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Engineering solutions for the environment and communication

BIM in Lithuanian infrastructure projects: Actual experience

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The concept of BIM:

- BIM (Building Information Modeling) is a process involving the generation and management of the entire building information throughout its entire life cycle – from the initial concept to the demolition or renovation.

- BIM includes the entire designed and existing geometry of the building; its spatial connection with the environment; lighting analysis; geographical information; quantitative and qualitative calculations of the building components; energy efficiency indicators and optimization thereof; and the entire infrastructure of the building, including water supply, electricity, communications, etc.

- The use of BIM significantly reduces the time and costs of designing, construction work organization, construction, technical maintenance, and operation. The analysis of a BIM model enables the detection of errors before the start of production when the building correction costs are minimal.

- Using modern equipment to implement the works allows the creation a consistent BIM model enabling parallel work of different groups of the life cycle – designers, producers, building managers, etc. – eliminating the disadvantages of delayed corrections or harmonization. A BIM model allows optimal use of the employed equipment, and achievement of optimal results during the phases of designing, analysis, construction, organization of works, and building operation.

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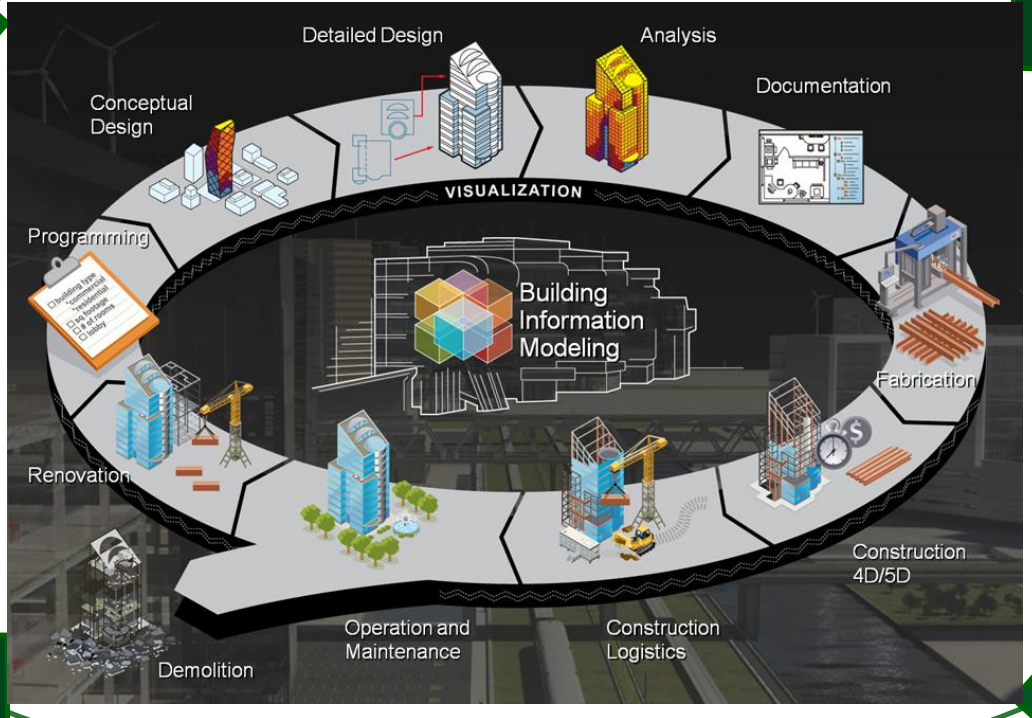
Scheme of building information modeling

Information (document) flow



Information (document) flow

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Factors influencing the demand for BIM:

- **Higher expectations:**
  - Faster implementation.
  - Higher return on investment.
  - Greater transparency.

- **Advanced technology:**
  - The phases of analysis and planning provide an opportunity to employ LIDAR, ortophotography and GIS data, as well as methods of analysis of traffic, vehicle maneuvers, visibility, etc., combining all of the information into a single model.
  - The designing phase involves the creation of a model corresponding to the one that will be constructed.
  - Smart equipment automatically carries out precision construction works on the site according to the designed model.
  - A database of designs may be used for operation purposes.

