Virtual Design & Construction

More than 3D Modeling

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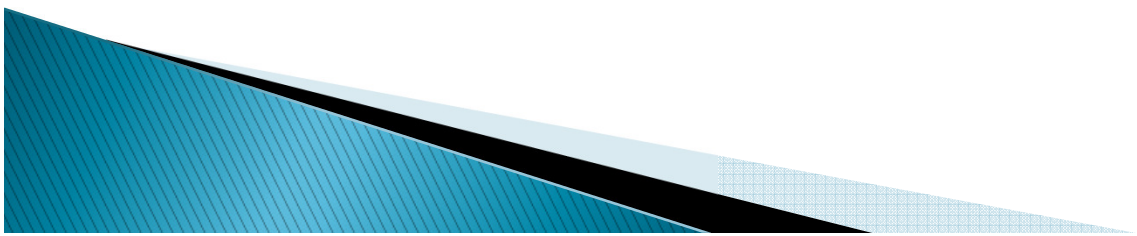
Virtual Design & Construction

- Everyone is talking about it
- Everyone is doing research on it
- Feds are creating programs to encourage it



What is Virtual Design & Construction?

- Method using technology based on 3D models.
- Uses 3D topographic data collection
- Uses 3D model based design processes
- Uses visualization techniques for:
  - Collaboration
  - Technical review
  - Team decision making
  - Marketing of a project.
- Automated construction

Components of VDC

3D Data Acquisition

3D Model-Centric Design

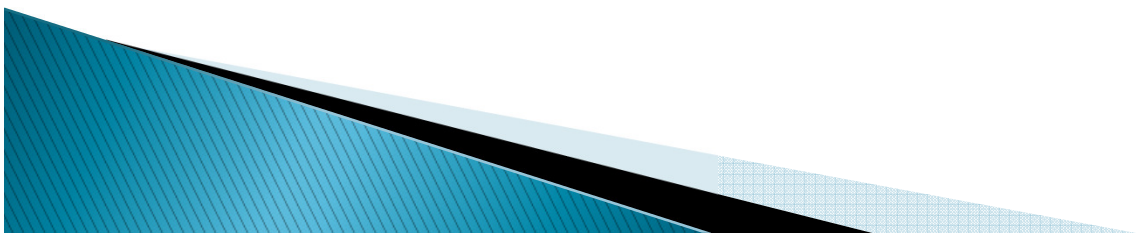
3D Based Construction

3D Data Acquisition Technology

- Data captured with sensor technology
  - Photogrammetry & Remote Sensing (Google Earth)
    - Uses high resolution aerial or satellite imagery
    - Requires specialized software to create & view the 3D models
  - LIDAR (Aerial, Mobile or Static)
    - Uses laser scanning technology
    - Requires specialized software to create 3D models
    - Point clouds/3D models can be viewed with CADD software

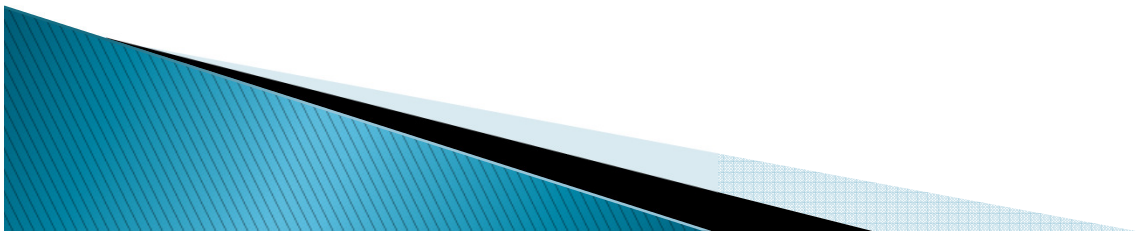
3D Data Acquisition Roles

- Client
  - Clearly defines the purpose of the data, expected accuracies & deliverables to meet agency workflows
  - Responsible for QA
- Mapping Professional
  - Chooses the technology best suited for the purpose
  - Responsible for establishing geodetic control
  - Provides “ready to use” deliverables for the client
  - Responsible for QC



3D Model-Centric Design

- Uses 3D modeling software (CADD)
- Easier to make changes than traditional methods
- Takes advantage of powerful visualization
- Provides ready deliverables for 3D construction methods
- Plans become by-products of the model
- Provides tools for better team collaboration
- Provides tools to calculate better quantities

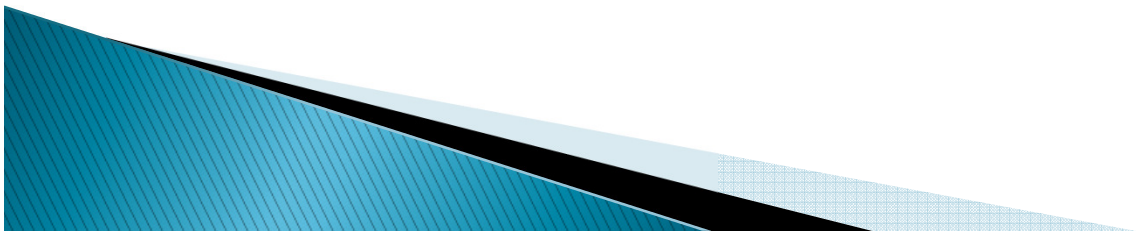


3D Model-Centric Design Roles

- Leadership
  - Champions policies and funding sources for VDC
  - Supports staff with training, tools & resources
  - Encourages risk
- Highway Designer
  - Education/training
  - 3D coordinate correct designs
  - Build-able and not just bid-able plans
  - Complete, reliable, and construct-able digital data
  - Responsible for updating ANY design changes
- Project Manager
  - Reviews 3D model with core team during the design
  - Includes JSP's for the use of VDC methods

3D Based Construction Technology

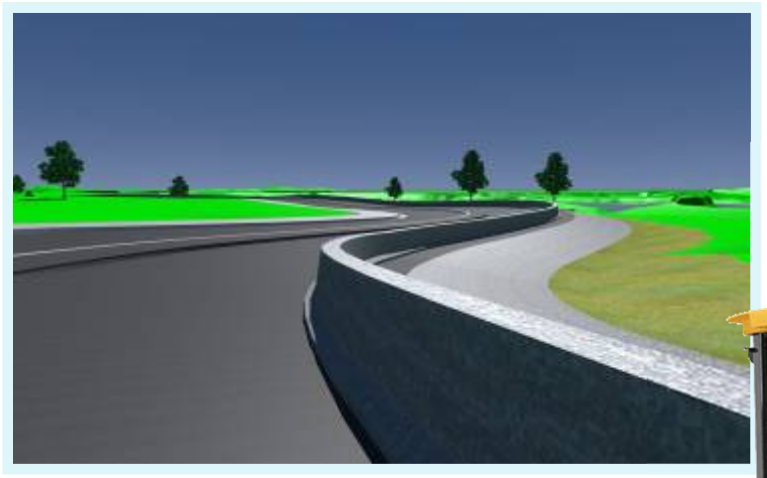
- Machine Automation
  - Computer interface – equipment operator
  - Machine Guidance & Control
    - GPS, TPS, Laser, Combination
  - Components
    - Sensors, hydraulic control, radio
- Computerized Inspection
  - Viewing of 3D design models
  - As-built 3D models
  - Quantities based on 3D models vs. 2D plans



