FIMAN-T
NCEM & NCDOT’s Response Tool for Managing Flood Impacts

NCAFPM Webinar Series
March 25, 2020 – 12:00pm – 1:00pm
Hurricane Matthew and Florence

Road Crossing Failures

RESILIENCE?
FIMAN T Objectives

Leverage Data
- 3D QL1/2 LIDAR Roadway Data
- FIMAN Infrastructure
- NCDOT Bridge Information Databases
- Existing Flood Inundation Modeling and Mapping
- NCDOT Asset Location

Software Goals
- FIMAN-T Enhancements
- Isolated from FIMAN Production
- Visualization Options for roads, bridges, assets
- New Reporting Tools for EOC

2019 Season Pilot Study
- Neuse River Corridor (Clayton to New Bern)
- Expanded Inundation Libraries
- FIMAN-T Functionality
- Beta = Development Server – not open to public
FIMAN-T

FIMAN Production Database

FIMAN-T DATABASE (BETA)

FEATURE CLASSES
- $S\_DOT\_ASSETS$
- $S\_DOT\_HYDCROS$
- $S\_DOT\_HYDCROS\_SINGS$
- $S\_ROAD\_INUNDATION$
- $L\_INUNDATION\_HYDCROS$
- $L\_ROAD\_INUNDATION\_ROLLUP$

TABLES
- OBJECTID
- BRIDGE_ID
- FTR_INTRSC
- F_CARRIED
- BRDG_TYP_NM
- COUNTY
- ROUTE
- RTE_ID
- BISP_BRIDGE_NM
- DIVISION
- FUNC_CLASS
- SUPERSTRUCT
- STRUCTURAL
- B_SLOUCHYOSL
- DRAINAGE_AREA
- GAGE_ID
- DECK_SL
- SHAPE
- L_INUNDATION_HYDCROS
- OBJECTID
- BRIDGE_NUMBER
- GAGE_ID
- LEVEL_ID
- L_INUNDATION_HYDCROS
- OBJECTID
- GAGE_ID
- LEVEL_ID
- Depth_Cat
- Tor_Count
- Src_Miles
- Int_Count
- Int_Miles
- US_Count
- US_Miles
- NC_Count
- NC_Miles
- Local_Count
- Local_Miles

FIMAN PRODUCTION DATABASE

FEATURE CLASSES
- $S\_GAGES\_ALL$
- $S\_FLOOD\_INUNDATION$

TABLES
- $S\_GAGES\_ALL$
- $GAGE\_TREND\_CALC$
- HYDRO\_ALL
- HYDRO\_FORECAST
- $L\_IMG\_FILE\_TYPE$
- $PIN\_IMAGES$
- $SYMBOL\_IMAGES$
- TREND\_HISTORY
Foundational Data

FROM BUILDINGS (FIMAN) TO TRANSPORTATION INFRASTRUCTURE (FIMAN-T)
Lidar Derived 3D Road Elevation Grids
Lidar Derived 3D Road Elevation Grids
Lidar Derived 3D Road Elevation Grids
Raster to Polyline Routines

Why polylines?

- Conflate LRS polyline data with raster to **leverage** attributes:
  - Road Name
  - Road Type
  - NCDOT Class
  - AADT
  - Feature Lengths
- Ability to query, search, aggregate
- Smaller file size
For the Geeks

- FIMAN Foundation (*shared data – separate app*)
- ASP.NET web application within .NET Framework (*v4.5*)
- Languages used: HTML, CSS/Bootstrap, Javascript, C#, SQL, Python, ArcGIS Javascript API
- Spatial Data published (*ArcGIS Web Services*)
- Kendo and amCharts (*tables, slider bar, hydrographs, etc.*)
- Scheduled tasks extracting Contrail and NWS Forecast (*every 15 min*)
- Weather radar loop (*every 5 min*)
FIMAN-T Login Page

WELCOME TO FIMAN-T

Enter Your NCID Credentials:

NCID Username

NCID Password
User Administration Module

Current Users and Administrator View

Add User Tools
FIMAN-T: Pilot Area Home Screen

This is the site for FIMAN-T with select river gauges along the Neuse River basin. Click a division to view active gauges within.
Current Conditions (Inundation and Road Flooding)
Current Conditions (Bridge Performance)
Current Conditions (Bridge Performance)
Current Conditions: Road Impact - Summary

- Roadway classification and flood inundation values determined by using NCDOT LRS datasets overlaid on NCDM QL1 and QL2 raster datasets. All lengths are in miles.
- Some roadways may be inundated that do not appear in this application.
- Information should be evaluated with ground conditions before road closures or other emergency response actions.

