

Testing Your Linear Referencing System (LRS)



Presented by

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Testing Your LRS - Overview

Introduction

Understanding LRS Requirements

Test Plan

Roles, Responsibilities, and Artifacts

Use-Cases and Risk Mitigation

Test Data Content

Identify Test Scripts - Risk vs. Test Matrix

Tracking Results

A Look at the result of Build 1

Maintain Linear Datum

Long Term Transaction Management

Temporal Filters (System and Real World)

Wrap Up

Introduction: LRS Requirements



**Are we are really supposed to model this?!?,
and If so, how is it tested.**

Introduction: LRS Requirements

Linear Referencing System -

A system for integrating transportation business data located by different Linear Referencing Methods(LRM's).

There is a finite set of common LRM's employed at most DOT's across different business areas.

They are:

Coordinate Route

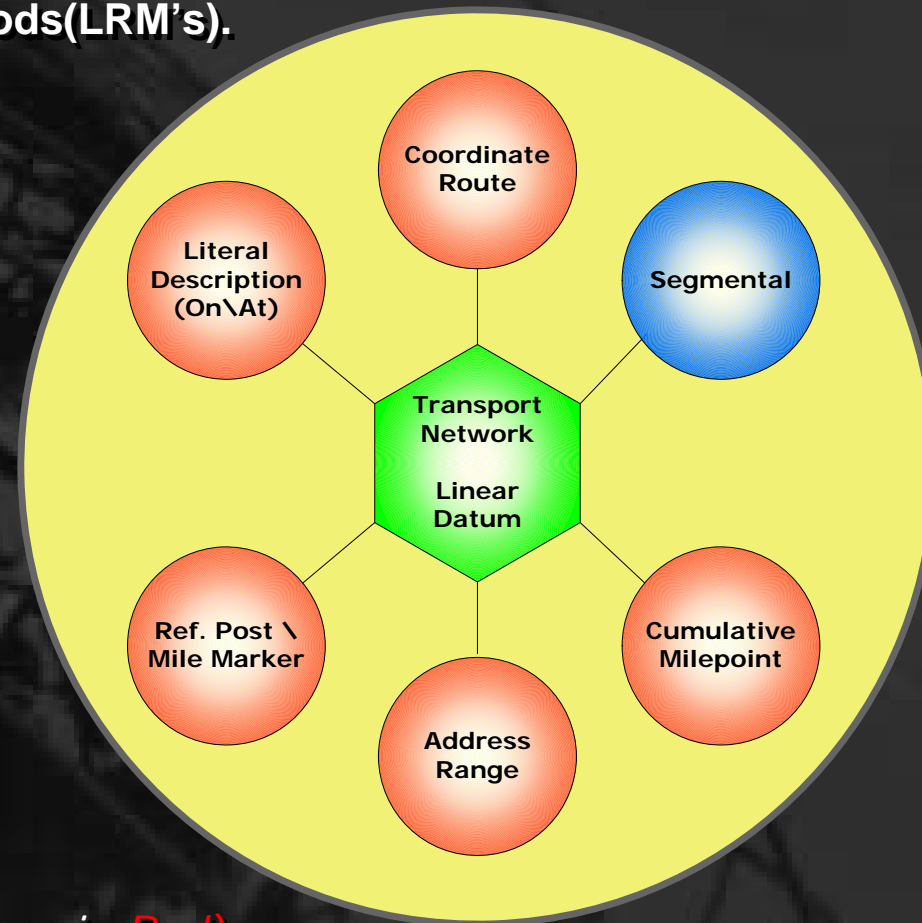
Cumulative Milepoint

Reference Post or Mile Marker

Literal Description (On\At)