3D Based Construction

- Machine automation (contractor)
  - Excavation
  - Grading
  - Paving
  - Curbs & sidewalks
- Construction surveys (design surveyor)
  - Horizontal & vertical control
  - Data management
- Construction inspection (inspector)
  - Change process/specs for payment of quantities
  - Need additional training and technology
  - Quality assurance NOT quality control

3D Based Construction

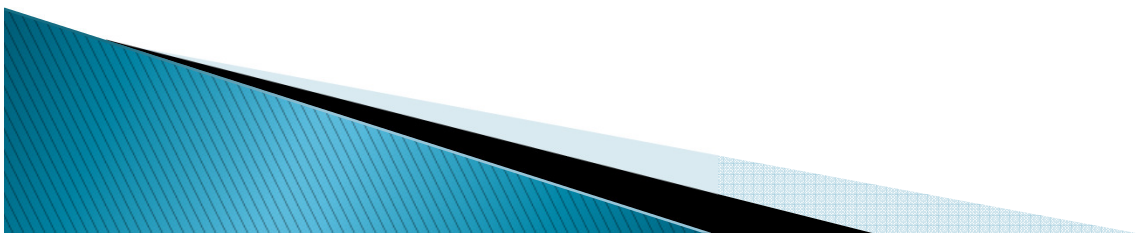


3D Based Construction

3D Based Construction

3D Based Construction

What's MoDOT Doing with VDC?

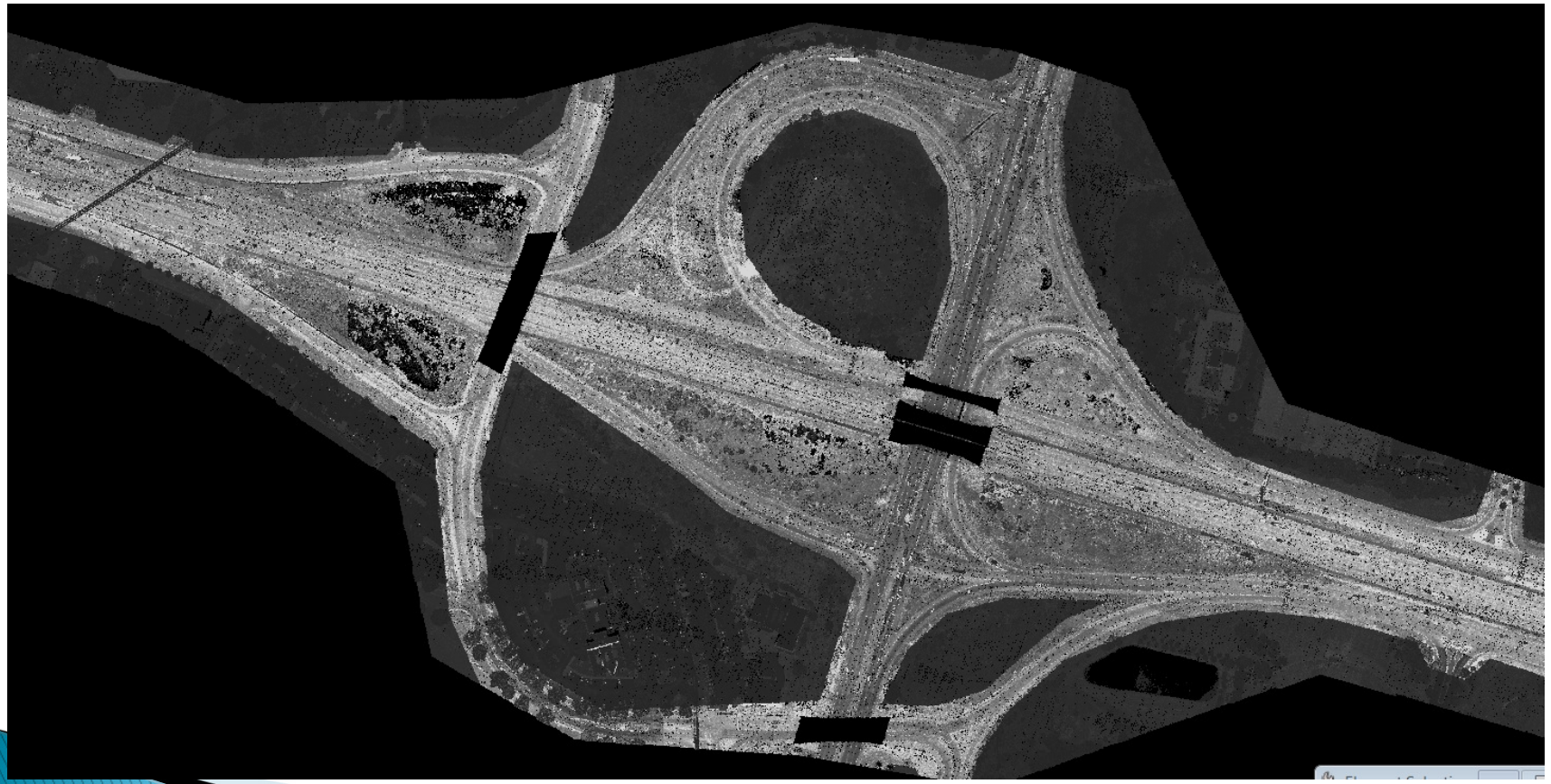


3D Data Acquisition

- 3D Data Acquisition
  - Has replaced photogrammetric mapping with LIDAR
  - Utilizing LIDAR that is appropriate for project
    - Aerial (Fix wing or Helicopter)
    - Mobile (mounted on a vehicle)
    - Static (Tripod scanner)
- Mapping Deliverables
  - Point Cloud (Classified)
  - 2D/3D topographic features
  - TIN model(s)
  - Georeferenced ortho-mosaics (B&W photos)

