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# Contractor using LandXML

**(Machinecontrol, masscomputation, efficency)**
**“How we use LandXML”**

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07.06.2012

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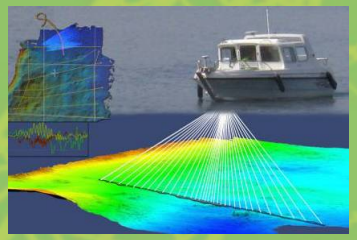
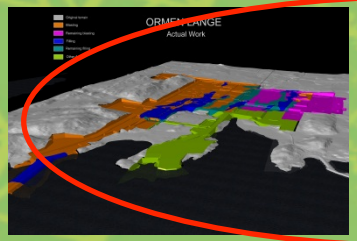
# Concepts – Skanska Survey

Surveying

Laser scanning

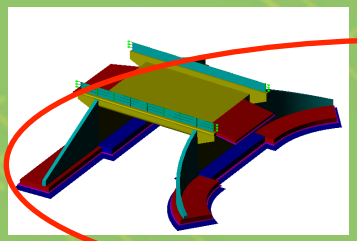


Seabed mapping



Terrain models/
Mass calculation

GIS / Terrain analysis



3D modeling

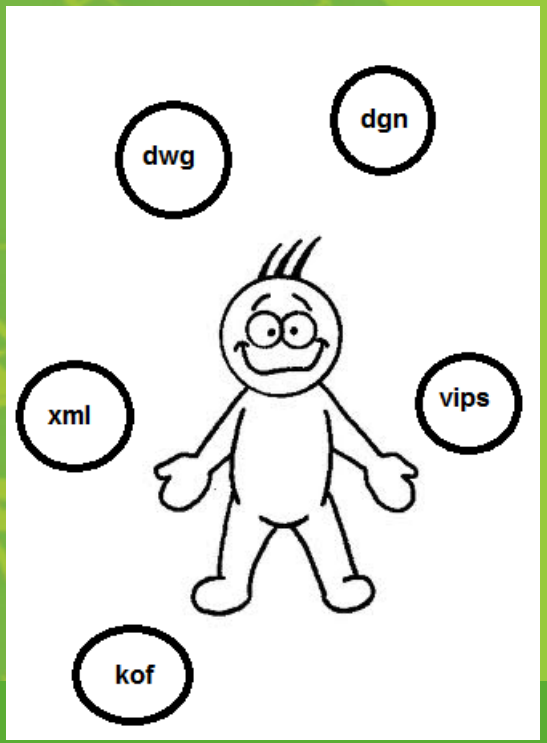
Machine control

Instrument

# Mission: Make life easier for those outside

- We have knowledge to work efficiently
  - How does the surveyor work?
  - How is the data made/Where does it come from?
  - Content of design model
    - 2D/3D?
    - type of objects?
  - Choice of software to do a task

## Juggling with data and programs



# Juggling overview: Where do the data go



**Design data to production**

Tunnelrigger

BEVER TEAM, ATLAS

Maskinstyring

GEOROG, PROLEC,

Traditional surveying

GEOPAD, LEICA Roadrunner

Tunneling

Blasting/ earthworks

Structures
Concrete, steel, wood

Buildings
Axis, details

Miscellanious
Geotechnic, landscaping, environment etc..,

Converting

**DESIGN DATA**

3D-models
VIPS, LandXML. PDMS, 3D-face, ++

Coordinat files
Punkt og linjedata

CAD-drawings

Paper drawings

**Self-made**
Lift 2D up to 3D

**DOCUMENTATION**
Asbuilt/FM

**Contract/ Quantities**

**Calculation/ planning/ scheduling**

Survey's role: put together, modify, edit, build…

# Software juggle

- SBG GEO, main software for the surveyor
  - ”Simple” mass calculations”
  - Design roads/building pits/trenches
  - Drawings and documentation.
- Bentley InRoads
  - Complex mass calculations, terrain modelling
  - Design roads/building pits/trenches
- NovaPoint SiteTool
  - Convert VIPS-data to other formats
    - Some mass calculation
    - Geometrical control
- AutoCad Civil 3D
  - Quality control of surfaces
  - Terrain-modelling
  - Volume computations
- Gemini
  - Mass calculations for roads
  - Documentation “as built”