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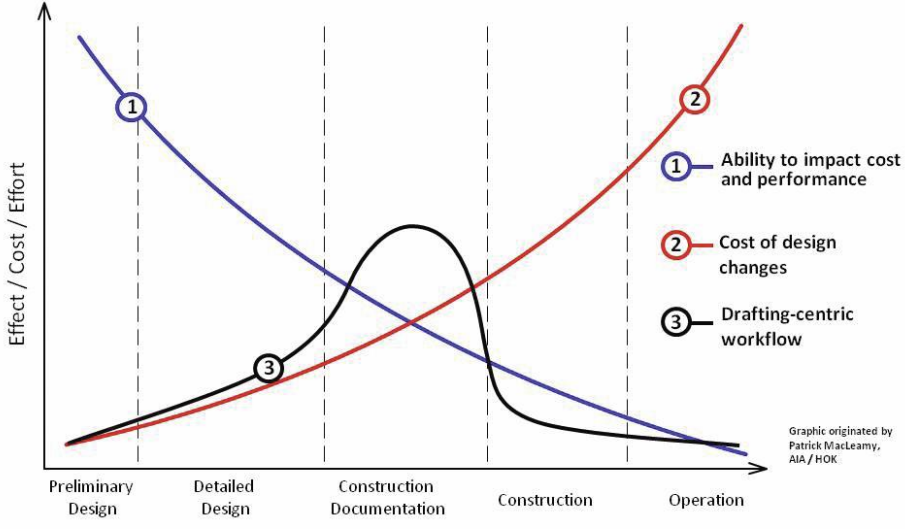
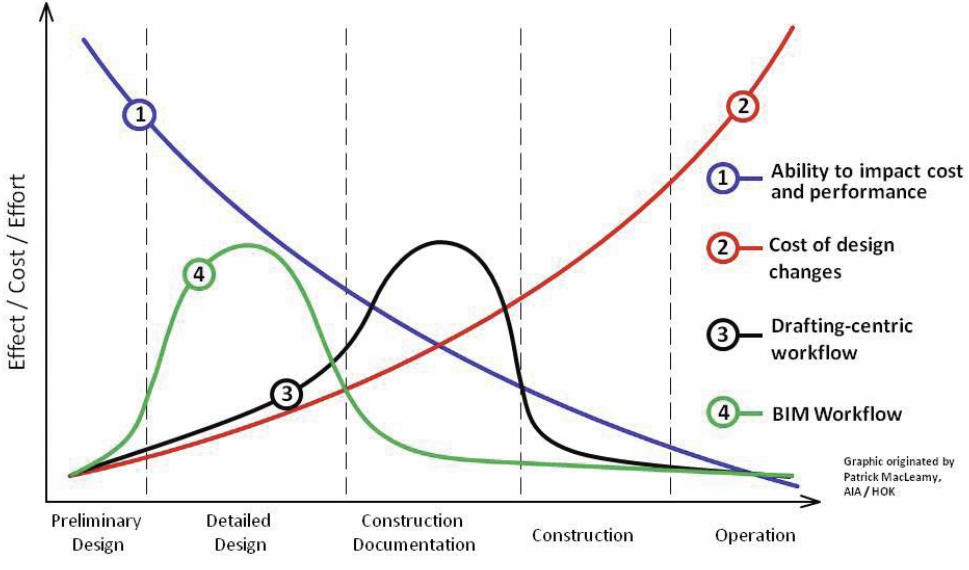
Phases of 2D designing



When the detailed design of the building is finished, required documentation can be obtained automatically. When changes are implemented, new documentation is generated.

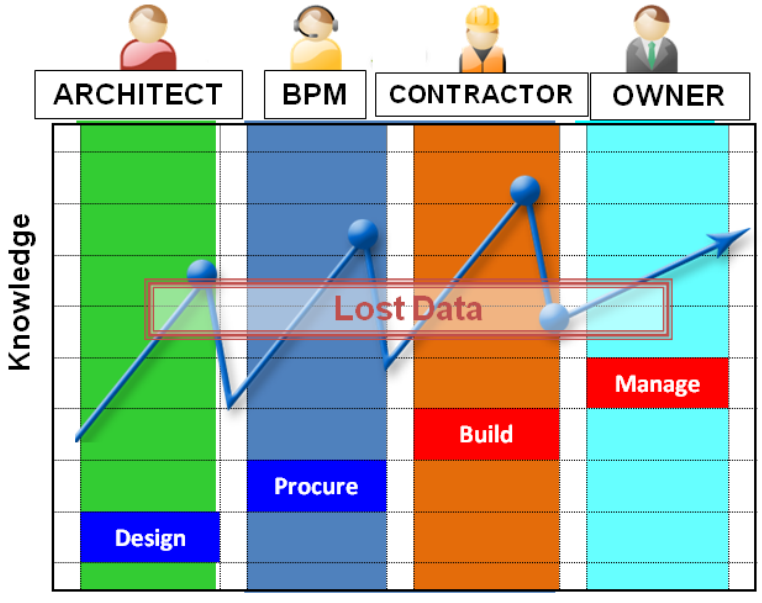
BIM enables building analysis, simulation and corrections while the costs are still minimal (the construction and the production of building elements has not started).