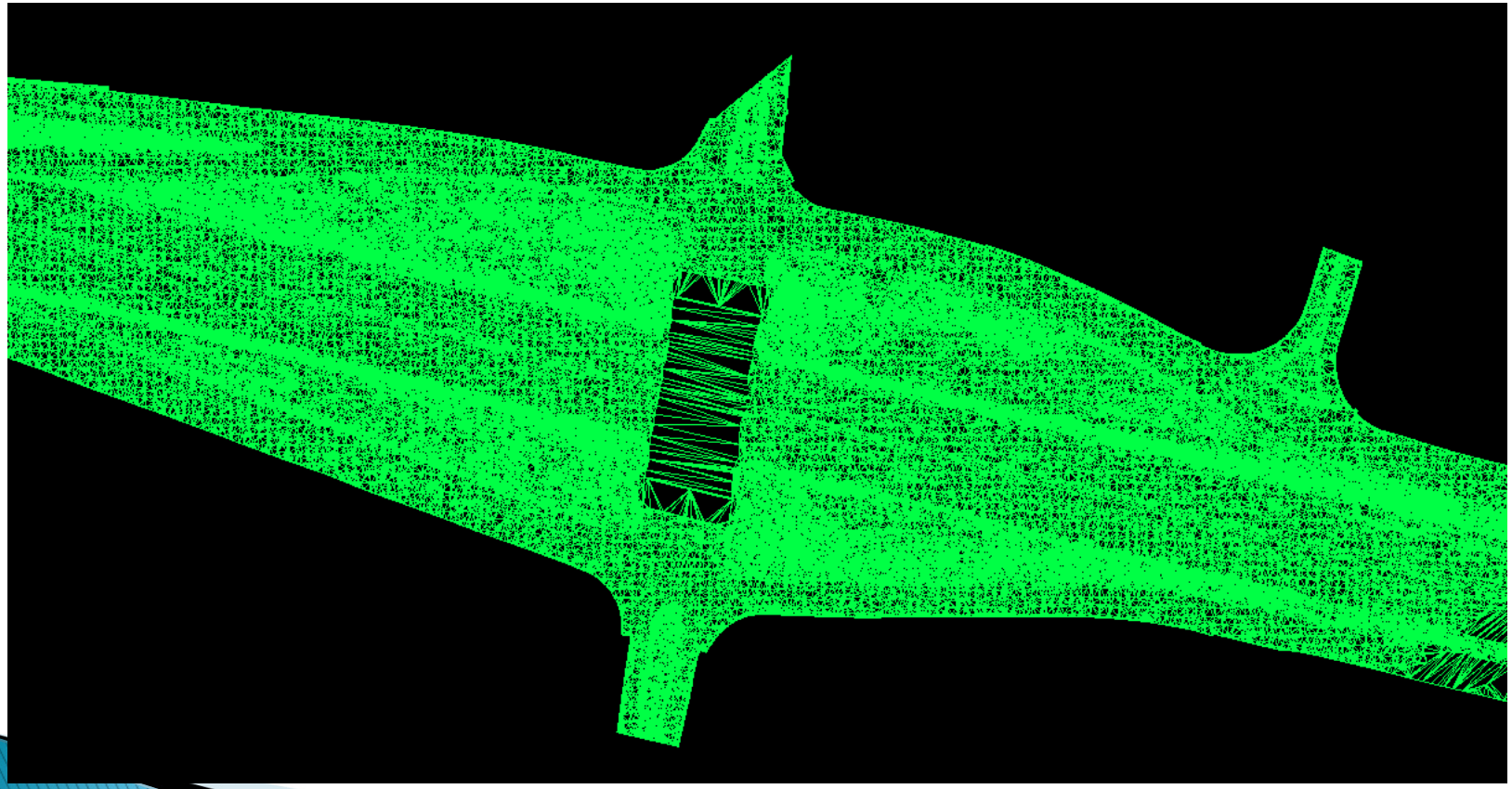
3D Data Acquisition

- Aerial

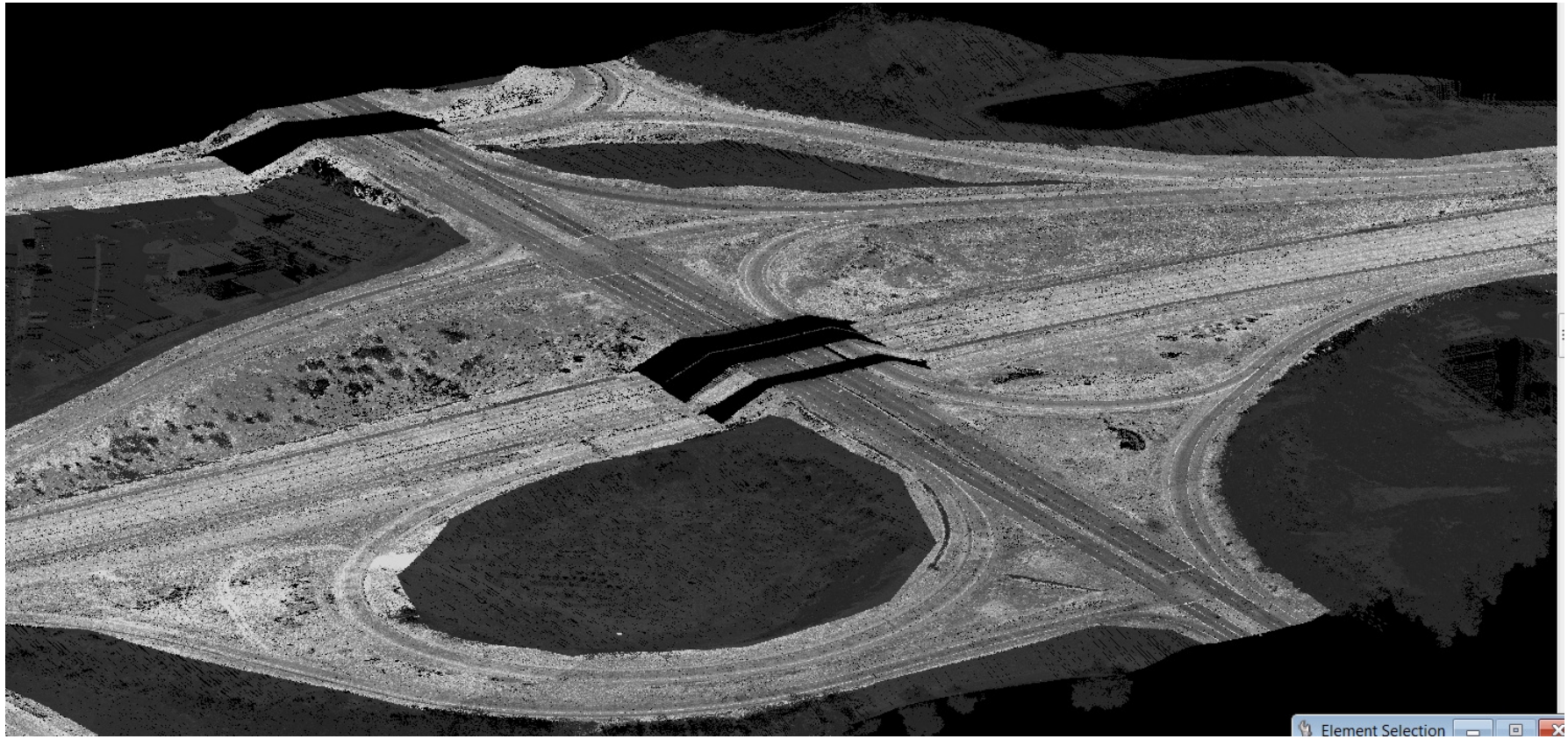


3D Data Acquisition

- TIN Generated from LIDAR:

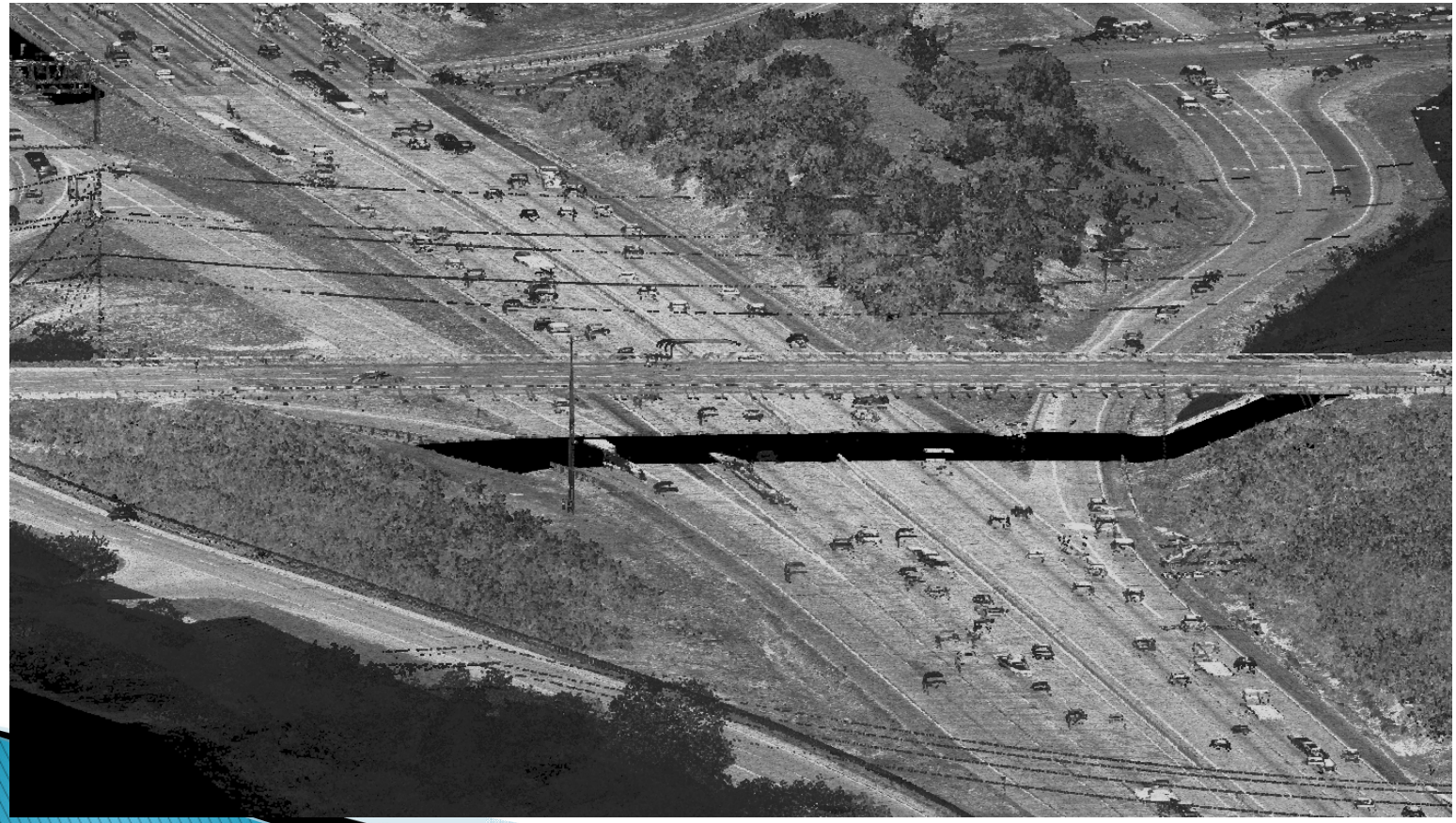


3D Data Acquisition



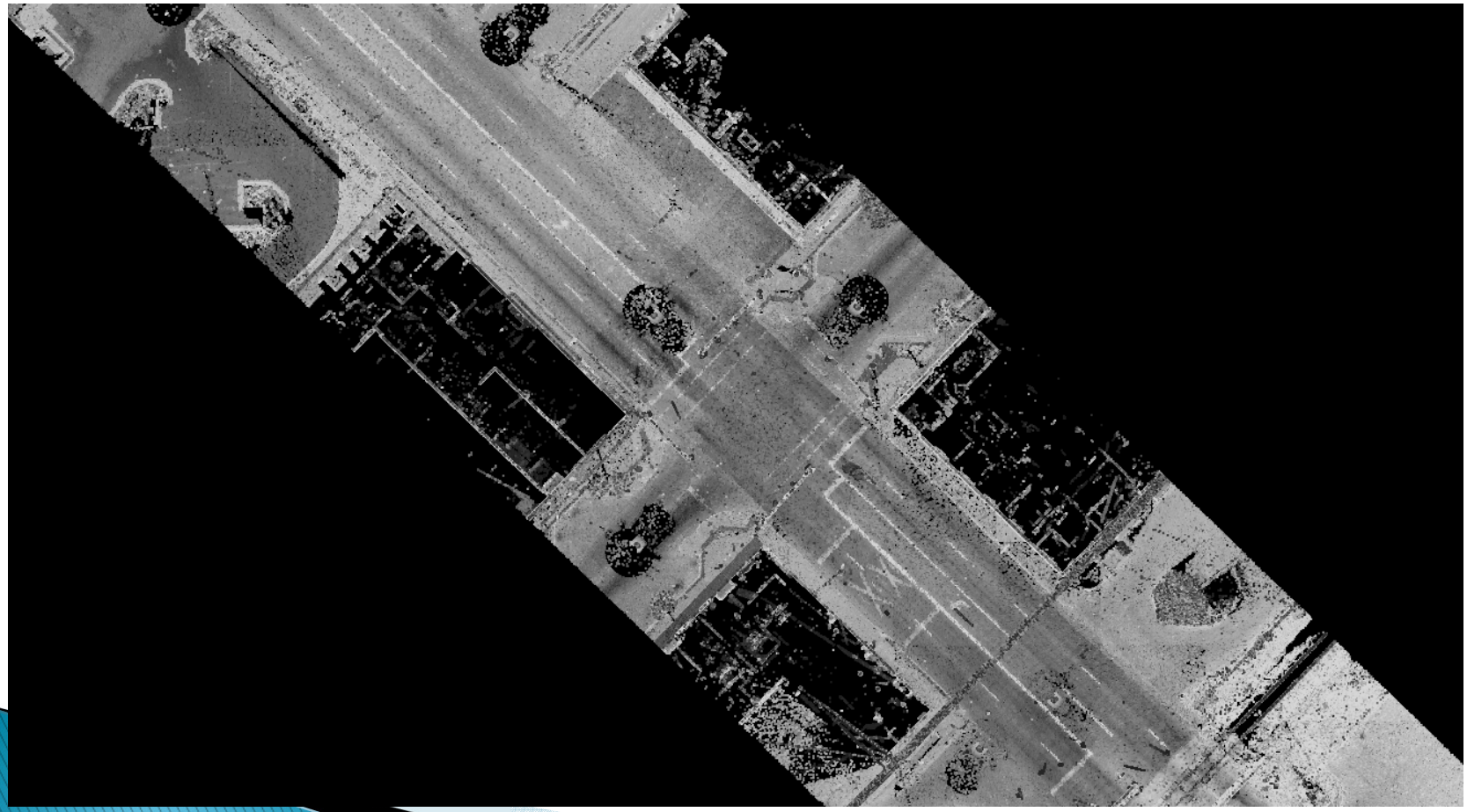
3D Data Acquisition

- Aerial



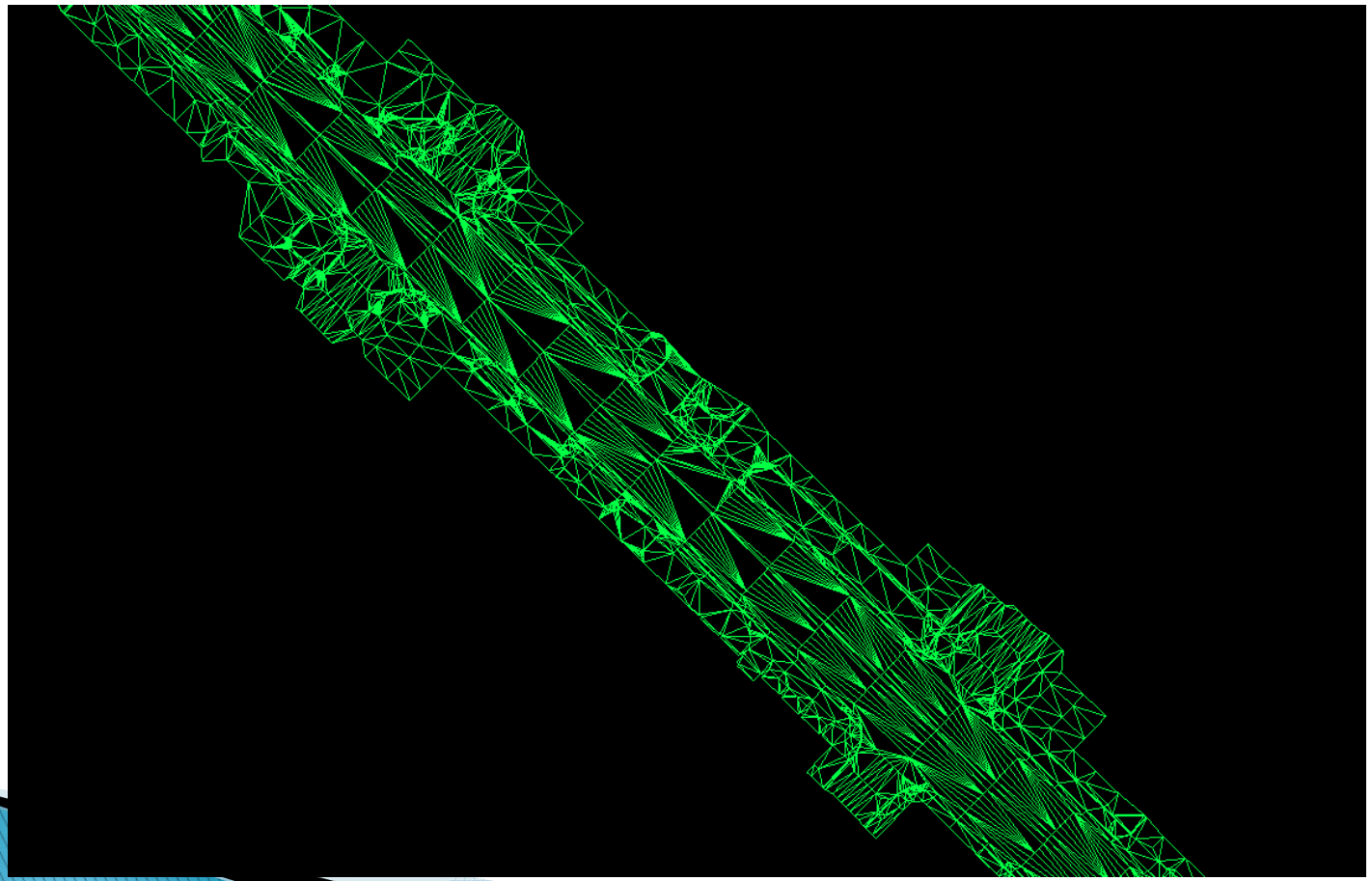
3D Data Acquisition

- Mobile



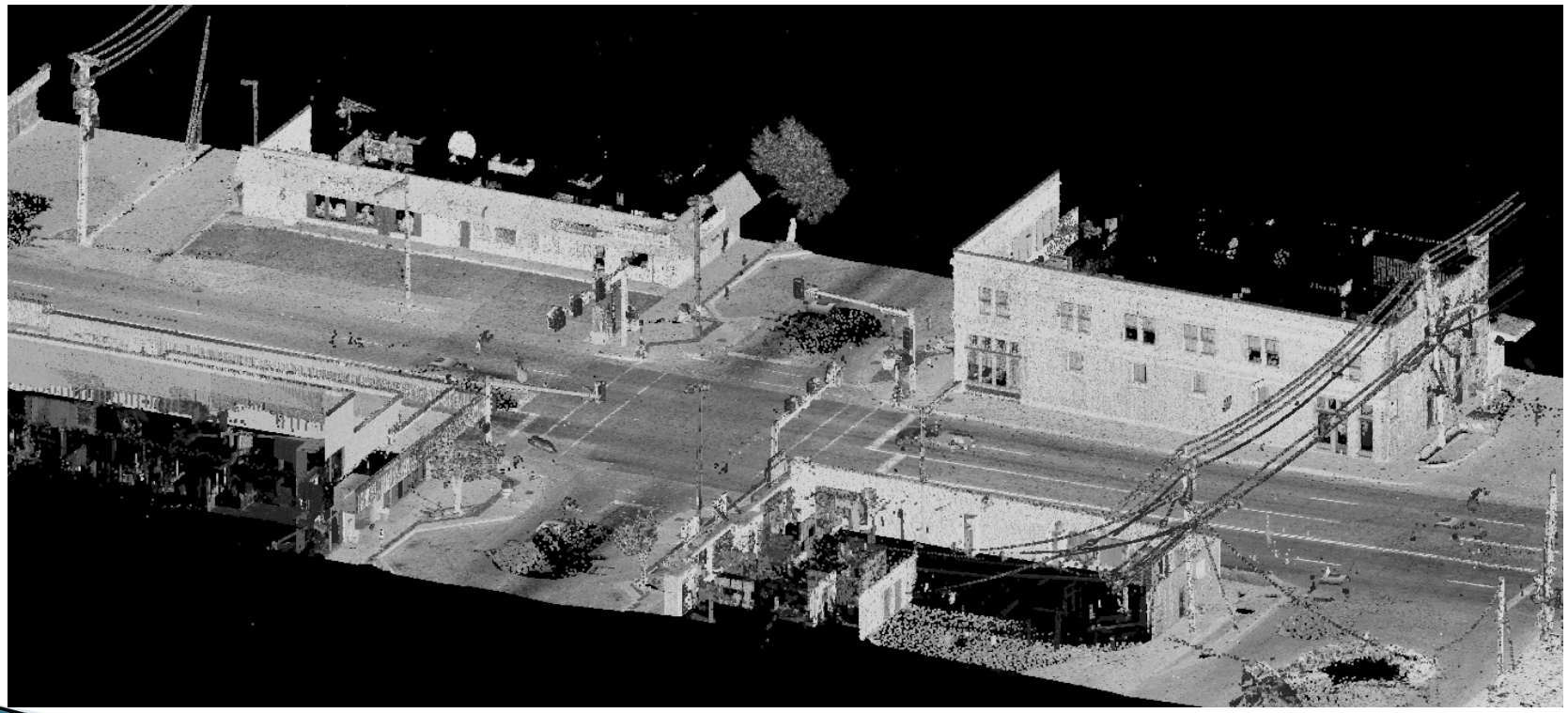
