1. Regulating the use of GPS and RTK using CORS

Supervisors: C Roberts  
Student: Daniel Lees

Description: The recent growth of CORS networks in various states of Australia and the federally funded national CORS network encourages the use of GNSS surveying for traditional surveying tasks and encourages new opportunities. However surveyors must still ensure their work adhere’s to standards and regulations. Indeed satellite surveying techniques challenge these standards whereby the use of coordinates replaces traditional bearing and distance measurement. Consequently land authorities have been developing new standards and regulations that encourages the use of GNSS surveying without diminishing the integrity of the traditional surveying tasks. This project will critically examine these new regulations (NSW Surveyor General’s Directions No. 9 and the ICSM SP1 (draft)), propose some measurement scenarios and conduct some field experiments to assess these new regulations.

References: NSW Surveyor Generals Directions no. 9 and the ICSM SP1 (draft) as well as a number of other docs from other countries.

2. Summary of 10 Recent Cadastral Law Cases

Supervisors: MB Green  
Student: James Wards

Description: This will be a matter of selecting 10 cases, summarising them, visiting the sites (preferred) and analysing their impact on Survey Practice.

The student will select each case, write a short paragraph to summarise the case and then present this to the supervisor for approval. Often the key words in a law report will assist with this level of summary. Where possible cases should be selected from those where the citation date is between 2008 and 2010 and should cover different matters. For example, one case could be based on a dispute over a Right of Carriageway, another over a natural boundary and so on. It will be suitable to chose two cases on a single topic where the cases address separate issues. For Example, one case may be based on the use of a Right of Carriageway while another may be on the cost sharing for repairs to a Right of Carriageway. Variety in subject matter will be the primary target.
Cases that are linked are acceptable where they are recent but fall before 2008. An example of this would be where one case is heard in 2008 and relies on a precedent that was reported in 2006. When the cases are selected and approved, a more complete summary of an authorised report is prepared and then analysed. It will be preferable to select cases within easy travel distance so that the sites of the dispute may be photographed for inclusion in the thesis. Any opportunity should be taken where parties to a case can be interviewed. A Surveyor who is an Expert Witness is an example of such an interviewee.

References: Guided by the supervisor.

3. Getting the most out of CORSnet-NSW

Supervisors: C Roberts

Student: Luke Shields

Description: CORSnet-NSW has been launched and soon will offer Network-RTK capabilities to users. However for surveyors the range of options available, and how to access them is daunting. This project will tackle head-on all the problems and trouble-shooting a modern surveyor will face when using CORSnet-NSW services, including RINEX, DGPS, Single base RTK or Network RTK. Leica's QC GNSS software will be used to investigate data quality and all the options available will be investigated by the student, such as extracting solutions from SINEX files, time series, IONEX maps, etc. It is expected that this work will contribute toward a hands-on user guide to encourage new users of CORSnet-NSW.

References: Leica website, Lands & Property Management Authority website, and contacts provided by supervisor.

4. Very Fast Trains for Australia: A Surveyor’s Perspective

Supervisors: C Roberts

Student: Anthony Grace

Description: China anticipates building 20,000km of Very Fast Train infrastructure by 2015, providing mass transport of people at speeds in excess of 300km/hr. This infrastructure will challenge domestic airline services and can significantly reduce China's “carbon footprint”. Is VFT feasible in Australia? This thesis will investigate first the numerous plans that have come and gone with respect to such infrastructure, then look at the feasibility from a surveyor's perspective. Issues such as purchasing a land corridor, engineering design constraints for either electric or maglev technology, and ongoing maintenance and monitoring of this infrastructure (especially in hot Australian summers), are just some of the topics to be addressed.

