Ground investigation service of the Geological Survey of Finland and the National Standard for ground investigation data exchange

Hilkka Kallio

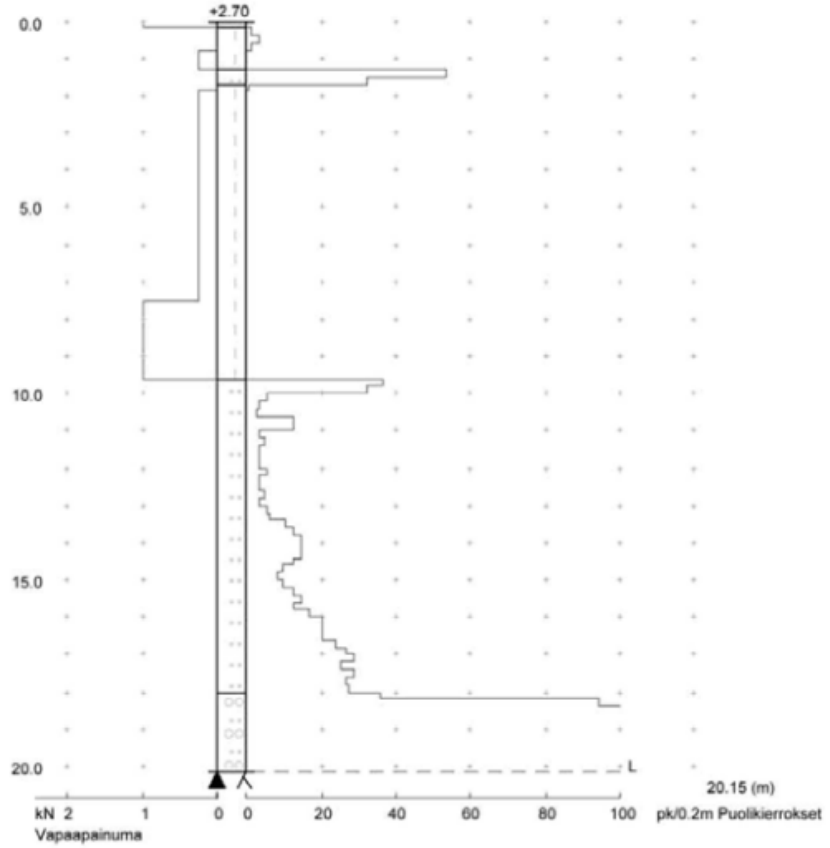
Geological Survey of Finland

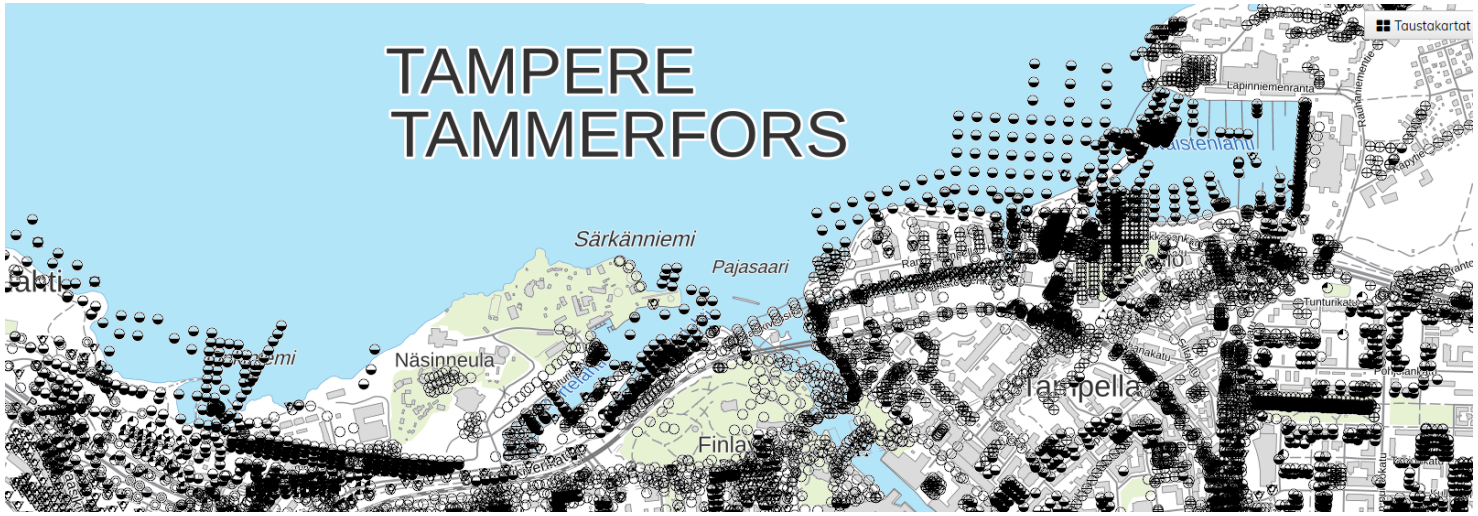
Hilkka.kallio@gtk.fi

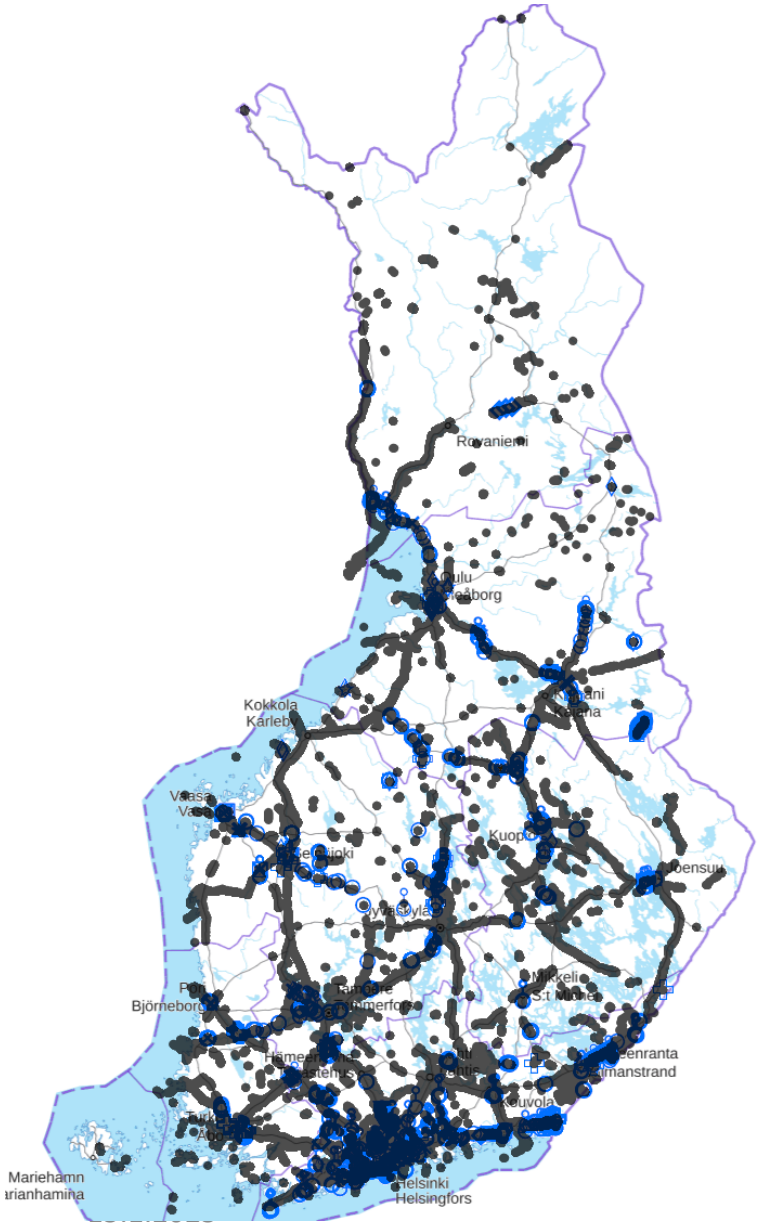
24.10.2024

Ground investigation service of GTK

- The biggest ground investigation database in Finland
- Established in 2011 in co-operation with the Finnish Transport Infrastructure Agency (Väylä)
- Data from public sector organizations
- Open license – all data freely downloadable
- 250 website visits per week
- New data in every week
- To the service