3D Data Acquisition

- TIN Generated from LIDAR



3D Data Acquisition

- Mobile

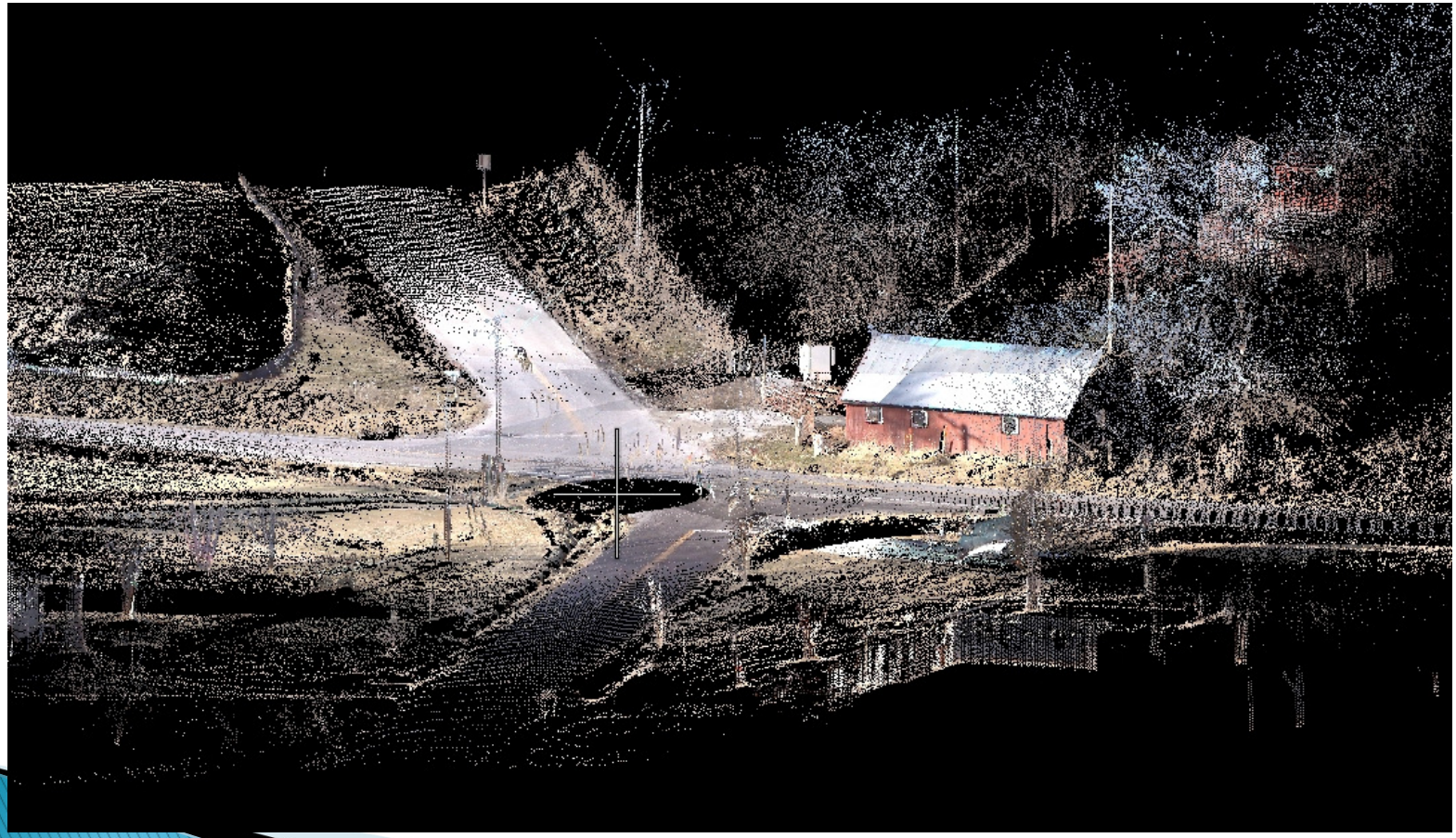


3D Data Acquisition

- Mobile

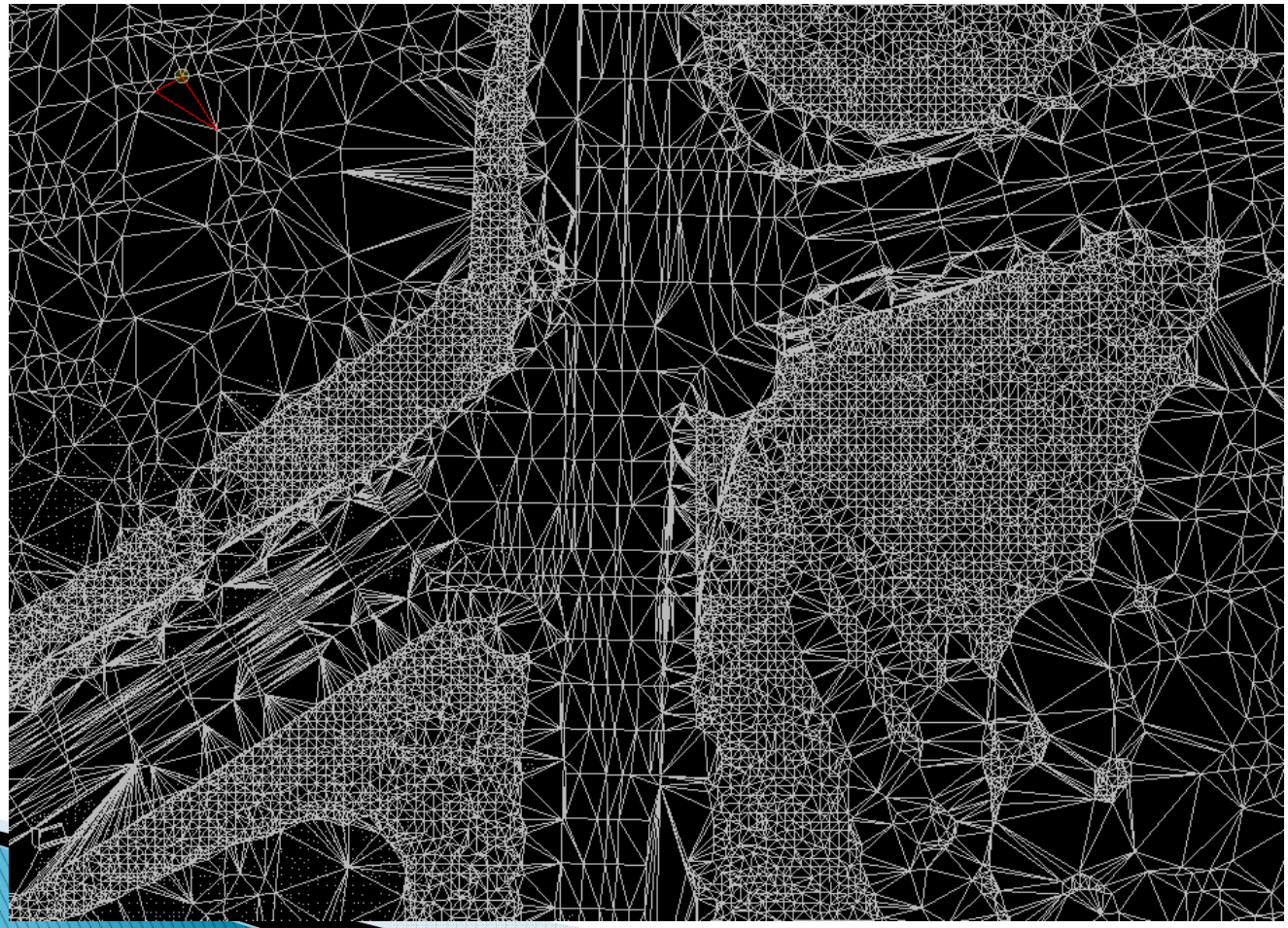
3D Data Acquisition

- Static