<table>
<thead>
<tr>
<th>Roadway Flood Depth Range</th>
<th>Total</th>
<th>Interstate</th>
<th>US Highway</th>
<th>NC Highway</th>
<th>Local Roads</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 0.5 ft</td>
<td>0.3</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.3</td>
</tr>
<tr>
<td>0.5 - 2.0 ft</td>
<td>1.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.3</td>
<td>1.7</td>
</tr>
<tr>
<td>2.0 - 5.0 ft</td>
<td>0.3</td>
<td>0.0</td>
<td>0.0</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>5.0 + ft</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2.8</td>
<td>0.0</td>
<td>0.0</td>
<td>0.3</td>
<td>2.5</td>
</tr>
</tbody>
</table>
Current Conditions: Road Impacts – Details

- Roadway classification and flood inundation values determined by using NCDOT LRS datasets overlaid on NCEM QL1 and QL2 radar datasets. All lengths are in miles.
- Some roadways may be inundated that do not appear in this application.
- Information should be evaluated with ground conditions before road closures or other emergency response actions.
Current Conditions: Road Impacts – Details

Roadway classification and flood inundation values determined by using NCDOT LRS datasets overlaid on NCDM QL1 and QL2 raster datasets. All lengths are in miles.

Some roadways may be inundated that do not appear in this application.

Information should be evaluated with ground conditions before road closures or other emergency response actions.
Current Conditions: Road Impacts – Details

• Roadway classification and flood inundation values determined by using NCDOT LRS datasets overlaid on NCEM Q1.1 and Q1.2 raster datasets. All lengths are in miles.
• Some roadways may be inundated that do not appear in this application.
• Information should be evaluated with ground conditions before road closures or other emergency response actions.
Current Conditions: Bridge Performance
Current Conditions: Goldsboro
FIMAN-T Forecast Tab: Goldsboro
Forecasted Peak: Goldsboro
Forecasted Peak: Road Inundation Summary

- Roadway classification and flood inundation values determined by using NC DOT LRS datasets overlaid on NCEM QL1 and QL2 radar datasets. All lengths are in miles.
- Some roadways may be inundated that do not appear in this application.
- Information should be evaluated with ground conditions before road closures or other emergency response actions.
Forecasted Peak: Interactive Road Inundation (Zoom to)
Forecasted Peak: Google Earth Export

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Forecasted Peak: Bridge Performance Table
**Forecasted Peak: Bridge Performance Excel Export**

### FIMAN-T: Bridge Performance Summary

- **Neuse River near Goldsboro**

  This report was generated using an elevation of 10.5 ft. and a stage of Forecast Stage: 27.6 ft.

<table>
<thead>
<tr>
<th>Road Name</th>
<th>Bridge Number</th>
<th>Flood Source</th>
<th>Road Elevation (ft)</th>
<th>Low Chord Elevation (ft)</th>
<th>Current / Scenario / Export</th>
<th>Freeway (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NC591</td>
<td>950018</td>
<td>Neuse River</td>
<td>72.5</td>
<td>69.1</td>
<td>Neuse River</td>
<td>-0.9</td>
</tr>
<tr>
<td>NC111</td>
<td>950027</td>
<td>Neuse River</td>
<td>65.5</td>
<td>62.8</td>
<td>Neuse River</td>
<td>-1.2</td>
</tr>
<tr>
<td>US13/US17 SBL</td>
<td>950033</td>
<td>Neuse River</td>
<td>77.6</td>
<td>74.8</td>
<td>Neuse River</td>
<td>2.2</td>
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<tr>
<td>NC111</td>
<td>950042</td>
<td>Neuse River Overflow</td>
<td>61.0</td>
<td>58.3</td>
<td>Neuse River Overflow</td>
<td>-1.3</td>
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<tr>
<td>US13/US17 SBL</td>
<td>950052</td>
<td>Neuse River Overflow</td>
<td>74.4</td>
<td>71.7</td>
<td>Neuse River Overflow</td>
<td>-0.6</td>
</tr>
<tr>
<td>NC111</td>
<td>950054</td>
<td>Neuse River Overflow</td>
<td>63.9</td>
<td>60.7</td>
<td>Neuse River Overflow</td>
<td>-1.2</td>
</tr>
<tr>
<td>US13/N &amp; US17 SBL</td>
<td>950057</td>
<td>Neuse River Overflow</td>
<td>75.7</td>
<td>73.4</td>
<td>Neuse River Overflow</td>
<td>-0.8</td>
</tr>
<tr>
<td>SR108B</td>
<td>950072</td>
<td>Neuse River Overflow</td>
<td>79.7</td>
<td>77.4</td>
<td>Neuse River Overflow</td>
<td>2.1</td>
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<tr>
<td>NC381</td>
<td>950083</td>
<td>Neuse River Overflow</td>
<td>65.2</td>
<td>62.7</td>
<td>Neuse River Overflow</td>
<td>-1.5</td>
</tr>
<tr>
<td>NC381</td>
<td>950010</td>
<td>Neuse River Overflow</td>
<td>72.1</td>
<td>69.8</td>
<td>Neuse River Overflow</td>
<td>0.9</td>
</tr>
</tbody>
</table>