Phases of a BIM project



Building information model covers the entire life cycle of the building:

- Requirement analysis
- Design suggestions
- Creation of a conceptual model
- Designing
- Analysis
- Preparation of documentation
- Production of building elements
- Construction planning (4D, 5D) including the assessment of time and costs
- Logistics planning and construction
- Building operation
- Building renovation or demolition



BIM's Interoperability Challenge

Transition from one phase to another causes information loss. The point of BIM is to minimize this loss and to facilitate the exchange of data between all participants of the given phase.

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Problems

- **STR 1.05.06:2010 *Building design***
  - The Builder shall be provided with the number of copies of the Design and data storage devices with the copies of the Design as set out in the Contract. The minimum resolution of the copy of the Design recorded on a storage device shall be **200 dpi, acceptable formats *.jpg, *.gif, *.tif, *.png, *.rtf, *.pdf,** without digital signatures). The Contract may also stipulate the provision of an original copy/copies of the Design to the Builder. The Builder shall not be provided with the calculations of design solutions.
  - The Designer shall hold the copyright to all of his/her design solutions [5.8]. Unless permitted by the Designer, the Builder shall be entitled to using the copies of the Design exclusively for the purpose of the implementation of the Design.
- **At present, BIM is used by engineers for the optimization of the designing process only, but the digital model could be used in other phases of BIM too.**

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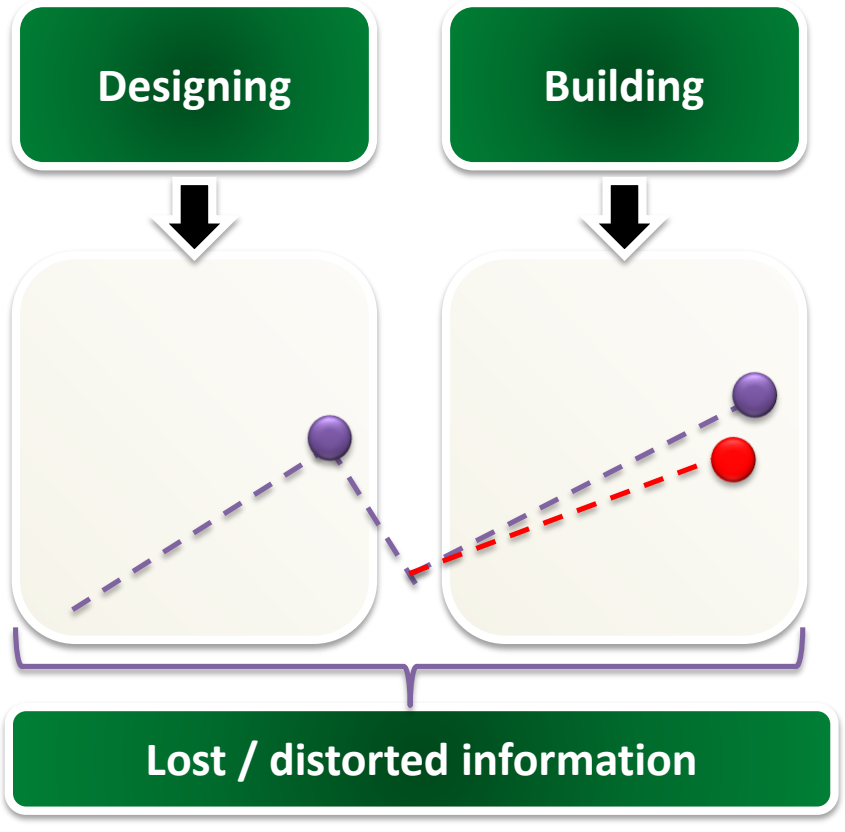
Consequences of the absence of BIM

- The generated digital model is not transferred to production organizations during the designing phase.
- The production organization recreates the digital model from the paper design.
- The recreation process may cause deviations from the original model.
- The generated information is not stored anywhere, so it cannot be used for the operation or reconstruction of the buildings.