# SKANSKA Case 1: Common dataflow

VIPS

Novapoint

Site Tool

LandXML: Alignments, profiles, surfaces

AutoCAD Civil 3D

Bentley Sustaining Infrastructure

LandXML: Alignments, profiles, surfaces

LandXML: Alignments, Profiles

SBG·GEO

LandXML Alignments, profiles, surfaces Instrument format

Survey Data: instrument format

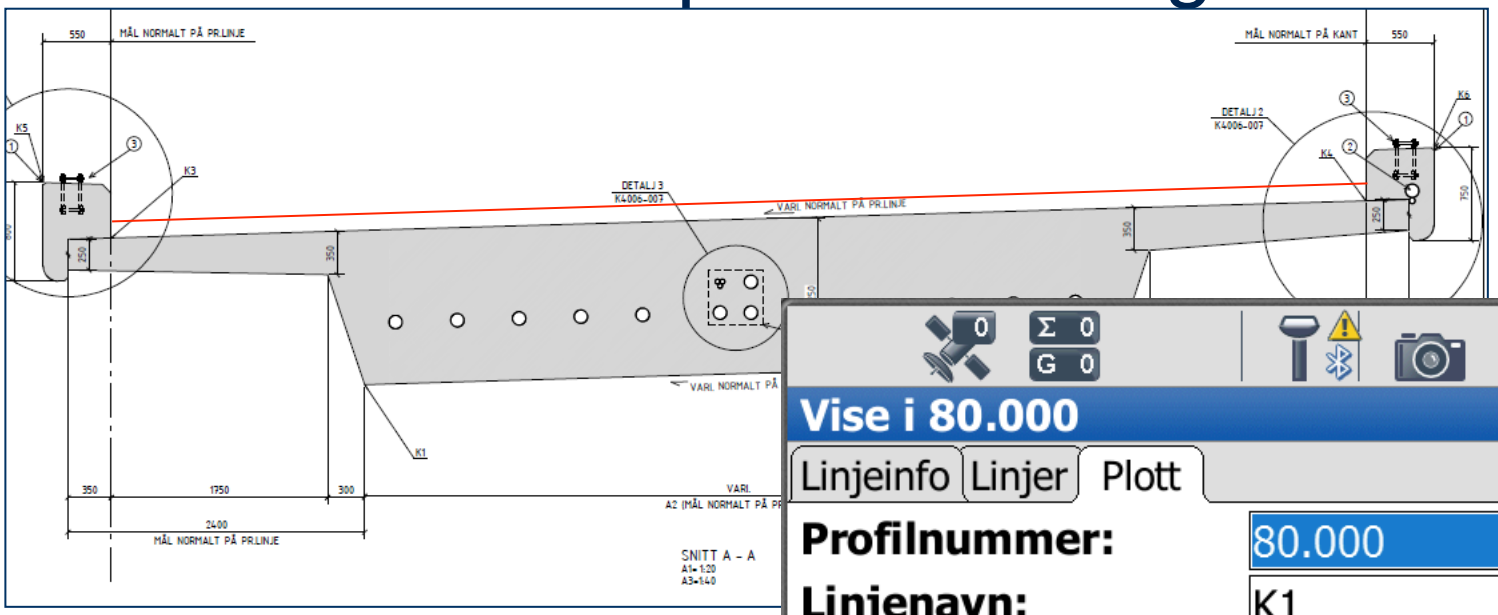
RoadRunner Data: DBX LandXML alignments, profiles with special import on instrument