Types	Total
WST (Weight sounding test)	383 904
PO (percussion drilling)	128 143
NO (Disturbed sample)	55 119
TR (Vibration drilling)	52 784
HP (Static dynamic penetration test)	49 279
HE (Dynamic probing)	26 247
SI (Field vane test)	20 448
PI (Stick drilling)	10 683
VP (Ground water well)	7 157
LY (Hammer drilling)	6 667
KO (Test pit)	4 149
PU	3 866
NE (Undisturbed sample)	3 646
CPTU (Piezocone penetration test)	2 358
KK	614
PT	447
KE (Core sampling in rock)	190
VO (Perched groundwater well)	154
PM	82
CPT (Electric cone penetration test)	67
KN (Core sampling in rock)	38
HV	25
KR (Core sampling in rock)	21
MW (MWD drilling)	21
TU	10
CU-RL	6
KG	6
Null	7
PV	3
VPK	1
SUM	**756 142**

Ground investigation service

Number of ground investigations stored into the database 2015 – 2023 (11.10.2023)

Year	Total	Owned by Väylä	Owned by Väylä %
2023	21 043	17 724	84
2022	39 786	17 807	45
2021	44 775	29 305	65
2020	26 140	22 560	86
2019	63 205	55 777	88
2018	43 032	24 594	57
2017	119 864	35 550	30
2016	95 915	93 322	97
2015	45 520	37 020	81

Väylä = The Finnish Transport Infrastructure Agency

Ground investigations removed from the database this year ~4500

Cities and municipalities deliver ground investigation data

- Providing data is voluntary for the organizations – there's no law in Finland that obliges data providing to us
- Big cities maintain their own registers, but some municipalities prefer to share their data with us rather than distribute it themselves >> saves human resources
- Municipalities we have a contract with

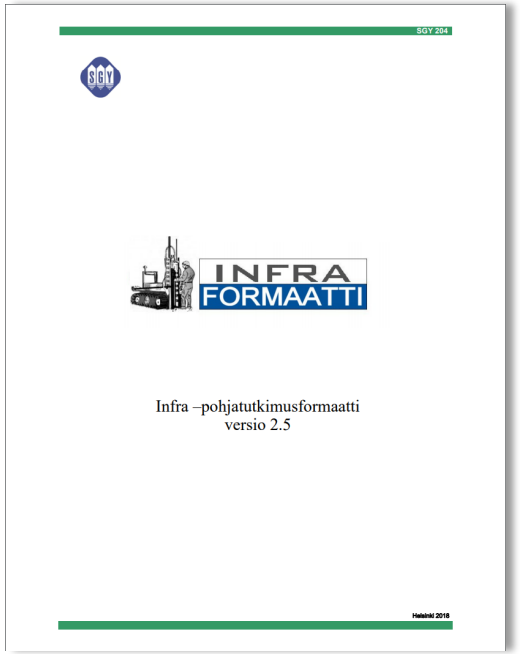
Tampere	Pirkkala
Oulu	Ii
Nurmijärvi	Akaa
Raisio	Kempele
Kaarina	Tyrnävä
Järvenpää	Kangasala

Quality control

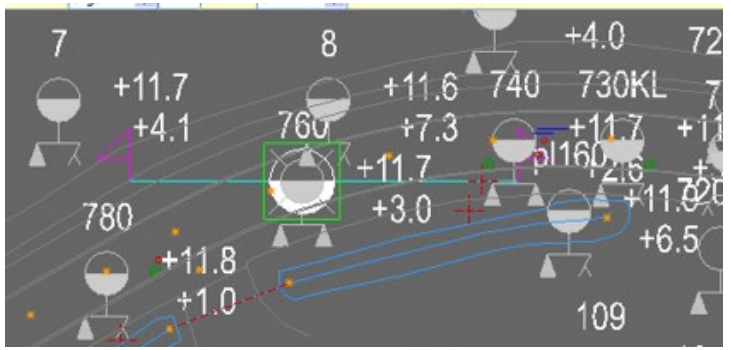
- The data stored in the database normally follows with the national standard
- Sometimes handwritten format >> doesn’t follow exactly the standard >> the software reads no data in >> data is corrected by GTK, the responsible designer or the driller before saving
- The format is so simple that, at least until now, errors related to it have been easy to find and corrected without special quality control tools
- GTK is not allowed to change the measured data – we can only correct metadata and errors causes by the misuse of the standard