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General information on JSC “Kelprojektas”

- The company was founded in 1956. Currently UAB Kelprojektas is the leading transport infrastructure engineering company in Lithuania.
- The company focuses on the designing of transport communications, utility systems, and public buildings.
- The vision of the company: to be two steps ahead at all times. In 2012, UAB Kelprojektas won the competition Innovation Prize 2012 in the category of the Innovative Company 2012.

UAB Kelprojektas employs around 250 highly qualified specialists and uses state-of-the-art software:

- Autodesk AutoCAD Civil 3D
- Autodesk AutoCAD Civil 3D+GeoMap
- SoFisTik
- Bentley Microstation
- ANSYS/Structural
- Bentley MXROAD
- Autodesk 3Ds Max Design
- Autodesk Robot Structural Analysis, etc.
- Autodesk Vault Pro.
- …

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JSC “Kelprojektas” experience with BIM

- **Generation of digital models of roads and railways**
  - Over 7 years of generation of digital road models using Civil 3D.
  - Over 3 years of generation of digital railway models using Civil 3D.
- **Generation of digital models for pipelines**
  - Over 3 years of generation of digital pipeline models using Civil 3D.
- **Reports, technical documentation, and data for equipment control**
  - Around 10 years of supplying pavement milling equipment with necessary data (MX RoadMax, Civil 3D).
  - Over 7 years of generation of technical documentation and sheets from digital models.
- **Visualizations**
  - Visualizations of models generated with 3Ds Max Design using Civil 3D digital models.

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JSC “Kelprojektas” experience with BIM

- **Technical design of the Jakai Interchange reconstruction**
  - Object visualizations with 3Ds Max Design using Civil 3D digital models.
  - Traffic analysis.
- **Designs of Vilnius International Airport ramp and taxiways reconstruction**
  - Technical documentation, detail drawings.
  - Information for automated control of asphalt milling machinery.
  - Automated pavement milling enables carrying out works faster and with greater precision, and optimizing the use of materials.
- **Over 10 years of preparing road pavement strengthening designs**
  - Automated pavement milling has been used on many kilometers of Lithuanian roads allowing optimal use of materials.