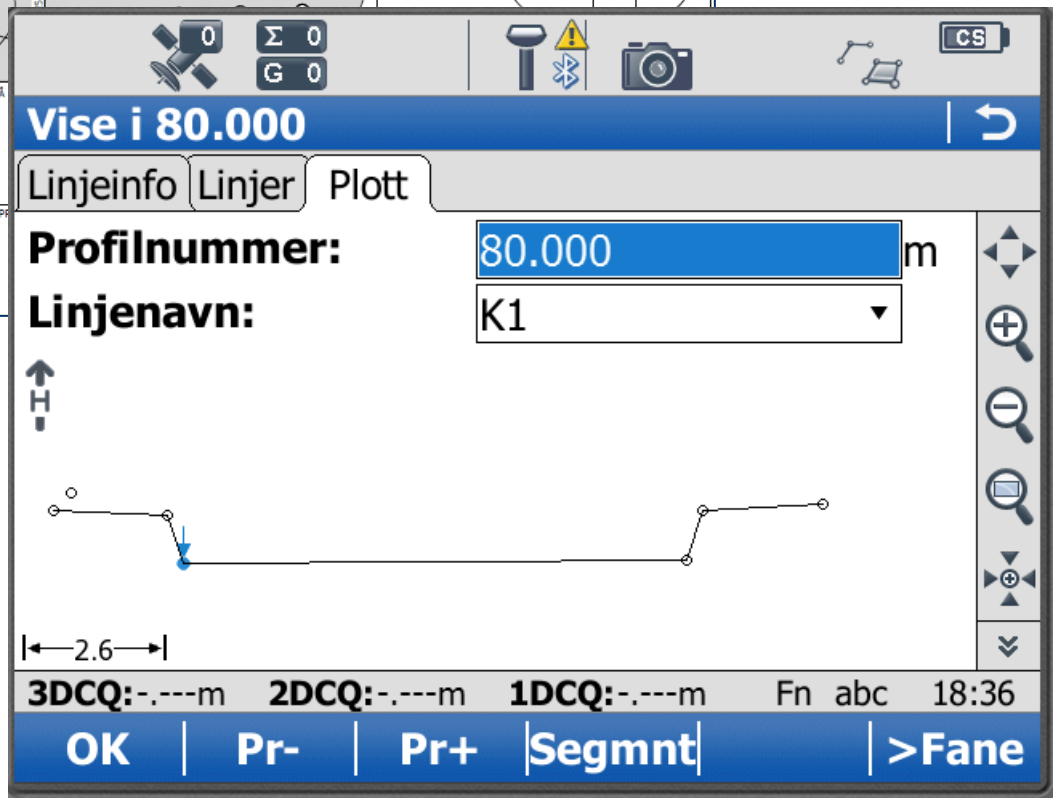
**VIPS - SiteTool – Geo – GeoROG/Leica**

# Case 1 example: E18 bridges

- Stake-out data for bridges needs to be modelled
  - Avaialble: Very discrete data (every 5m)
  - Road alignment and profil => concrete bottom of bridge
    - Stake-out as a road
- LandXML
  - From consultant via VIPS,
  - Exchange data between programs (three in total)
  - Export final data to surveyors equipment (with nice information)
    - Use line-names and codes

# Case 1 example: E18 Bridges




- Data from consultant/VIPS edited for the surveyor

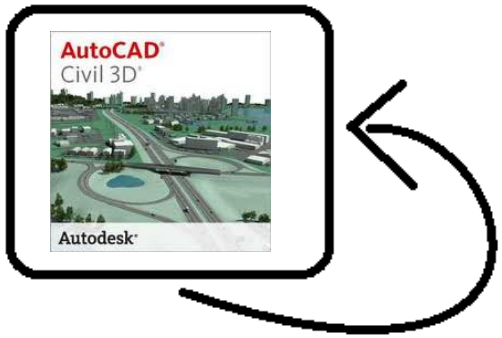
LandXML:

- Export VIPS from NovaPoint
- Export final product from Geo (possible LXML)

# Case 1 important point: Data flow

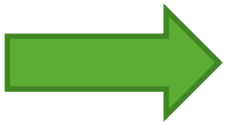
- Only open format for direct import/export of alignments/profiles
  - Don’t need to re-create alignment.

