Introduction

• Offer different perspective (Civil Engineering)
  – Project management
  – Risk Management
  – Design Management
  – Construction and Contract Management

• Application of LiDAR in forest engineering
The Motivation

• Challenging steep country logging
• High exposure to environmental risk
• Recurrent engineering failures
• Increasing road construction costs
• Recognition that current processes not providing reliable outcomes

Propositions

– Stakeholder expectations have increased and the industry needs to adapt
– Predictability / certainty of outcomes is good for business (what we are striving for)
– Effective early design translates in improved out-turn costs (less variance to budget)
– LiDAR and associated technology is now sufficiently advanced to support these ends
Benefit of early design effort

More simply - what’s the cheapest way to run your design iterations?

Design technician @ $65/hour

c.f.

D6 Bulldozer @ $235/hour
What is LiDAR

• Light (Li) Detection (D) and (A) Ranging (R)

Remote laser sensing technology that measures the properties of scattered light pulses to measure the distance to an object or surface

LiDAR Outputs

Correctly specified LiDAR can provide:

• Digital Elevation Model (DEM)
• Tree crop information (canopy height and density)

The challenge is determining the correct specification
LiDAR outputs

NZTA - SH36 Mangorewa Gorge (LiDAR Survey)
PF Olsen LiDAR Trial

Three challenging Bay of Plenty Coastal Forests
- Waikawa
- Omaio
- Waioeka

- Total Area 5,695ha (productive 2,915ha)
- Harvest of 1.2M m³ over the next 10 years

PF Olsen LiDAR Trial

LiDAR Specification
- Level of ground strike through tree canopy uncertain
- Acquisition Parameters = 2 pulse/m²
- Investment of approximately $45K
  - $8/ha for total area surveyed / $15/ha for productive area
  - less than 5 cents per tonne
- Other costs of software and training $15 -20K
PF Olsen LiDAR Trial

What did we get for our investment.

- Ground classified point cloud
- Digital elevation model (DEM)
- Digital surface model (effectively canopy top)
- Normalised DSM
- Stratified normalised point cloud
- Contours (1m and 2m produced from TIN from ground classified points)
- Ortho-photos

Delivered in NZTM 2k tiles (960m by 1,440m)

PF Olsen LiDAR Trial

Is the data any good?

In Short

Yes
LiDAR Outputs

1:5000 scale 5m Contour (ortho-photo)                  1:5000 scale 2m Contour (LiDAR)
LiDAR Outputs

Better, more complete terrain information and we haven’t even had to go to the forest yet.

We know more about our landscape and focus on finding solutions.

LiDAR Outputs

Consider the costs of alternative ground survey methods i.e. compass, clinometer, tape measure

Time consuming and not efficient, always
Design Applications

Waioeka Landing Design (option 1)
Waioeka Landing Design (option 2)

Waioeka Landing Design (option 3)
Waikawa Forest Harvest Plan

- First Rotation / Green Fields Planning
- Very Steep (slopes > 30 degrees)
- Fingers of indigenous vegetation
- High value water ways
- High erosion zone
- High engineering / logging and transport costs
Waikawa Forest Harvest Plan

Harvest access road design (5km of primary road confirmed)
Waikawa Forest Harvest Plan

– Cable Analysis using DEM plus canopy surface

Benefits

– Improved landscape data at equivalent cost
– Better planned and control earthworks
– More robust consideration of Geotechnical hazards (hazard identification)
– Optimisation (scope to test more options – total chance panning)
– Cost certainty (firms up exactly how much dirt needs to be moved)
Benefits

Works Risk &
Transaction Risk

Improved design outputs allows alternative commercial models and better sharing of risk (our project is yet to advance to this stage)