3D Data Acquisition

- TIN generated from LIDAR:

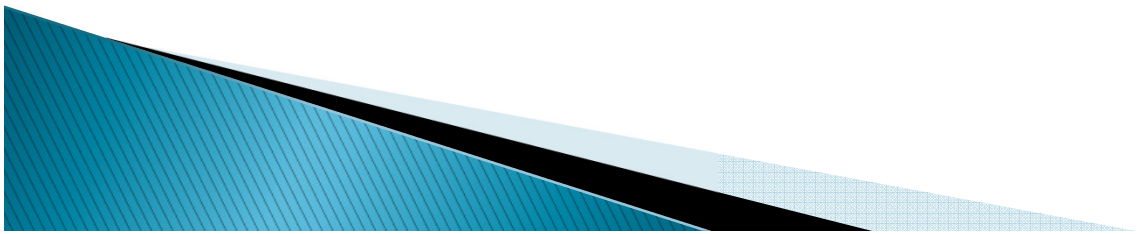


3D Model Based Design

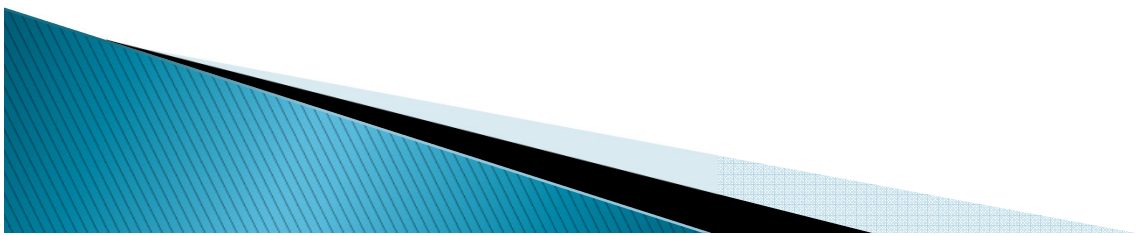
- MoDOT's Current 3D Design
  - Linear corridor modeling
  - Major intersections
- MoDOT's Electronic Deliverables
  - EPG 237.14: Electronic Design Data Delivery
  - Microstation/Geopak files
  - 3D model
    - Required: Linear corridors, major intersections
    - Accepted: Bridges, entrances, other design detail