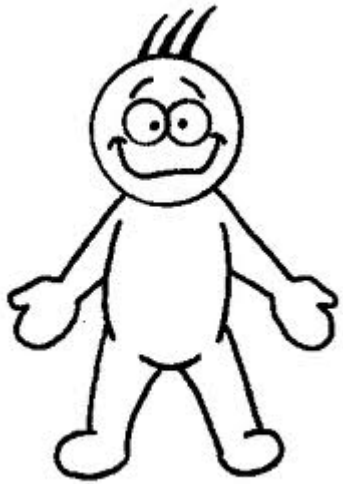
# Case 2: Internal/between drawings




- Method to save model-surface
- Dwg-Model containing buildingblocks
  - Surface, feature-lines, etc
- Export via LandXML: Static model, final product
- Same method possible for other programs

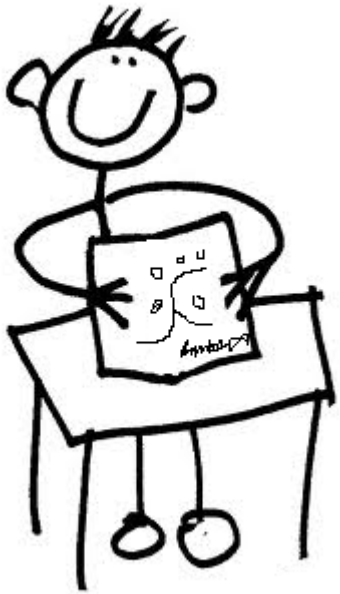
# Case 3: Between users – different SW





Bentley
Sustaining Infrastructure