Matthew Wright from Beyond Zero Emissions.
ABC Science Show Website

5. Water Rights

Supervisors: MB Green

Student: Gavin Watson

Description: Water Rights can be held by a property owner after the sale of property, rendering the parcel of land much less valuable than it previously was. This has posed problems for new buyers/businesses and lending authorities. With the ongoing drought conditions in some parts of NSW and Australia, and the recent Federal government intervention, water rights are set to become a very important issue for the general community. Surveyors will be asked to determine the catchment capacity of land. Who owns the rain? Will land owners be tempted to dig dams on their property to increase the value? This thesis will ask the student to consider all the issues surrounding water rights and the role of surveyor. The student should then speculate on what the future may bring, and identify some new opportunities for the surveying profession.

References: Azimuth, ISNSW, and various references provided by the supervisor.

6. Comparison of the Accuracy and Suitability for Digital Aerial Imagery and Lidar Data for the Extraction of Buildings and Other Features for Digital Mapping

Supervisors: JC Trinder, M Chang

Student: Sean Cunningham

Description: LPMA have recently acquired state-of-the-art technologies for the acquisition of digital aerial images and airborne laser scanner data, or lidar. These include the Leica ADS40 digital aerial camera and ALS50 lidar with medium format camera. This equipment requires new techniques for processing the data for the acquisition of digital mapping and GIS data data. The project will investigate the procedures for orientation of the digital aerial images using LPS software on the digital stereoplotters and the accuracy and ease of use for the extraction of cartographic information. Data derived from the laser scanner will be analysed on appropriate software such as the QuickTerrain Modeler, already available in the School, as well as other software such as from ESRI. Comparisons should be made of the accuracy and quality of data derived from both images and lidar data, with suggestions on how the efficiency of data acquisition can be improved by additional software measures.

Objectives:
- Understand the issues in orienting and extraction of spatial data from ADS40 pushbroom scanner data.
- Determine accuracies and efficiencies of information extraction from ADS40 data.
• Determine the processes of extracting information from lidar data and its quality.
• Compare the suitable of digital aerial images and lidar for extracting spatial information.
• Consider automatic methods that would be suitable for extraction information from images and lidar data.

Methodology:
• Literature research and study of processes for operation of LPS software and QuickTerrain Modeller.
• Measurement of sample data from Bathurst.
• Presentation and review of results obtained in observations of aerial and Lidar data.

7. Effects of Coastal Erosion on Properties – Belongil Beach

Supervisors: MB Green

Student(s): Russell Baker

Description: The Byron Shire plan for coastal management involves the policy of ‘planned retreat’, under which new development close to the coastline is prohibited. This policy also prevents residents with existing homes on the waterfront to defend their homes with measures such as emergency rock walls or sandbags. The area of Belongil Beach in the Byron Shire has experienced severe erosion problems and a legal battle between the property owners and council is underway. This battle could set a major precedence for coastal development and have major ramifications for beach front property owners. I will look at the history of court proceedings, document the erosion problems and affect on property boundaries, and look at environmental issues associated with defending erosion problems and their effect on realignment of coastline.

References: guided by the supervisor

8. Development of a Clean Water Monitoring System

Supervisor: S Lim

Student: Nor Yahaya

Description: One of the measures available to monitor the usage of clean water is to assess the pressure of the running water. An excessive water pressure will lead to water pipe breakages and cause leakage in the water supply. Thus, a clean water monitoring system will be proposed in this study in order to monitor/maintain the standard level of the water pressure and ensure the sustainable water supply. The proposed system will also identify potential/actual problematic areas and provide corresponding solutions of the existing water supply network by using GIS techniques.

Expected Tasks:
- To conduct a case study on water pressure management
- To collect and aggregate datasets
- To perform data analysis by using GIS
- To design a system to assess water pressure
- To implement the system enabling water pressure monitoring and data queries

Data:
- Water pipelines data for the study area
- Water components
- Water intakes and treatment plants
- Water main breaks history
- Water users and demands (optional)
- Districts/suburbs/localities
- DEM/contours


Supervisors: C Roberts

Student: Nic Gowans

Description: Precision agriculture has been demonstrated to improve the efficiency of farming practices in a range of different environments, farm sizes and for differing techniques. It has been repeatedly demonstrated that the initial capital expenditure of many $1000s can be recovered in 2-3 years. Yet the uptake of PA is only at the 15% level. With the growing CORS networks across Australia and the fact that surveyors represent the largest group of high precision GPS users, there is a business opportunity for surveyors, as consultants, to encourage the uptake of PA into farming operations. This thesis will give an overview of status of PA technology, provide a literature review of PA case studies, and suggest ways that surveyors can change their language to open a new business area into their surveying consultancies.