Growing Pains…

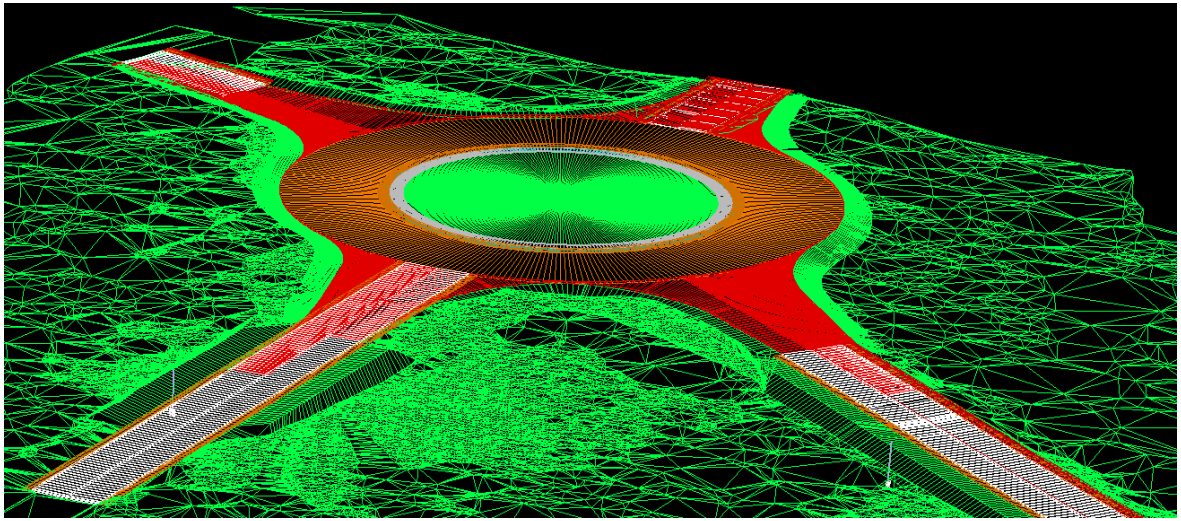
- Learning from our mistakes
  - LIDAR Deliverables
  - Cost of Data Acquisition
  - Data Storage & Sharing
  - Implementation of Corridor Modeling Tools
  - Current software limitations
  - Training & Support
- What's next
  - Visualization?
  - Changes in plan production workflows?

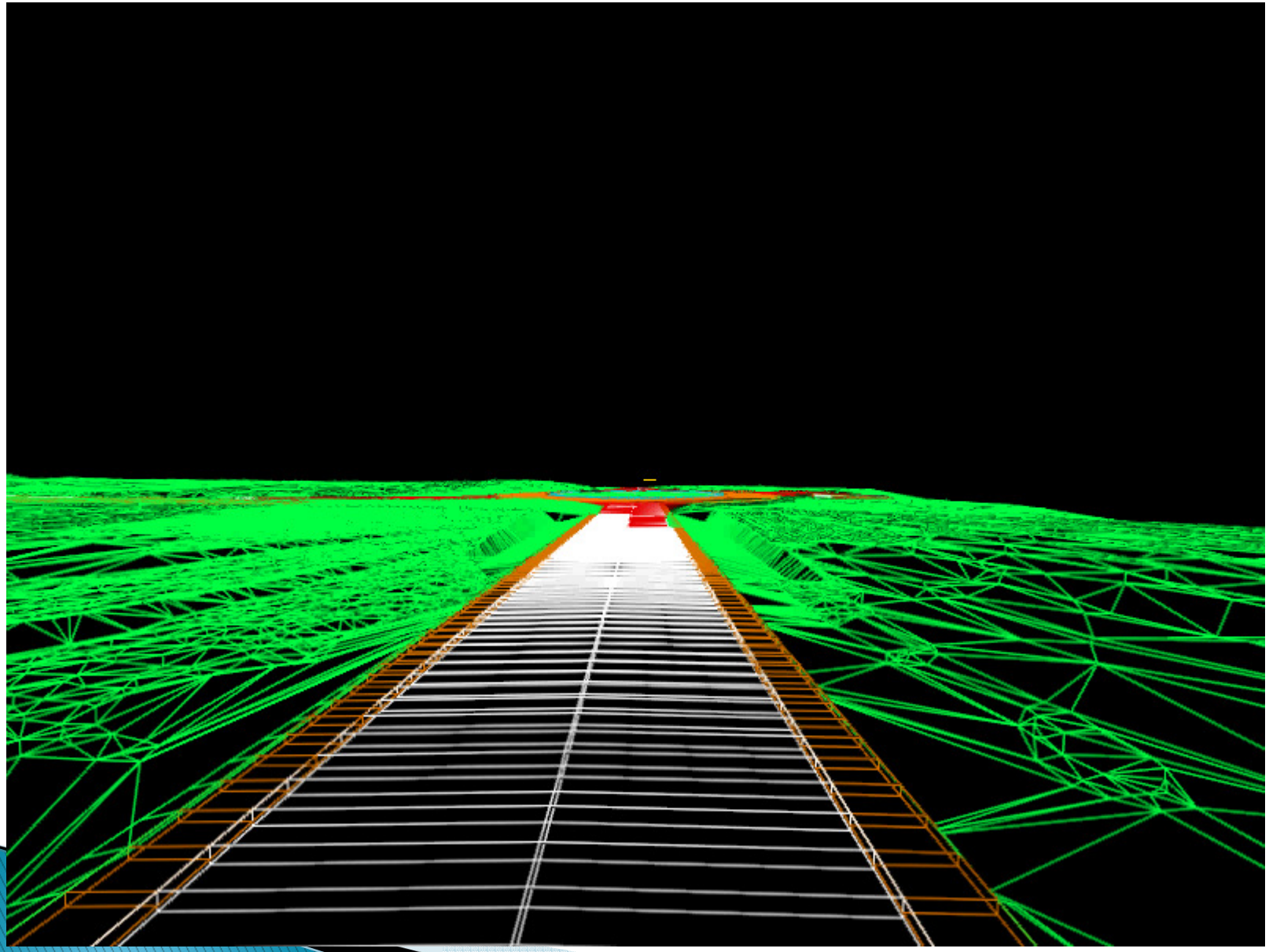


Our Current Tools Can…



Today's Tools Can Do…





Thank You