# Case 4: Consultant to production



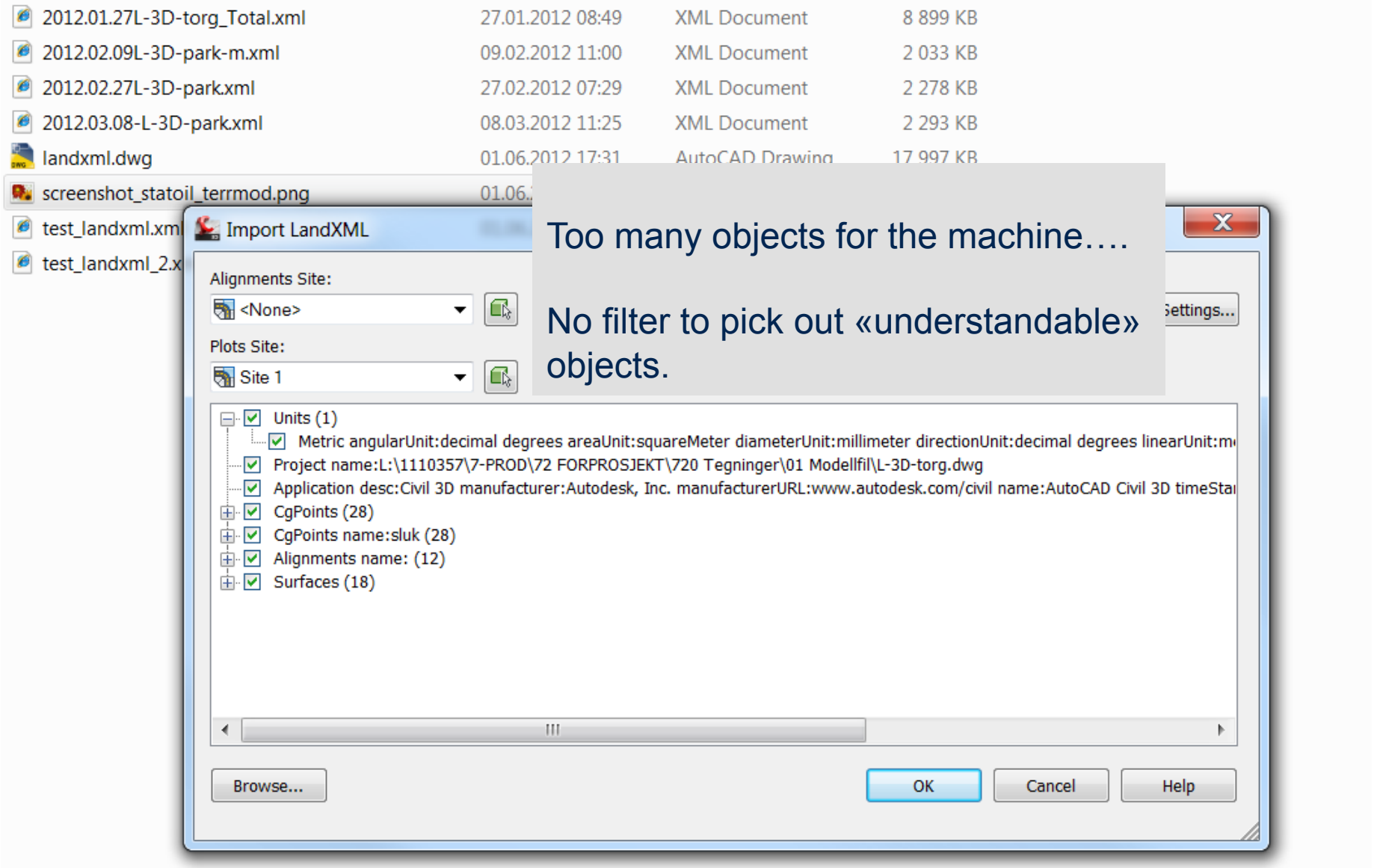
Direct

Possible, but prefer VIPS
One object, one file

Direct

Possible, but consultant need to know exactly what: One object, one file….

# SKANSKA Case 4: Statoil




Too many objects for the machine….

No filter to pick out «understandable» objects.

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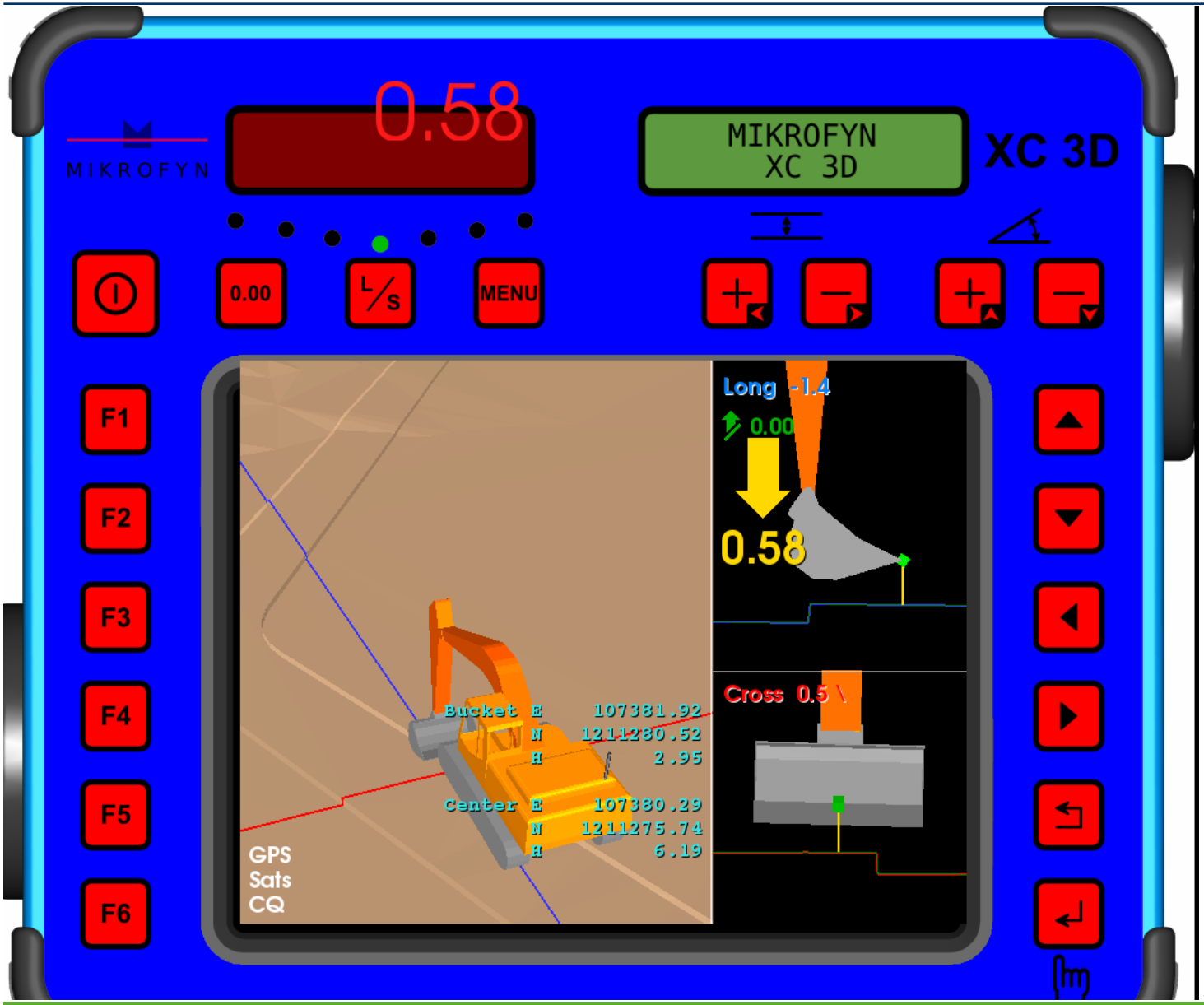
# Case 4: Statoil: In the machine!