References: Supervisor has lots of documentation.

10. Strata Titles

Supervisor: MB Green

Student: William Daman

Description: This topic is an extension of that completed by Ryan Fifield in 2008. Mr Fifield’s thesis is certainly valuable as an example of a high standard submission and it will lead to opportunities to investigate new matters impacting on Strata Titles.
In recent times it appears that the plans prepared by surveyors for Strata Title subdivisions are becoming a tool for the long term management of strata complexes. This means that the simplified nature of strata plans may not be the best format. Society has also become more complex with a need to map the cadastre in more detail and correctness. Strata Plans do not necessarily meet this requirement. The construction of buildings with mixed development, eg retail, commercial and residential and perhaps also used to house communication towers, has further introduced complications with respect to the information shown in Strata Plans. The current plan requirements may not meet the future use and development of a site. Some possible material can be researched through:

- Speaking with industry stakeholders to identify issues with current procedures and regulations in NSW that need to be addressed. Make recommendations as to how these issues may be resolved.
- Attending Strata Industry Working Group meetings through ISNSW
- Researching interstate strata systems and also consider international 'equivalents' of our Strata Title system. Look at how our system differs to these examples and potentially find attributes that may be beneficial if adopted in our system.
- Look into the history of Strata Titling in our country to gain an understanding of what the original intention of Strata Titles was, and how it has evolved into the system we have today.

On an industry level this thesis project can assist in addressing issues surrounding current Strata Title survey procedures and regulations used by surveyors in NSW.

**Suitability:** Student who is interested in land development and cadastre matters.

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### 11. The Growing Society – Urban Consolidation, Urban Sprawl and Village Development

**Supervisor:** MB Green

**Student:** Anthony Wallace

**Description:** If Australia is to have a population of 35 million people it is likely that NSW will have 9 million and Sydney 6 million of this population. What alternatives can the State adopt to meet the expected growth in population? At present society seems to be faced with either urban consolidation, urban sprawl or village development.

To many people urban consolidation means increased population densities that would initially occur along transport routes and then spread to make the dream of the quarter acre block just that, a dream. On the other hand, urban sprawl provides the quarter block, somewhat reduced in size, but this type of development will impact on the food basins of the cities. Then there is village development or in other words, decentralization. This type of development is often portrayed as an expensive answer to coping with increased populations. Regardless of the method/s adopted to house a growing population we still have to weigh up whether the State or for that matter, Australia, can sustain a large population. We are all familiar with the issues of fluctuating water supply and our poor infrastructure.

**Objectives:** This thesis will look at:
1 comparing alternatives for housing a growing population
2 consider a sustainable growth rate and distribution
3 investigate infrastructure requirements to meet the growing population
4 the social impact

12. Feasibility Study of Forest Parameterisation from Airborne Lidar Data

Supervisor: S Lim
Student: Shirley Johnson

Description: For the last few decades, analyses of forest area have been conducted using remote sensing techniques such as aerial photogrammetry, satellite imagery, synthetic aperture radar (SAR) images and lidar data. Airborne lidar systems, in particular, offer a cost-effective, versatile, operationally flexible and robust sampling tool for forest management. There is a growing industry trend towards techniques of “precision forestry” which results in precise mapping of vegetation structure with a realistic 3D visualization, including the potential application of lidar technology. Previous forest research using a lidar system has focused primarily on forest ecosystems with conifers as the predominant tree type. The use of a lidar system has been helpful in gaining a deeper understanding of canopy surface and segmentation processes for estimating dominant above-ground biomass (DAB) in a harvested forest. However, general lidar systems using a discrete-return pulse have limited capacity to detect tree types, stem quality and canopy understorey.