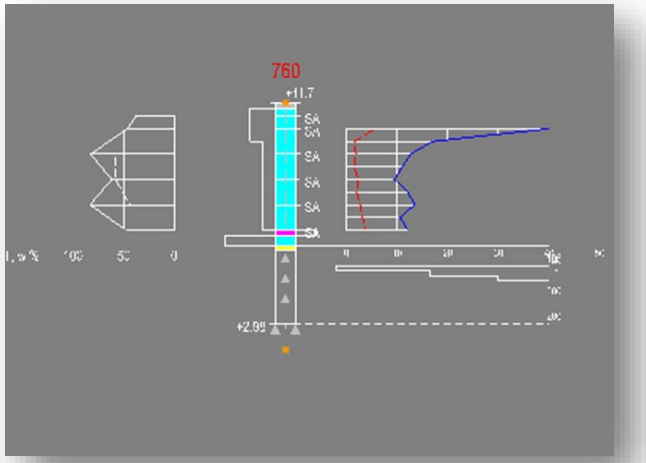
National Standard for ground investigation data exchange

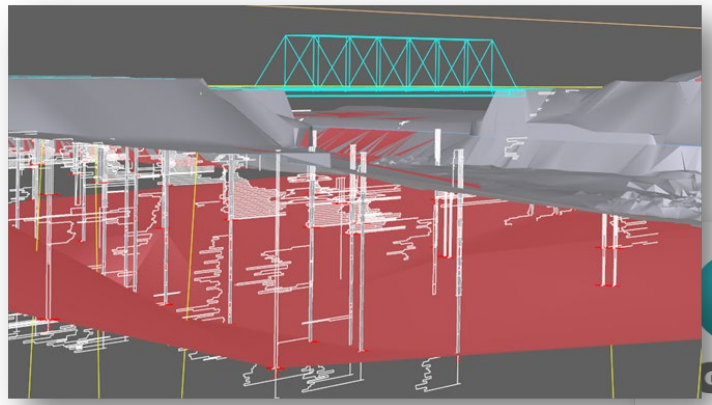
[To the format (sgy.fi)](#) version 2.5




```
TT  PA     1  -
XY     74767.910     34397.400    11.680  20051991  760
         .000        .00          0
         .200        .00          0  Hm
        1.500      50.00          0  Sa
        5.000      25.00          0
        5.200     100.00          8  Si
        5.600     100.00          0  Sa
        5.800     100.00        100  Hk
        5.900     100.00        100  Ki
        6.400        .00         -5
        6.600     100.00         16
        6.800     100.00         53
        7.000     100.00         80
        7.100     100.00        100
        8.000        .00         -5
        8.100     100.00        100
        8.700        .00         -5
-1  KI
TT  NE     1  -
XY     74767.910     34397.400    11.680  20051991  760
         .500  -              .500  SA
LB    w     37.800  %
        1.000  -             1.000  SA
LB    w     46.200  %
        2.000  -             2.000  SA
LB    w     82.300  %
LB    F     57.600  %
LB    VG    15.300  kN/m3
        3.000  -             3.000  SA
LB    w     61.700  %
LB    F     57.600  %
LB    VG    16.500  kN/m3
        4.000  -             4.000  SA
LB    w     82.900  %
LB    F     43.800  %
LB    VG    15.100  kN/m3
        5.000  -             5.000  SA
LB    w     47.600  %
LB    VG    17.100  kN/m3
-1
TT  SI     1  -
XY     74767.910     34397.480    11.650  11091991  760KL
        1.000     40.00      5.80       .00
        1.500     17.00      1.60       .00
        2.000     12.70      1.90       .00
        2.500     11.10      1.60       .00
        3.000      9.50      2.40       .00
        3.500     12.20      2.10       .00
        4.000     13.50      2.70       .00
        4.500     10.60      3.20       .00
        5.000     12.20      3.70       .00
```