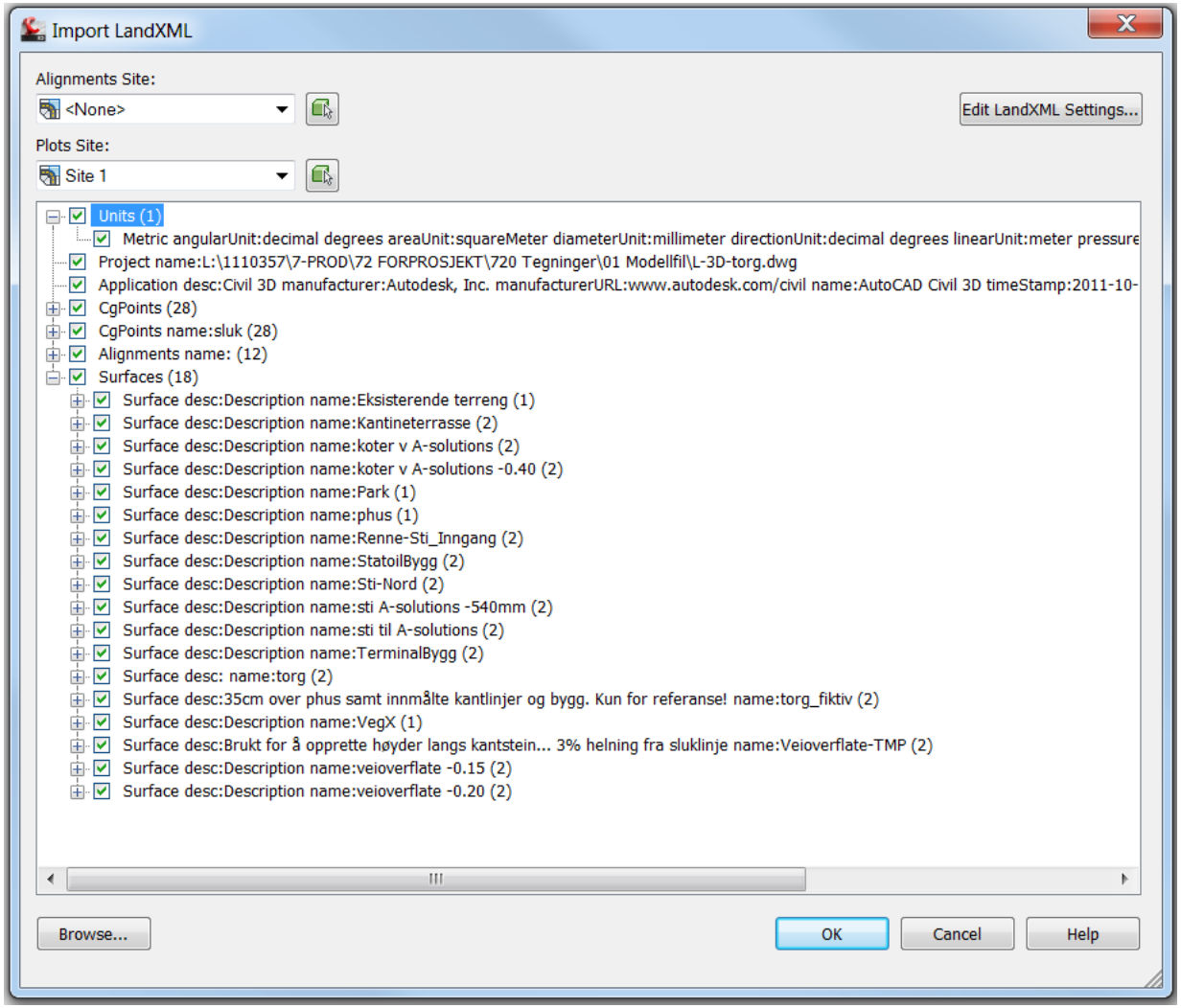



Not able to combine different object-types:

Reference system alternatives:
-“Akser”
-Alignment/ Chainage

-Possible to “implement” akser in landxml today?

# Case 4: Statoil: Volumes direct



# Case 4: Statoil: Volumes direct

| Index | Surface Pair | | Volume | | |
|---|---|---|---|---|---|
| | Base Surface | Comparison Surface | Cut | Fill | Net |
| 1 | Eksisterende terreng | Park | 11613.38 Cu. M. | 28224.99 Cu. M. | 16611.61 Cu. ... |

# Case 4: Machine control Statoil Fornebu

- Data flow: Consultant -> Site (in landxml)