Address Range

Segmental

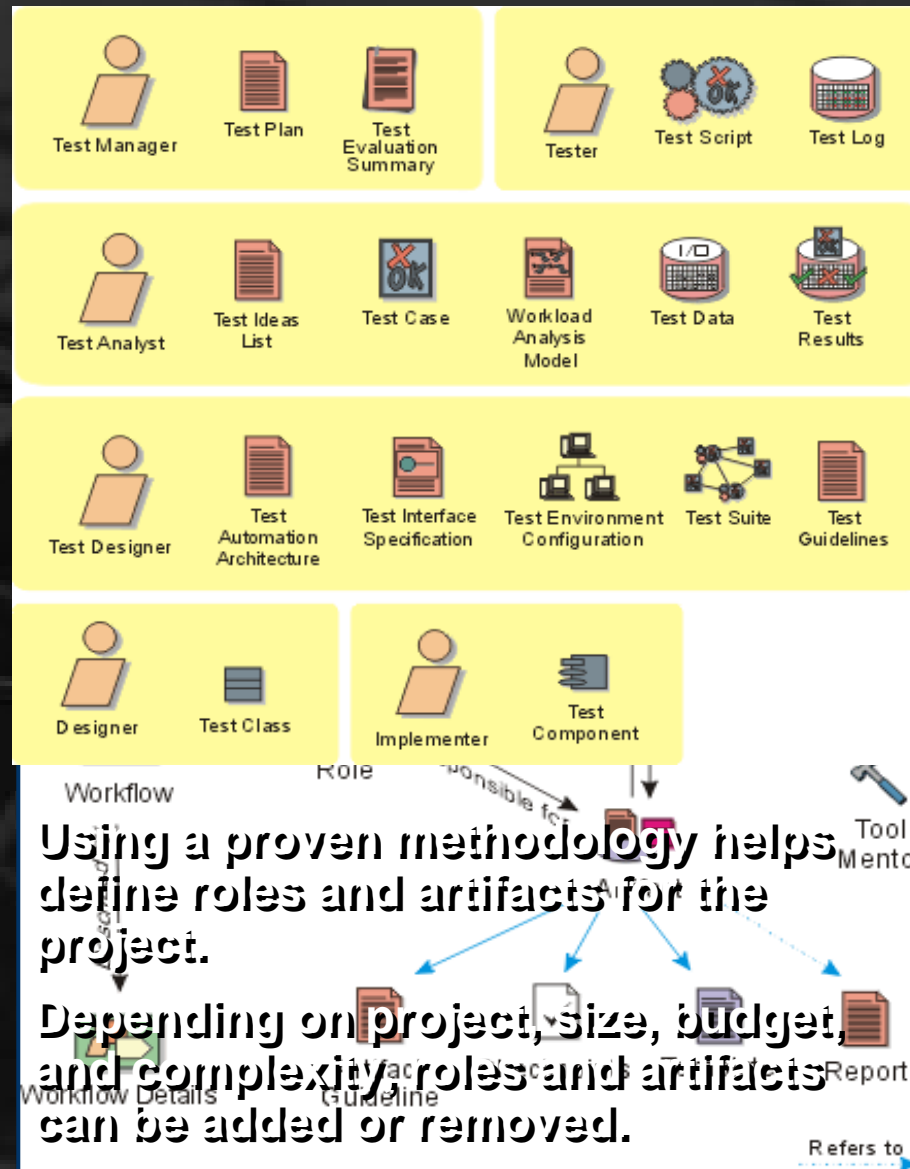


(Route base LRM's are in Red)