GTK
gtk.fi

Weight sounding test (TT = PA)

```
TY   4477
TT  PA  3.
PK   4477      - -
LA  0
LN     0      0.000   0.000
XY  6703656.300  1576456.800   26.400 01011992
    0.200    0.00      0 SI
    0.400  100.00       0
    0.600  100.00       4
    0.800  100.00       4
    4.800   25.00       0 SA
    4.900   50.00       0
    5.400   25.00       0
    5.800   50.00       0
    6.000  100.00       5 SI
    6.200  100.00       4
    6.400  100.00       3
    6.600  100.00       4
    6.900  100.00       0
    7.100  100.00       5
    7.300  100.00       5
    7.500  100.00       7
    7.700  100.00       9
    7.900  100.00       9
    8.100  100.00      13
    8.300  100.00      12
    8.500  100.00      14
    8.700  100.00      12
    8.900  100.00      18
    9.100  100.00      15
    9.300  100.00      16
    9.500  100.00      11
    9.700  100.00      16
    9.900  100.00      24
   10.100  100.00      17
   10.300  100.00      18
   10.500  100.00      24
   10.700  100.00      15
   10.900  100.00      20
   11.100  100.00      15
   11.300  100.00      17
   11.500  100.00      30
   11.700  100.00      54
   11.900  100.00      50
   12.100  100.00      95
   12.500    0.00      -5
-1 KI
```

Depth, time, soil type (in-situ observation).

Soil type layer bottom = one row above soil type code

Undisturbed sample (TT = NE)

```
TY  15290  Hiedanranta_T67_Allianssi,_rai
TT  NE  -  1  -  -
XY  6823350.273  24483111.281  102.563  06032020  4189
   4.30  1  4.33  saSi
HM  Ödometrikokeessa O66_1A ei havaittu esik
RK  0.00100  8.0
RK  0.00130  10.0
RK  0.00260  20.0
RK  0.00650  36.0
RK  0.00880  40.0
RK  0.02200  65.0
RK  0.03400  75.0
RK  0.04800  83.0
RK  0.06300  100.0
LB  w  36.50
LB  VG  18.70
LB  Rs  2.70
LB  e  0.99
LB  Sr  100
LB  m1  47.95
LB  bet1  0.34
LB  cv  326
   5.30  2  5.33  Si
RK  0.00100  0.0
RK  0.00140  1.0
RK  0.00270  3.0
RK  0.00670  9.0
RK  0.00920  11.0
RK  0.02300  23.0
RK  0.03500  48.0
RK  0.04900  65.0
RK  0.06300  82.8
RK  0.12500  98.9
RK  0.25000  100.0
LB  w  39.50
LB  VG  18
   6.13  3  6.16  Hk
RK  0.00700  0.0
RK  0.01000  0.0
RK  0.02300  10.0
RK  0.03700  14.0
RK  0.05200  25.0
RK  0.06300  26.7
RK  0.12500  72.4
RK  0.25000  98.3
RK  0.50000  98.9
RK  1.00000  98.9
RK  2.00000  98.9
LB  w  23.90
LB  VG  19.80
-1  MS
```

Sample top, id, sample bottom, soil type

RK = particle size distribution, sieve size, passing %

LB = laboratory analyses, w = water content, VG = bulk density, etc.

Sample top, id, sample bottom, soil type

Groundwater well (TT = VP)

Water table level, date, top of the well, bottom of the well, length of the sieve, measurer

```
TY  PETSU  Petsun pvp
PK  -  VW  -  RLB
TT  VP  -  19A_998  -  -
XY  6821866.507  24489172.013  111.943  28112011  -
   107.66  23112011  112.990  103.130  6.00  V.WA
   107.73  12092012  -  -  -  V.WA
   108.95  16112012  -  -  -  V.WA
   107.76  13022013  -  -  -  M.OR
   108.93  10052013  -  -  -  M.OR
   107.75  14082013  -  -  -  M.OR
   108.69  11112013  -  -  -  JP.A
   108.68  31012014  -  -  -  V.W
   108.38  01042014  -  -  -  M.OR
   107.96  14052014  -  -  -  V.W
   107.78  31072014  -  -  -  JP.A
   107.68  31102014  -  -  -  V.W
   108.88  12052015  -  -  -  V.W
   108.46  18082015  -  -  -  M.O
   107.64  13112015  -  -  -  M.O
   108.79  25022016  -  -  -  V.H
   109.04  24052016  -  -  -  V.W
   108.11  21092016  -  -  -  V.W
   108.77  31032017  -  -  -  M.O
   108.42  09062017  -  -  -  JPA
   108.77  29092017  -  -  -  MO/JPA
   108.96  12022018  -  -  -  MO/JPA
   108.19  29032018  -  -  -  V.WA
   108.25  21062018  -  -  -  VW
   108.03  27072018  -  -  -  JPA
   108.25  30102018  -  -  -  JPA/MO
   108.16  17122018  -  -  -  VW/VO
   108.55  13032019  -  -  -  MO
   108.81  29052019  -  -  -  VW
   107.76  12092019  -  -  -  VO
   108.84  27112019  -  -  -  VW/VO
   109.10  14022020  -  -  -  JPA/MO
   108.97  06052020  -  -  -  VO
   108.69  28052020  -  -  -  VO/MO
-1  MS
```