- Problems: Amount of models*
- LandXML: Terrainmodel for design surface
  - All points, alignments, profiles and surfaces in one xml-file
- Machine-control systems limits:
  - not able to choose what to import
  - Method: Import via Civil 3D, re-export single surface
    - Also possible in geo, in-roads
- LandXML in general:
  - Nice:
    - Possible to add desciptions direct on objects
  - Cons:
    - SW up to date? SW could display more information?

# LandXML is not allways used….

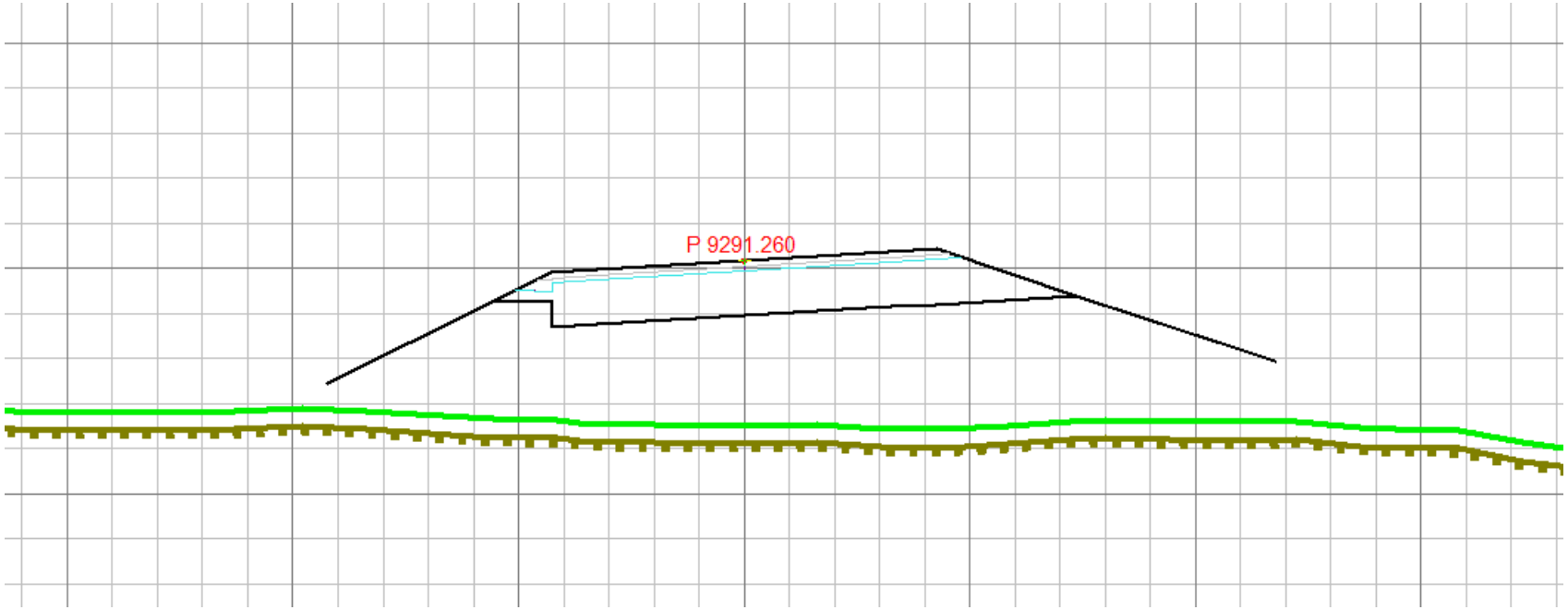
- Survey and Survey-DB
- Roadmodel?
- Pipe-network