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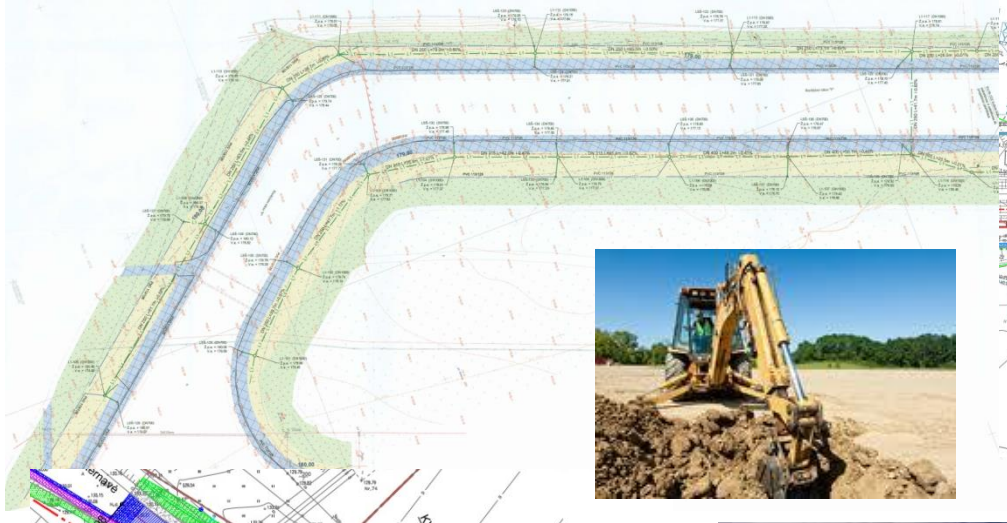
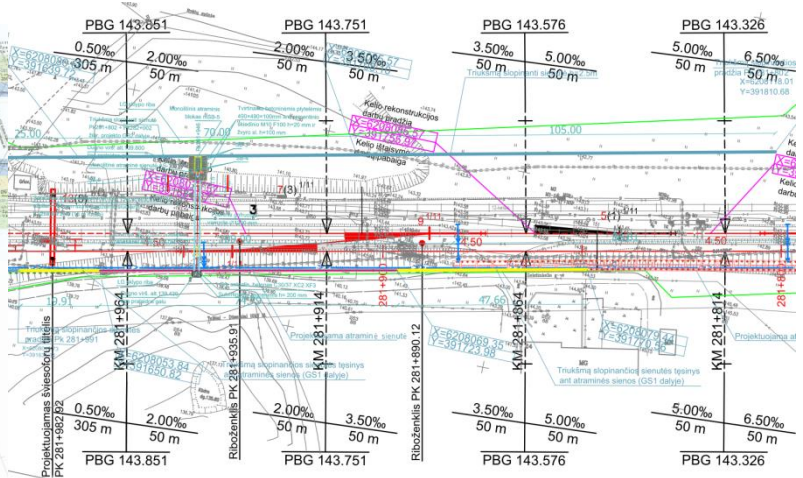
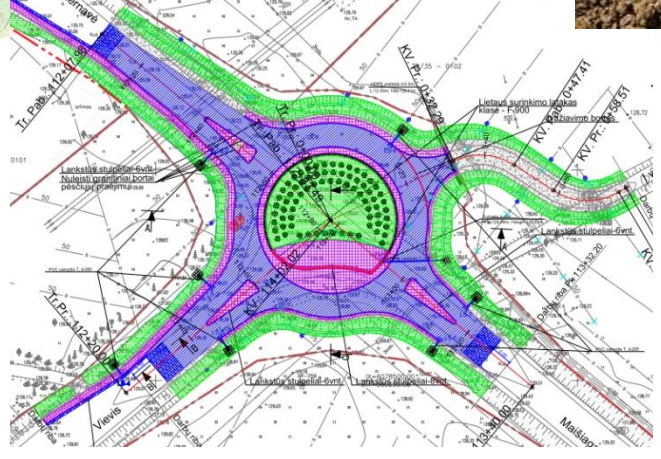
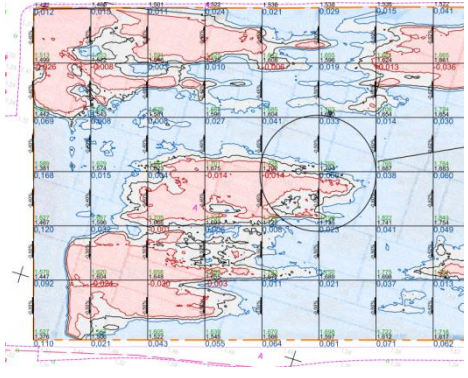
Digital models of roads, railways and airports