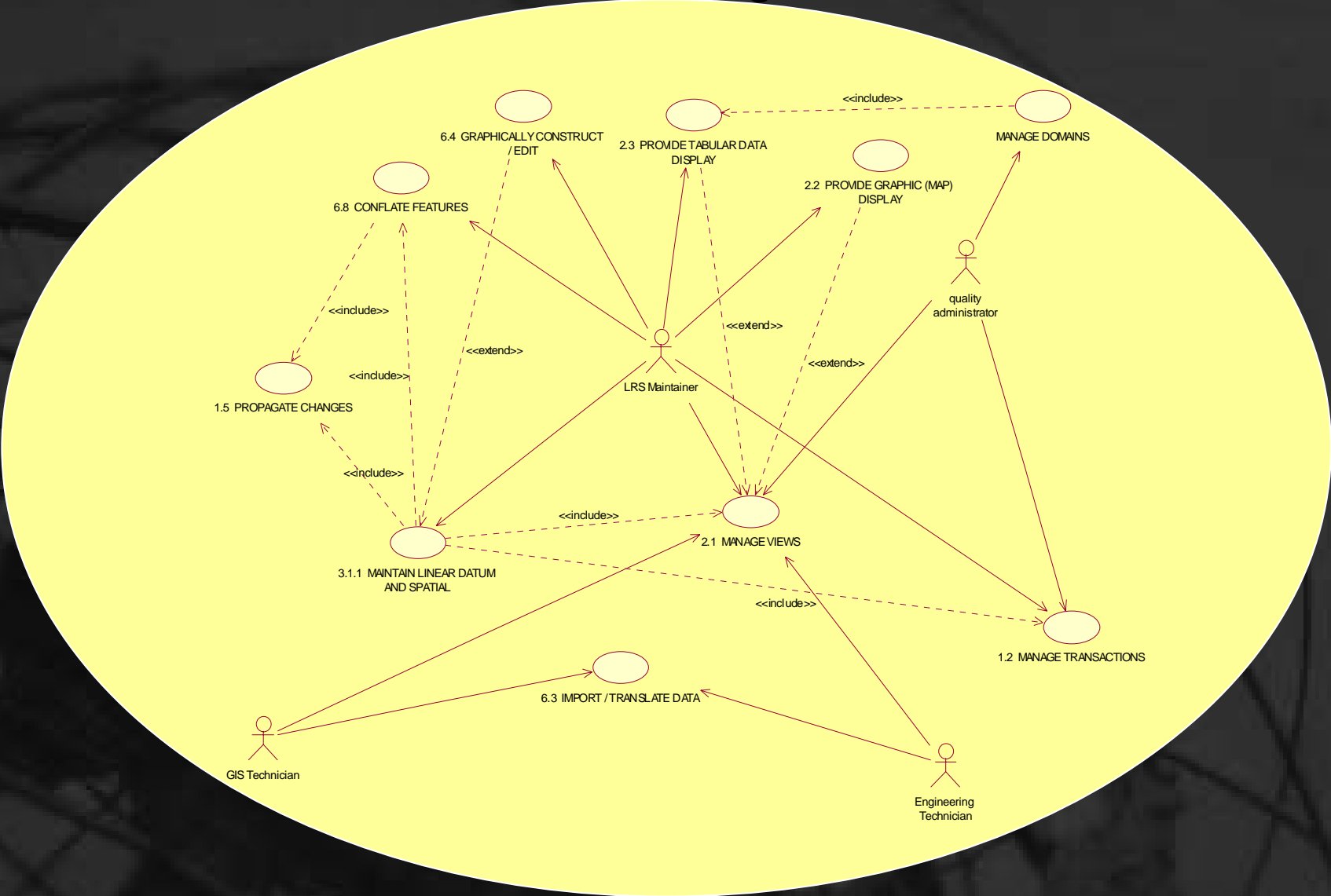
Test Plan: Steps

- 1. *Define Process - Roles, Activities, and Artifacts for Testing***
- 2. *Use-Cases or Workflows***
- 3. *Identify Risks to Mitigate***
- 4. *Build Test Data Content***
- 5. *Risk vs. Test Matrix***
- 6. *Track Results***

Test Plan: Roles, Activities, and Artifacts



Test Plan: Use-Cases and Risk Mitigation



Test Plan: Use-Cases and Risk Mitigation

For the purposes of mitigating risks, the use cases chosen were:

1. Manage Long Term Transactions
2. Maintain Linear Datum & Spatial
3. View Temporality and Database Change

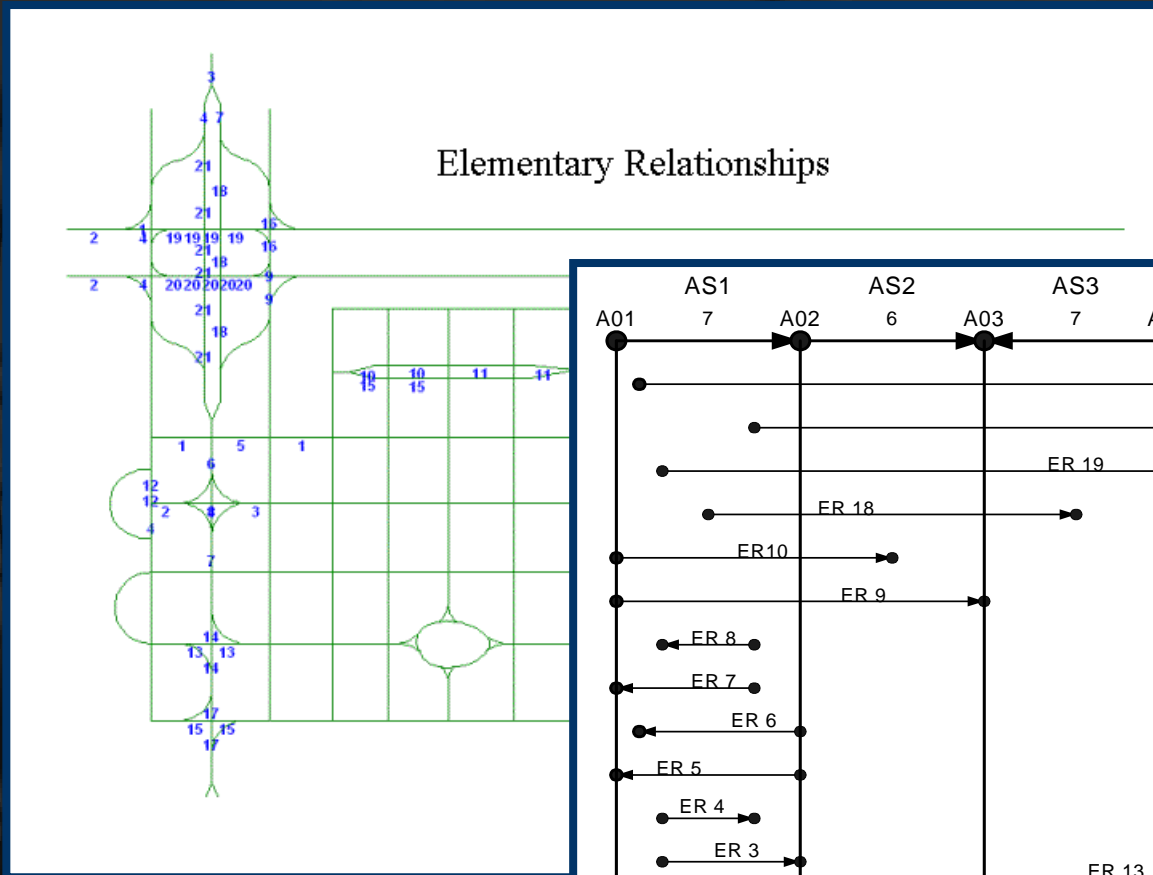
Consequently, the objective of testing is to mitigate the risks related to the high risk use cases.

