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A desktop cable harvest planning solution for harvest planners in steep forests of New Zealand

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What is cable harvest planning?

What is cable harvest planning?

- **Harvest planning objective:**
  - **Optimum plan of road infrastructure and harvesting equipment**
  - **Trade off between engineering and harvesting costs**
  - **Environmental and health & safety constraints**
- **Cable harvest planning =**

  determining payload that can be pulled to the hauler
  - **Analysis of topography**
  - **Hauler attributes, rigging, harvesting method**
  - **Payload analysis**
- **Productivity analysis**

Who would use a cable harvest planning tool?

- **For planning the harvest of trees on steep and broken terrain:**
  - **Harvest planners**
  - **Forest engineers**
- **For making operational decisions, estimating productivity, and setting contract rates:**
  - **Harvesting crew managers**
  - **Hauler operators**
- **For communicating harvest plans to regulatory authorities:**
  - **Environmental managers**

What are the issues with current tools?

- External to ArcGIS
  - Transaction cost of transferring data between applications
  - Stands, roads, hydrology, protected areas not visible
- Inability to make use of highly accurate DEM
- Outdated platforms
- Haul distances not adjusted for slope
- Limited live skyline payload analysis
- Inaccurate running skyline analysis
- No multi span analysis
- Lack of reporting
- Lack of support

What is CHPS?

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- CHPS = Cable Harvest Planning Solution

- ArcGIS for Desktop extension
- XML based project and configuration files
- SQL server database
  - Hauler attributes

- Flexible and configurable parameters
- Fast profile analysis calculations
- User friendly GUI, low training cost

How does a harvest planner use CHPS?

1. Define hauler and carriage parameters

Hauler parameters:

- **Hauler make & model**
- **Tower height**
- **Cable weights**
- **Drum diameters, lengths, breaking strengths**
- **Haulback attributes**

Carriage parameters:

- **Make & model**
- **Weight**
- **Strop length**

2. Define analysis parameters

Harvesting system:

- **Standing skyline**
- **Live skyline**
- **Running skyline**
- **Multi span analysis**

Profile parameters:

- **Tailhold height**
- **Ground clearance**

3. Locate hauler and tailholds

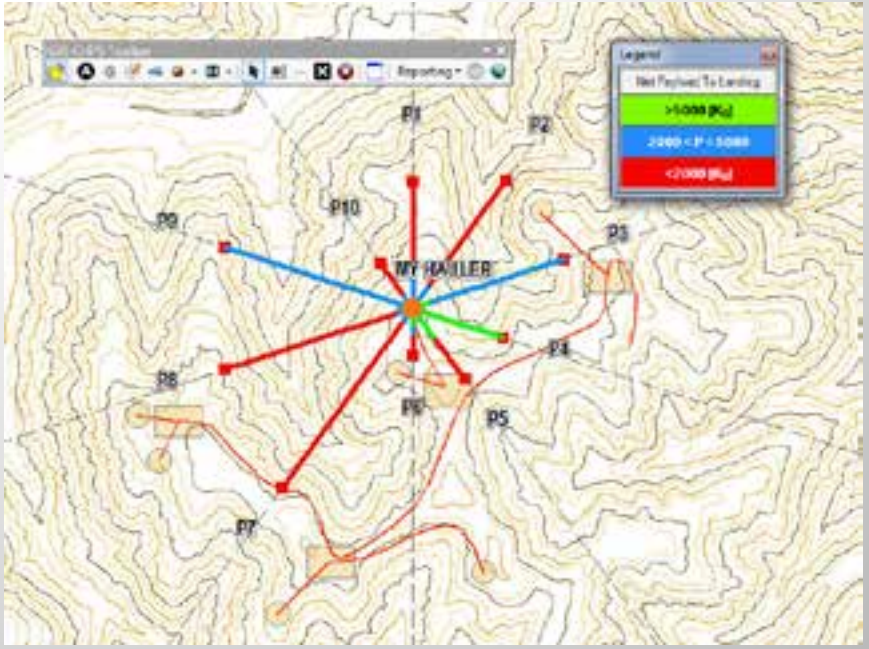
Spatial data inputs:

- Contour/terrain
- Stands
- Hydrology
- Roads
- Protected areas

Define likely hauler placement

Add tailholds:

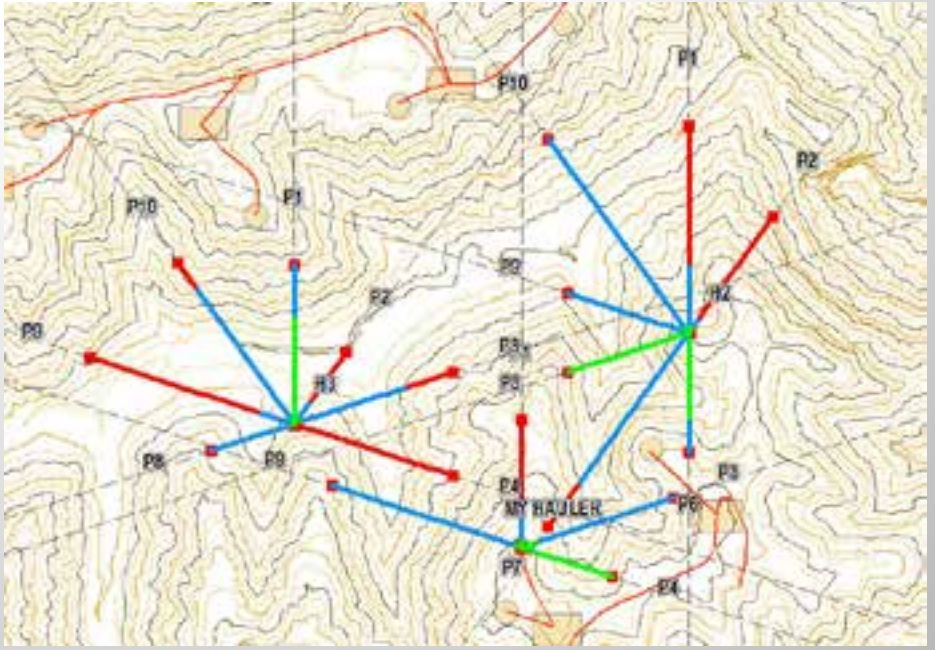
- Manually or automatically
- Auto-locate tailhold



4. Outputs

Harvest map

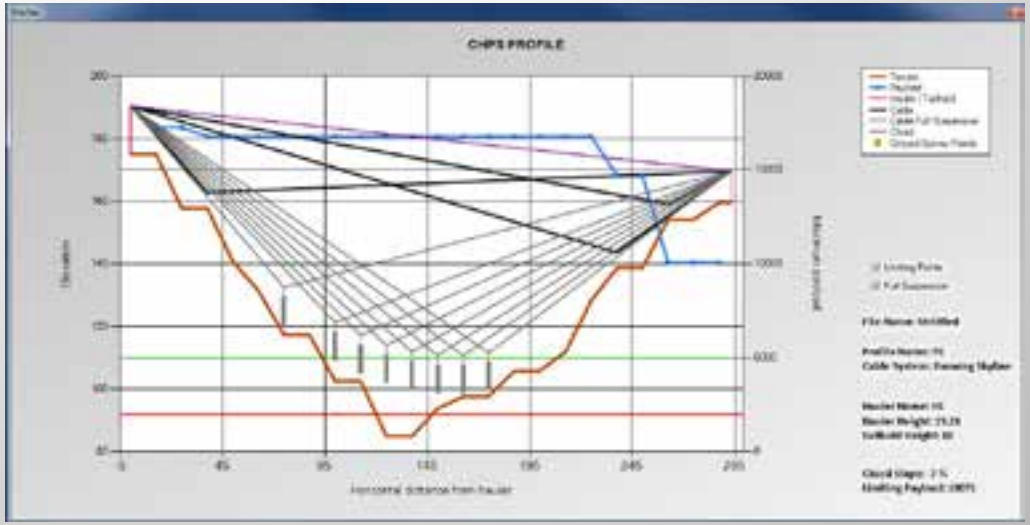
- **Hauler location**
- **Tailholds**
- **Payload analysis**