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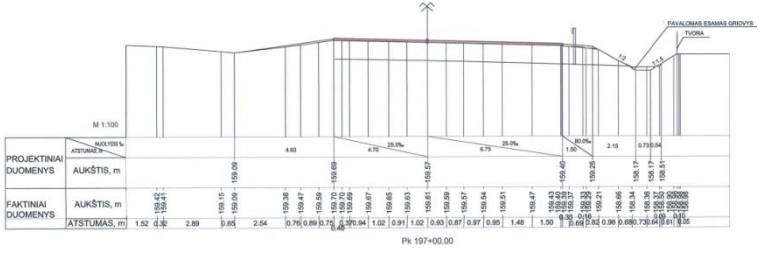
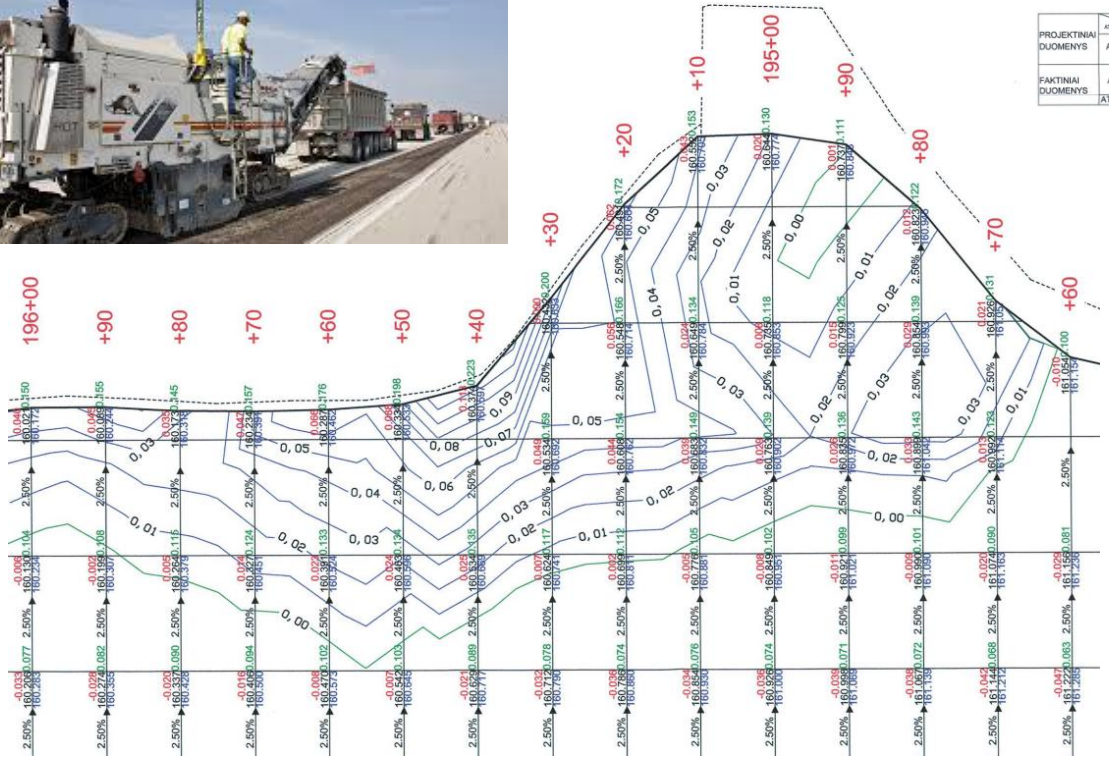
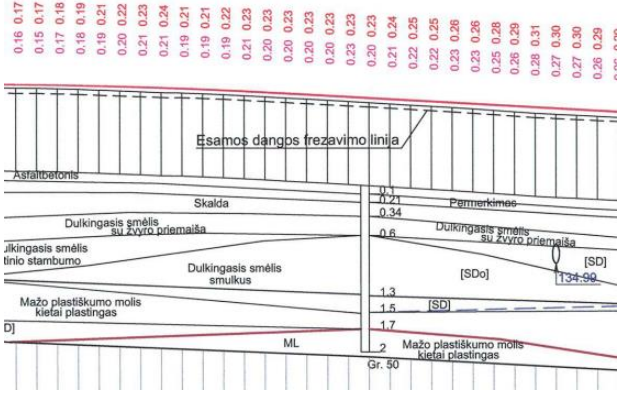
Over 10 years of pavement strengthening projects using automated control of pavement milling machinery







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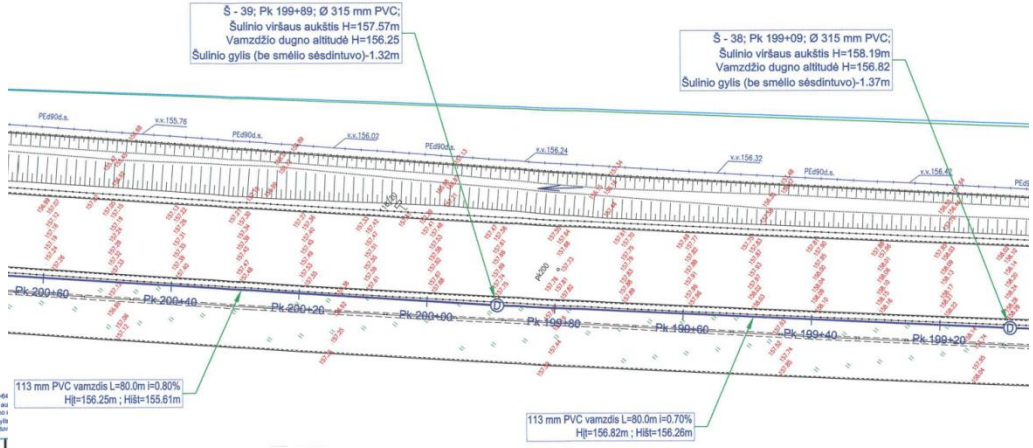
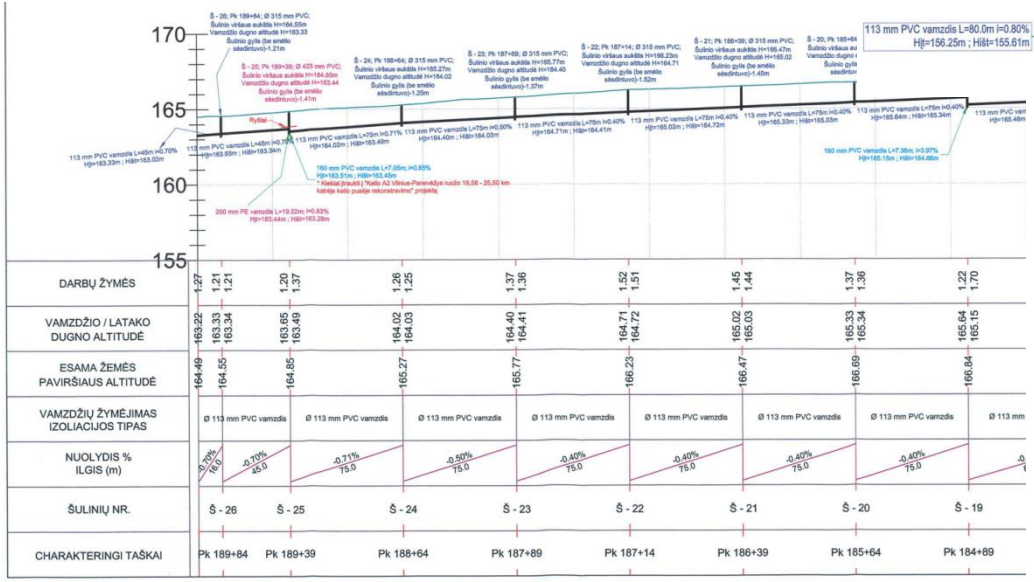
Over 100 km of drainage systems designed for the median strips of A1 ir A2 highways