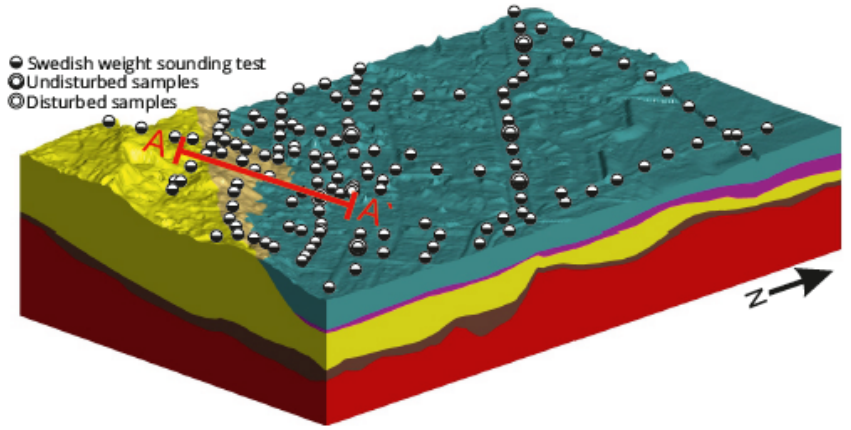
National geotechnical format – on-going development

An update for the Finnish national ground investigation format

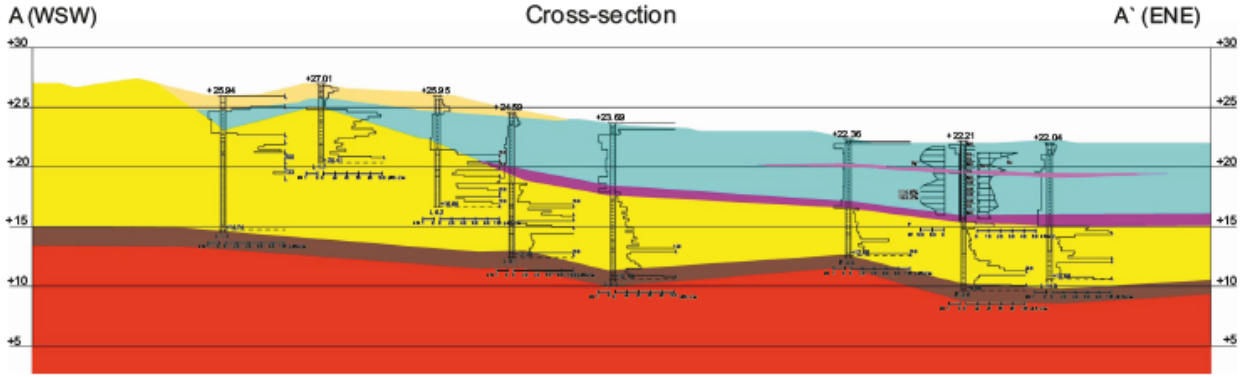
- GTK is a member of the working group operating under The Finnish Geotecnical Society
  - Working group decided to stay in the old ascii format so far and only make the necessary updates for the ground investigation parameters
    - Problem with the old format – after one key code many different parameters >> not the favorite of the software designers
    - Reason to stay in the old format so far – all the software in use read the old code >> too much work to change everything at once
  - Once the necessary updates have been made, changing the entire format could be planned (xml, json, …)
- The working group has no budget for the design, testing or programming – geotechnical data transfer is a small-scale business – no big markets

Use of the database

- 250-300 website visits per week, mainly visitors outside GTK
- Geotecnical designers are the largest user group of the database
- Geologists are using the data for geological 3D modelling



A 3D Leapfrog model with sediment units from NW side of Hiekkaharju esker, Vantaa. LiDAR DEM © National Land Survey of Finland