Test Plan: Test Data Content

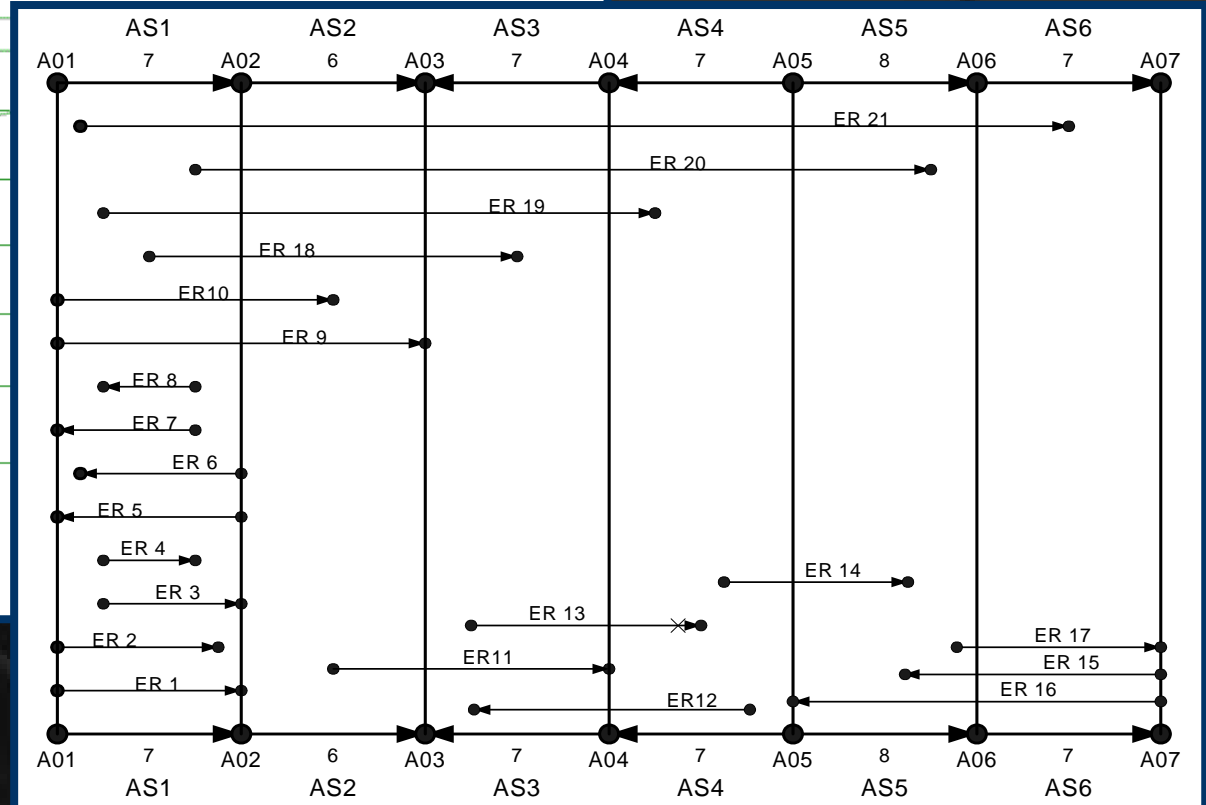
We identified the special case conditions unique to transportation modeling and built them into the data and scripts as **stress**.

1. **Elementary Relationships**
2. **Roadway Configurations**
3. **Temporality**

Test Plan: Test Data Content



Elementary Relationships



Elementary Relationships – (Fletcher, et al)