Automated shaping of the longitudinal profile





Automated shaping of the layout:

- Well labels
- Pipe information
- Bills of quantities

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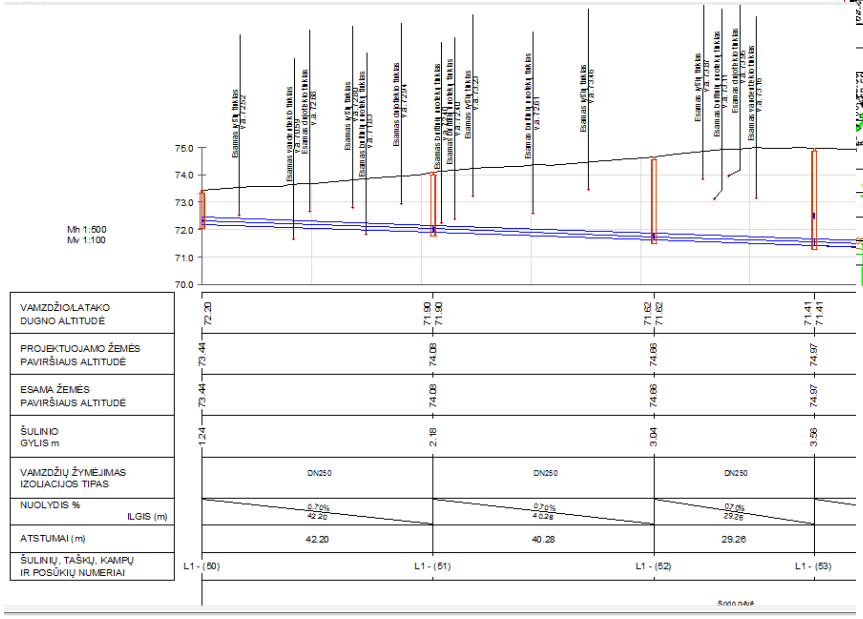
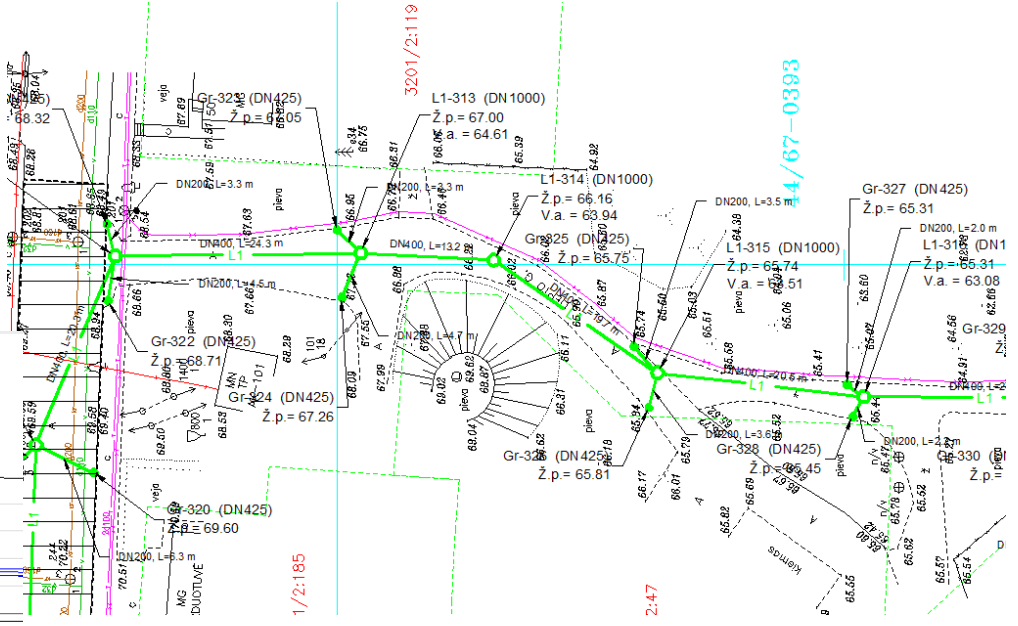
Digital models of pipelines