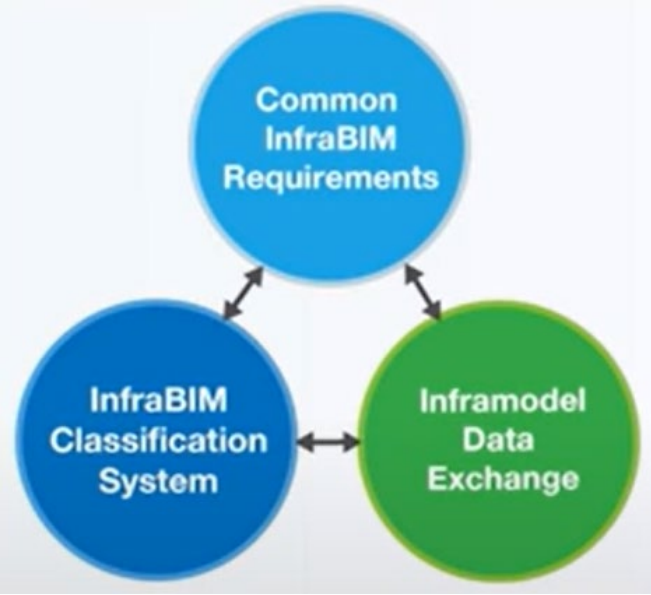


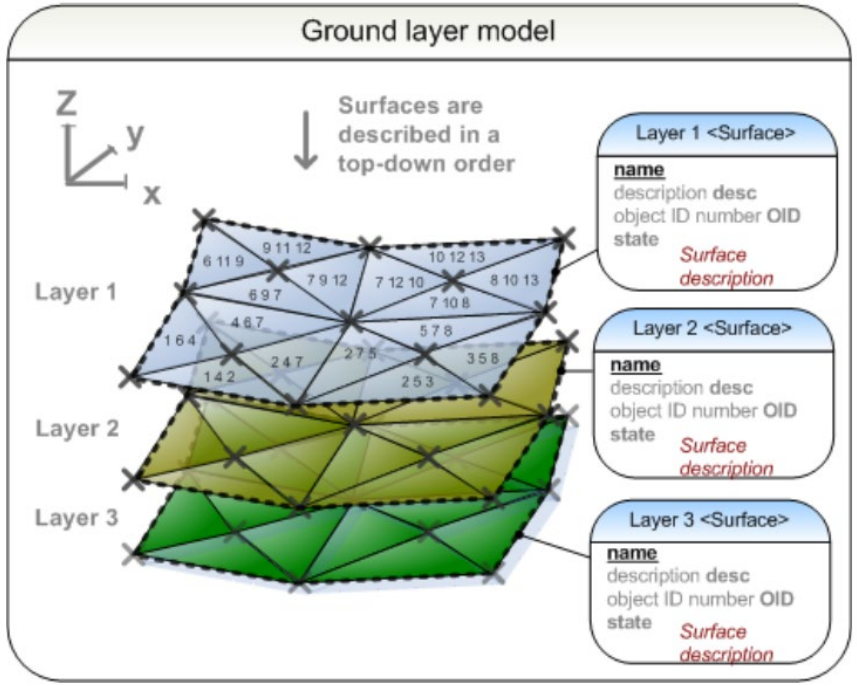
The cross-section of the Hiekkaharju 3D model shows the sediment units continuity along with the Swedish weight sounding tests and disturbed/undisturbed sediment samples (provided by City of Vantaa). Interpretation of the redeposited silt unit within the clay unit is based on the geotechnical samples and tests.

BIM for Infrastructure – Finnish InfraBIM framework and Inframodel

Inframodel 4.1 13.10.2023 application documentation for LandXML version 1.2

- Inframodel is an open method for transferring infrastructure data
- Based on the international LandXML standard
- Implemented by the buildingSMART Finland collaboration network
- All infrastructure design softwares import and export the format
- The Finnish Transport Infrastructure Agency started to use and require the use of infraBIM at 2015





- File headers
- Base data
- Route planning
- Road and street design
- Railway design

  Railway signs
- Waterway design

  Waterway signs
- Area structures
- Pipenetworks
- Planimetric features
- AsBuilt data
- Deep foundations
- Inframodel <Feature> extensions