH26 & TRH27 Compliance
- User Defined Workflow
- Automated Task Assignment based on Work Regions (from GIS)
- System-managed compliance and documentation checks
- Progress tracking
- Automated progress and issue notifications
- Automated Reminders and Escalations
- Automated communication between the applicant, engineer, contractor, municipality and other service owners in the application area
- Real-time data
- Risk management



- Documentation management
- Applicant assistance with legislative and procedural compliance
- Applicant guidance throughout the process
- Online Design Review of submitted documentation
- Automated Design Review distribution and management
- Mobile Field Information
- Mobile Field Inspection and management
- Online Road Closure Application
- Road Closure Permit Management



T. Software Solutions and Training

GESS has been a TerraSolid partner for more than 10 years. We sell, support, train, deploy and customise engineering solution on these technologies to clients across all engineering disciplines.

With our professional resources we have the experience to recommend appropriate solutions to clients as well as assist clients with the technology which we use within our own organisation on project work specifically in the transportation, plant, hydro, urban and mining industries.



We understand the local conditions and standards and can assist clients to get operational and maximise their return on their software investment.

a. TerraSoild

Contact GESS for software sales, support (SLA), training, production procedures, product integration and development for customised solutions integrated to your enterprise solutions.

















b. Contact List: Technical & Sales

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