Šulinių duomenų lentelė		
Šulinio Nr.	Koordinatė Y	Koordinatė X
F1-7b	600424.89	6151628.89
F1-8	600441.40	6151643.12
F1-8a	600443.76	6151645.63





Digital model enables:

- Automated generation of the layout and longitudinal profile
- Generation of bills of quantities
- Generation of well and pipe labels

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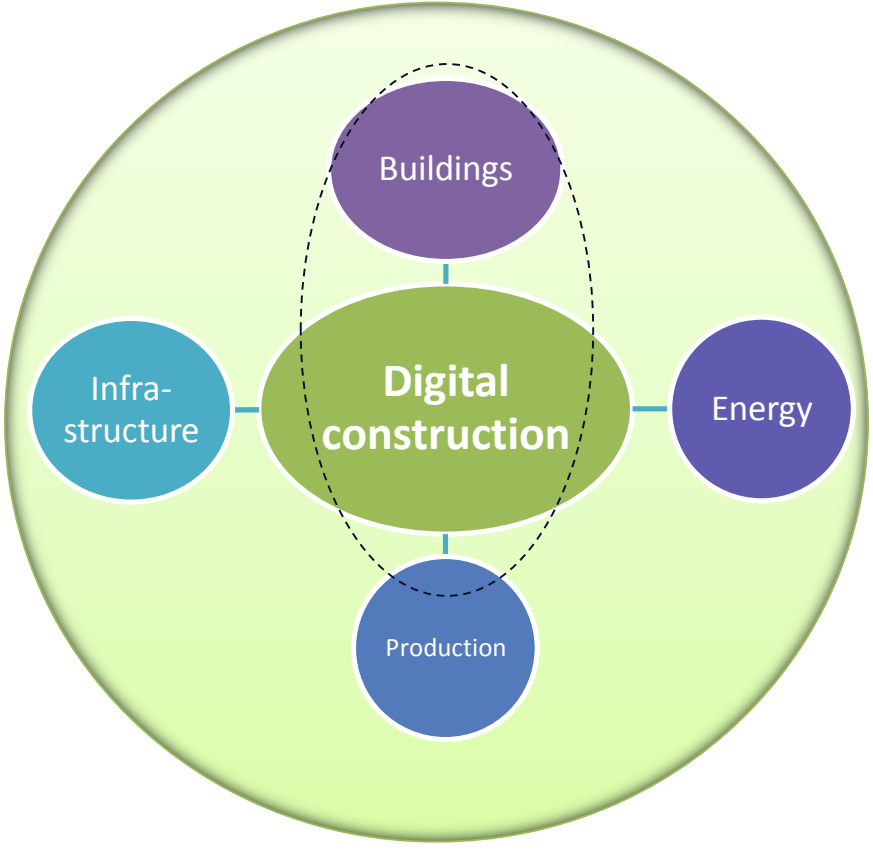
Inside Lithuania

- All participants of the building's life cycle have understood the need to optimize work processes and to work as a team.
- Digital Construction initiative work group has been founded.
- There are intentions to obtain funding from the EU for the implementation of BIM in Lithuania.
- Non-standard pilot BIM buildings are being constructed.



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Klaipėda