**Legend**

- NCDOT Assets
- Bridges
- Road Inundation Levels
  - > 5 ft.
  - 2.5 ft.
  - 0.5 ft.
  - 0 ft.
Scenario Modes for Planning:  Kinston (33-ft)
Scenario Modes for Planning:  Kinston (35-ft)
Scenario Modes for Planning: Kinston (36-ft)
Scenario Modes for Planning: Kinston (37-ft)
Version 2 Enhancement
Hydraulic Performance Dashboards
Ground Truthing Opportunity
NC 581 over Neuse River Prices Landing Boat Ramp
4.25 miles from FIMAN Gage

Date: 2/12/20
Time: 9:30am
Neuse Stage: 22.4
NC 581 over Neuse River
FIMAN-T Bridge Freeboard Ground Truth

4.25 miles from FIMAN Gage

NC 581 Relief Opening: FIMAN-T ‘Modeled’
Freeboard = 0.1 ft

Observed Freeboard 0.5 ft (+/-)

NC 581 Bridge 950314
Photo Taken: 2/12/20 at 9:20am
NC 581 over Neuse River
FIMAN-T Bridge Freeboard Ground Truth

4.25 miles from FIMAN Gage

NC 581 Bridge:
FIMAN-T ‘Modeled’ Freeboard = 7.8 ft

Observed Freeboard Measurement = 7 ft (+/-)

NC 581 Bridge 950315
Photo Taken: 2/12/20 at 9:20am
Slick Rock Road downstream of Goldsboro

FIMAN-T Inundation and Road Flooding Depth Ground Truth

Note: 8.3 miles downstream from FIMAN Gage

FIMAN-T Shows 1.5 feet of water over road.
Current FIMAN Limit

FIMAN –T Beta Limit

Ground Truth Site +/- 10 miles D/S

Current FIMAN Limit
NC 55 over Neuse River
Lenoir County

9.7 miles from FIMAN Kinston Gage

Date: 2/13/20
Time: 12:45pm
Kinston Stage: 17.8

Surveyed Flood Elevation = 19.5 ft (NAVD88)

FIMAN Library Elevation = 20.0 ft

Photo Taken and Survey Collected 2/13/20 – 12:45pm
FIMAN-T: Planned Next Steps

- Integration with Production FIMAN
- Bridge Hydraulics Dashboards
- FIMAN-T Coastal Surge Module
- Multi-Modal Integration
- System Coverage Expansion (Phase 2)
  - Gage Installations
  - North East Cape Fear River / Wallace / I-40
  - Lumberton / I-95
  - Tar-Pamlico Basin
  - Roanoke / Chowan Basin
  - Statewide Implementation
- Divisional Training/Engagement/Feedback
WEBINAR ATTENDEES QUESTIONS?

(PLEASE USE CHAT WINDOW IN SKYPE IF POSSIBLE)
Webinar Attendees Questions?

*(please use chat window in Skype if possible)*
Attendance Roster and Continuing Education Credits

- Please visit the link provided in the Webinar Chat window
  
  https://docs.google.com/forms/d/e/1FAIpQLSdeAOgYgdZmAIXhOp42WGMlzMriz0j08VRpophA_E0DqW2U7g/viewform?usp=sf_link

- Complete the roster and fill in applicable CFM, PE and PLS information