WHEREAS, Advancements in technology are providing increasing opportunities and needs for the transfer of electronic engineering data throughout the life of a highway project; and

WHEREAS, The Standing Committee on Highways (SCOH) established a Joint Technical Committee on Electronic Engineering Data in October 2007; and

WHEREAS, SCOH charged this committee with the development of national standards and guidance for the transfer of electronic engineering data that are used to develop and deliver capital projects; and

WHEREAS, This technical committee is a joint effort of the Subcommittees on Design, Construction, Bridges and Structures, and Information Systems; and

WHEREAS, AASHTO members participated in NCHRP Project 20-64, which was undertaken to develop data exchange formats using Extensible Markup Language, or XML; and

WHEREAS, TransXML provides an open, vendor-neutral format for storing, exchanging, and archiving transportation data; and

WHEREAS, The output of NCHRP Project 20-64 was the development of schemas (i.e., data structures) using TransXML for the sharing of electronic data in several engineering business areas, including Construction/Materials, Bridge Structures, Survey/Design, and Safety; and

WHEREAS, NCHRP Project 20-64 recommended TransXML for the expansion of these schemas for transferring information throughout the full project delivery process, from initial data collection through as-built plans and for asset management; and

WHEREAS, The technical committee proposes to develop additional schemas for the transfer and sharing of highway electronic engineering data using TransXML; and

WHEREAS, Over the coming years, the technical committee will recommend the adoption of various schemas using TransXML as official AASHTO standards; now therefore be it

RESOLVED, That the Subcommittee on Information Systems supports and endorses TransXML as the basis for the development and expansion of future schemas; and be it further

RESOLVED, That the Subcommittee on Information Systems will review proposed TransXML schemas for approval as official AASHTO standards.
TransXML

XML Schema for Transportation Data Exchange

Overview
XML – A way to organize and define data

Data that used to look like this…

123456789ZIERING  ERIC  03115716  KINGMAN  RD024616175276933
019446301CIAMBOTTIBONITA04175316  KINGMAN  RD024616175276933
126321091NEUMANN  LANCE  010162100CAMBRIDGEPDR021406173540167
Now looks like this…

<Person>
  <SocialSecurityNumber> 123-45-6789 </SocialSecurityNumber>
  <Name>
    <LastName> ZIERING </LastName>
    <FirstName> ERIC </FirstName>
  </Name>
  <DateOfBirth> 03/11/1957 </DateOfBirth>
  <Address>
    <StreetAddress> 16 KINGMAN RD </StreetAddress>
    <City> NEWTON </City>
    <State> MA </State>
    <ZIPCode> 02461-1110 </ZIPCode>
  </Address>
  <TelephoneNumber> 617-527-6933 </TelephoneNumber>
</Person>
Things you should know about XML

- eXtensible Markup Language
- Self-documenting format – easy to interpret
- Tags can describe almost any kind of information
- Each XML file is known as a “document”
XML 101

XML is:

• widely adopted way of info exchange across web applications
• human-readable and self-documenting
• application independent

An XML schema is a data structure

An XML schema’s value depends on getting agreement across software vendors and agencies that produce and consume info – this is the hard part
What is XML Schema?

- A set of rules describing the types of information that can, or must, appear in an XML document

- For example: An accident report document...
  - Must contain the date, time, and location...
  - Must contain one or more vehicles...
    - Each vehicle must have a VIN, Make, Model, Plate #...
    - May have one driver (name, birth date, license #...)
    - May have one or more passengers (name, birth date...)
  - May contain one or more pedestrians... [etc.]

- Schema are like interlocking building blocks
XML Examples in Transportation

- LandXML – roadway design info
- aecXML – construction pay items
- AASHTO Trns*port construction management – data exchange between modules
- AASHTO Virtis/Opis – XML import and export routine
- AASHTO TSIMS (proposed)
- JusticeXML – driver records, arrest warrants
- Location Referencing Specification (SAE J2266)
- ATIS – XML vocabulary for Traveler Information Exchange
- GML – geographic markup language (object model & rules for developing XML schema)
- TranXML/Logistics XML
- TMML – Traffic Model Markup Language – data exchange across traffic modeling software packages
- FMCSA – motor carrier profile, safety audit, driver/vehicle/carrier clearance
TransXML Project History

- Initiated by AASHTO’s Technical Applications and Architecture (TA&A) Task Force
- NCHRP Project 20-64 created with a $500,000 budget
- Driving Forces:
  - Growing support for data exchange standards within DOT community – given ITS experience, increase in web apps
  - LandXML success – sharing of road design info
  - AASHTOWare program interest in migrating to XML as data exchange method in all products
  - Desire to coordinate/fill gaps in multiple fragmented XML efforts: construction, design, safety, GIS, ITS
TransXML Project Objectives