The aim of this thesis is to investigate the feasibility of 1) an “individual-tree-based” and 2) an “area-based” forest parameterisation from airborne lidar data. Whilst the individual-tree-based approach is suited to process high-density airborne lidar data (e.g. full-waveform lidar data) and derive forest parameters (tree height, tree crown diameter, diameter at breast height, etc.), the area-based approach utilises reference data such as the forestry inventory data developed by FNSW, NSW Department of Primary Industries, in order to obtain crown cover, stand height, stem volume, biomass, etc.

Expected Tasks:
- To liaise with FNSW and LPMA to acquire high-density airborne lidar data
- To extract individual trees from lidar data and estimate individual tree parameters (tree height, tree crown diameter, diameter at breast height)
- To perform data fusion and estimate area-based parameters (crown cover, stand height, stem volume, biomass)

Data:
- Discrete airborne lidar data that covers a small urban vegetation (e.g. Centennial Park, Sydney)
- Terrestrial lidar data (optional)
- Full-waveform lidar data (optional)
- Forest inventory data
- DEM/contours

References:
13. Investigating the Design and Ownership of Manufactured Home Estates

**Supervisor:** MB Green

**Student:** David Reus

**Description:** At present those who live in Manufactured Home Estates or Caravan Parks have, at the best, Leasehold Title over the land they are occupying - the term of which varies. While there are cases where the length of stay is short, say overnight, there are other examples where the Manufactured Home can be either an opportunity to enter into or exit the home buyers market. The remnant period of a running lease will impact on the value of the property when presented to the market. By comparison dwellings in Retirement Villages virtually have their own market which does not appear to be affected by the fluctuations of the conventional home sales market. A caravan park designed around a theme with the right title system may well be the answer to many potential property owners.

The student should select a site, subdivide it with some innovation and provide community facilities in the subdivision and then apply a title system. It is proposed to investigate the possibility of a new title system under Torrens Title to provide a more stable tenure for dwellers in manufactured home estates. Investigations should not be limited to Australia but should include overseas cadastral systems.

**References:**

14. Evaluating the use of UAV’s in Strip Mining

**Supervisor:** J Wang

**Student:** Kiernan Smithson

**Description:** Unmanned Arial Vehicles (UAVs) are currently being used for surveying open cut mines in Western Australia. They have the potential to provide a more cost effective spatial solution for surveying strip mining than current mine surveying techniques such as terrestrial laser scanning, photogrammetry, LiDAR and RTK GPS. This project will compare the cost and effectiveness of different types of UAVs and current mine surveying techniques.
in the acquiring and processing of data at an open cut coal mine operated by Ensham Resources at Emerald, Queensland. In this comparison, factors such as safety, accuracy, time in gathering data, support, software and training will be considered; as well as maximum flight time, accuracy, weather resistance, flight automation, software, training, support and servicing for the several types of UAVs studied. The project will establish the feasibility for a more extensive use of UAVs for open cut mine surveying in Australia.

References:

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15. A Survey of the Sydney Harbour Bridge

 Supervisor: B Kearsley

 Student: Neil McDaid

Description: The aim of this thesis project would be to compare results achieved in the original survey with those that can now be achieved with modern equipment and adjustment methods. When the Bridge was finished in 1932, Bradfield surveyed the structure to compare the finished product to the design. It was done again some decades ago and a series of baselines set up around the harbour for this purpose. It is likely that the original baselines are gone or are obstructed. It will be a matter of setting out new baseline and taking measurements to check the present day structure, a series of measurements under different conditions will be required to achieve accurate results. The main focus will be on support bolts either end of the bridge as access to the bridge itself may be limited. It will most likely be necessary to get the RTA involved in this project. There are a large number of challenges relating to the project including acquisition of data relating to the bridge, which is now less accessible due to rising threat of terrorism. The first major steps for this survey will be acquiring and interpreting Bradfields original survey notes, along with the planning and management of the field work this will determine whether the project is feasible with the time, equipment and personnel available.