# LandXML: From the surveyor…?

- LandXML from the surveyor to consultant….?
  - Possibilities
    - Survey DB, not used?
    - Surface: triangulated together with breaklines, points, features
    - Put more information into the data
      - Codes, descriptions on objects
    - Possible to save coordinate-system in the file, not used
    - Problem with large surfaces and size of xml-file.
- Formats used:
  - Kof, dwg/dxf, sosi, geo (intern exchange)
  - + document describing the actual work and surveyor

# LandXML Road model?

- Static lines along road
- Not possible to exchange the information that defines the road
- Consequences for masscomputation and modifications of roadmodel
  - Choice of software narrows
- Prefer VIPS for more possibilities to extract data, edit data



# LandXML Pipemodel?

- Pipe network in use?
  - Should be possible to use the lines for stake-out
  - Should be possible to use data about manholes
  - Field-software not prepared for this model, but potential for stakeing-out like a road-model?
- Where is the ditch?
  - Edges
  - Width of bottom
  - Layers
- In Norway: DWG-model with built-in stake-out lines

# Conclusions by theme

- General: Good for juggling!
- Machinecontrol
  - LandXML in use (ref. statoil)
  - Obvious problems with the dialect
  - *Software limits “the kind of information” and “amount of information” possible to show
- Masscomputation
  - LandXML in use
  - **Surfaces, collecting different kinds of objects with information in one place
  - **Static road-data (?)
  - Reports (not common)
- Efficiency
  - ***Depends on knowledge (ref. e18, statoil)
  - ****Not really consistent implementation between programs

# The end…

- Questions?
- Other experiences?
- Weekend!

# Possible: Objects + quantities

- Surface + area2D + area3D + min height + max height
- VolSurface + surface volume calculation + area2d + area 3d + min height + max height
- Report from LandXML-file, not really used
- Implemented in some SW

```
<?xml version="1.0" ?>
- <LandXML xmlns="http://www.landxml.org/schema/LandXML-1.2" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.landxml.org/schema/LandXML-1.2
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        + <Faces>
        </Definition>
      </Surface>
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      </SurfVolumes>
    </Surfaces>
</LandXML>
```

# Possible: Raw data, survey DB

# LandXML – What is used?

- Used content for stake-out/machine-control:
  - Roads:
    - Alignments/Profiles + Surface
  - Terrain/Landscapeing:
    - Surface (+ points)
- Now: Possibilities limited by “field software”
  - Why not possible to show alignment and surface at same time?
  - Why convert nice smooth data to straight line-elements?

# LandXML – Contractor status

- For surveyor:
  - Direct from consultant to site
    - Quasi-Roadmodel (instead of vips, “stringlines”, fake layers)
    - Terrain-model (not many alternatives)
  - From site, landxml not used…?
    - Maybe to LARK
- For mass computations
  - Road-modell static
    - not possible to recalculate to updated terrain
    - Not possible to change layers in roadmodel obviously….
- For machines:
  - Still dialect problems…
  - SW has more potential (re aksesystem)