- Develop broadly accepted public domain XML schemas for exchange of transportation data
- Recommend institutional framework for future schema development and dissemination

Initial focus in **four business areas:**
- Survey/Roadway Design
- Transportation Construction/Materials
- Highway Bridge Structures
- Transportation Safety
NCHRP 20-64 Research Team

- Cambridge Systematics – Business Lead & Safety Schema
- Bentley Systems Inc. – Technical Lead & Survey/Design Schema
- Michael Baker Jr., Inc. – Bridge Structures Schema
- Info Tech, Inc. – Construction Schema
- Chuck Campbell, XML Consultant
<table>
<thead>
<tr>
<th></th>
<th><strong>Status Quo</strong></th>
<th><strong>Future Vision</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Proliferation of inconsistent, overlapping data standards</td>
<td></td>
<td>Coordinated, widely used core data standards</td>
</tr>
<tr>
<td>Time consuming to transfer data across applications</td>
<td></td>
<td>Open, non-proprietary data formats adopted</td>
</tr>
<tr>
<td>Duplicative data entry</td>
<td></td>
<td>Automation of data transfer</td>
</tr>
<tr>
<td>Limited access to information across functional areas in an agency</td>
<td></td>
<td>Sharing of information across planning, design, construction and operations</td>
</tr>
<tr>
<td>Technology change limits access to archived legacy data</td>
<td></td>
<td>Data archived in accessible, self-documenting format</td>
</tr>
</tbody>
</table>
TransXML Current and Possible Future Scope

TransXML

- Survey/Design
- Construction/Materials
- Bridge
- Safety
- Asset Management
- Maintenance Management
- Project Development
- Program Development
- Operations/ITS
- Modeling/Simulation
- Geospatial Data
- Freight/Logistics
TransXML Gaps and Opportunities
Survey/Design – Current Schema

- **LandXML**
  - Alignments
  - Coordinate Geometry Points
  - Grade Model
  - Surfaces – point, linear, triangle
  - Parcels
  - Roadways (IHSDM)
  - Survey Equipment and data

- **Geotechnical XML**
  - Soil testing results

- **aecXML Infrastructure**
  - Pay Items
  - Pay item prices for design estimates

- **Geographic Markup Language**
  - Geometries (points, curves, surfaces, solids, composite)
  - Topologies
  - Location & Coordinate Reference Systems
  - Measurement Units
  - Metadata
  - Presentation Styles
TransXML Gaps and Opportunities
Survey/Design – Best Opportunities

- Exchanging Roadway Design Info Across Design Team Members (recommend improvements to LandXML.org)

Geometric Design:
- Alignment
- Pavement section
- Superelevation
- Cross sections
- Geometrics

Surveyor
Hydraulics
Right-of-Way
Bridge
Utility
Traffic
TransXML Gaps and Opportunities
Survey/Design – Best Opportunities

- Pay Item Information from Design to Construction (expand on aecXML Infrastructure)
TransXML Gaps and Opportunities
Survey/Design – Best Opportunities

- Area Feature Support (LandXML-parcels, GML)

Diagram:
- Preliminary Design
  - ROW Constraints
  - Land Use
  - Wetlands Inventory
  - Soils
  - Hazardous Materials
  - Flood Plains
TransXML Gaps and Opportunities
Safety – Best Opportunities

- Highway Safety Analysis Schema

Highway Safety Characteristics
- Geometrics
- Safety Hardware
- Roadside
- Traffic
- Other

- Crash Data Collection Systems
- Safety Analysis Tools
- Crash Data Validation Systems
- Highway Data Repositories
TransXML Stewardship
Role and Functions

- Help Transportation Organizations to Reap the Benefits
  - Technical assistance for schema implementation
  - Ensure that implementation experience is used to improve schema and expand base of sample applications

- Serve as Focal Point for Continued Progress
  - Update and enhance initial set of TransXML schemas based on stakeholder input
  - Develop additional schema & sample applications

- Serve as Champion
  - Promote umbrella framework for transportation XML schemas to avoid inconsistent and overlapping efforts
  - Liaison with stakeholder communities, conference presentations
Current Status

- Stewardship of TransXML remains in limbo
- Web Site remains operational but not supported
  - www.TransXML.org
- Minor revisions/extensions have been proposed
- Inquiries from other groups suggest interest in participating