4. Outputs

Profile analysis chart

- **Terrain**
- **Payload limiting terrain point(s)**
- **Maximum payload**



4. Outputs

Profile report

- **Profile details**
- **Hauler details**
- **Line length report**
- **Haul distance**
- **Terrain point report**
  - **Deflection**
  - **Payload**
  - **Clearance**
  - **Full suspension**

CHPS REPORT

File Name: Untitled

Profile

Number	P5
Cable System	running skyline
Carriage Model	MINI-MAK I
Tailhold Height	0.50

Hauler

Name	H1
Model	BRIGHTWATER BE 60 LT
Height	18.30
Chute Length	0.00

Line Length Report

ROPE	REQUIRED	AVAILABLE	POSSIBLE
SKYLINE	396.79	630.00	YES
MAINLINE	395.29	560.00	YES
HAULBACK	754.34	1300.00	YES

Average Payload	0.00
Average Haul Distance	0.00
Maximum Haul Distance	0.00

Terrain Point Report

POINT	HORIZONTAL DISTANCE	DEFLECTION	NET PAYLOAD	PAYLOAD TO LANDING	LOG CLEARANCE	SKYLINE CLEARANCE	FULL SUSPENSION
1	12.50	44.24	32297.29	32297.29	0.00	0.00	YES
2	25.00	22.22	19302.81	19302.81	0.00	0.00	YES
3	37.50	14.89	13113.40	13113.40	0.00	0.00	NO
4	50.00	23.40	20283.99	13113.40	0.00	0.00	YES
5	62.50	19.37	16996.31	13113.40	0.00	0.00	YES
6	75.00	20.21	17694.89	13113.40	0.00	0.00	YES
7	87.50	21.92	19087.08	13113.40	0.00	0.00	YES
8	100.00	20.07	17578.18	13113.40	0.00	0.00	YES
9	112.50	16.99	14092.40	13113.40	0.00	0.00	YES
10	125.00	15.13	13330.92	13113.40	0.00	0.00	YES
11	137.50	11.17	9672.43	9672.43	0.00	0.00	NO
12	150.00	10.82	9337.34	9337.34	0.00	0.00	NO
13	162.50	6.59	5231.84	5231.84	0.00	0.00	NO
14	175.00	10.81	9324.84	5231.84	0.00	0.00	NO

What are the benefits of CHPS?

What are the business benefits of CHPS?

- Use of high resolution terrain data e.g. LiDAR
- Efficient deployment of harvesting equipment
- Reduced risk for forest manager and harvesting contractor
- Modelling of environmental constraints
- Speed of analysis, multiple profiles

What are the technical benefits of CHPS?

- **Integration with ArcGIS**
  - **No transaction cost of transferring data between applications**
  - **Ability to consider other spatial data in planning**
  - **Use of Esri products e.g. 3D analyst, video fly-through**
  - **Esri licensing**

What are the technical benefits of CHPS?

- **Live skyline payload analysis**
  - **Multiple lifts and drops**
- **Running skyline analysis**
  - **Consideration of drum brake capacity, rope diameter, brake torque, drum size**
- **Multi span analysis**
- **Transparent payload analysis calculations**
- **Ground control survey points**
- **Calculation of average and maximum slope adjusted haul distance**

Summary

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- **Harvest planning on steep and erosion prone slopes**
- **Historic tools inadequate**
- **Integrated ArcGIS extension solution**
- **Benefits:**
  - **Standing, live, running and multi span profile analysis**
  - **Use of high resolution terrain data e.g. LiDAR**
  - **Reduced risk for forest manager and harvesting contractor**
  - **Calculation of average and maximum slope adjusted haul distance**
  - **Comprehensive tabular and spatial reporting**
- **Collaborative development**

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