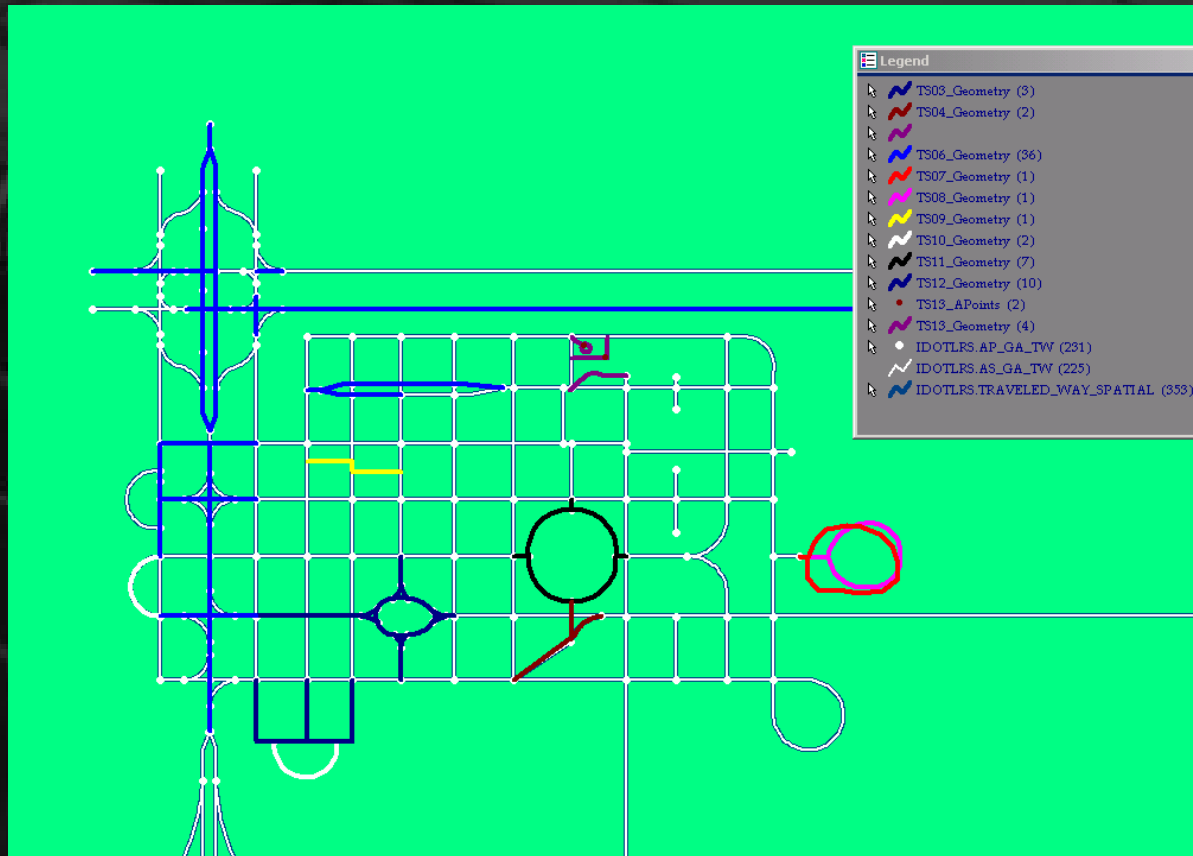
Test Plan: Test Data Content

The areas of stress built into our test data set are:

1. Elementary Relationships
2. **Roadway Configurations**
3. Temporality

Test Plan: Test Data Content

Roadway Configurations – Partially concurrent routes, duplicate routes names, jurisdictional changes, loops, cul-de-sacs.....



Different Roadway Configurations pose different risks to different LRM's and Maintenance Workflows.

Test Plan: Test Data Content

The areas of stress built into our test data set are:

1. Elementary Relationships
2. Roadway Configurations
3. Temporality

Test Plan: Test Data Content

Test Data Temporality - Location Service vs. Maintenance Application Testing

#	Revision Set Name	Tests Conducted			View				
		RS #	Test #	Effective Date	Transaction Type	LRS Change Event Type	Improvement Project Phase	LRS Maintainer (GA)	(IDOT)
1	New Subdivision	TS03	1	June 30, 2003	Add Subdivision	Open to Traffic	US 30 & R070 Multilane – Operations	Scott	Tom
2	Better Geometry	TS04	2	February 15, 2000	Maintain Linear Datum & Spatial	Modify Alternative	US 30 & R070 North Ramp – Engineering	Scott	Eric
3	Future Realignment	TS05	3	August 3, 2004	Add Subdivision	Generate New Alternative	US 30 & R070 South Ramp – Corridor Planning	Scott	Tom
4	Maintain Anchor Section Length	TS06	4	Same as Anchor Section	Maintain Linear Datum & Spatial	Submit Refinement	US 30 & R070 Multilane – Engineering	Scott	Eric
5	Conceptual	TS07	5	May 13, 2000 (end June 29, 2003)	Add Subdivision	Accept Alternative	US 30 & R070 Multilane – Conceptual	Scott	Tom
6	MLDS_RWY_Configs	TS08	6	June 30, 2003	Add Road	Accept Alternative	US 30 & R070 South Ramp – Operations	Scott	Eric
		TS09	6	June 30, 2003				Scott	Tom
		TS10	6	June 30, 2003				Scott	Eric
		TS11	6	June 30, 2003				Scott	Tom
		TS12	6	June 30, 2003				Scott	Eric
7	MLDS Mistakes	TS13	7	June 30, 2003	Maintain Linear Datum & Spatial	Close to Traffic	LRS Initialization	Scott	Eric
8	Manage Domains (secured?)	TS15	8	n/a	Perform Jurisdictional Transfer	Modify Alternative	US 30 & R070 North Ramp – Engineering	Scott	Tom

Identify Test Scripts: Risk vs. Test Matrix

Use-Cases

Manage Long Term Transactions

Maintain Linear Datum & Spatial

View Temporality and Database Change

Stress

1. Elementary Relationships

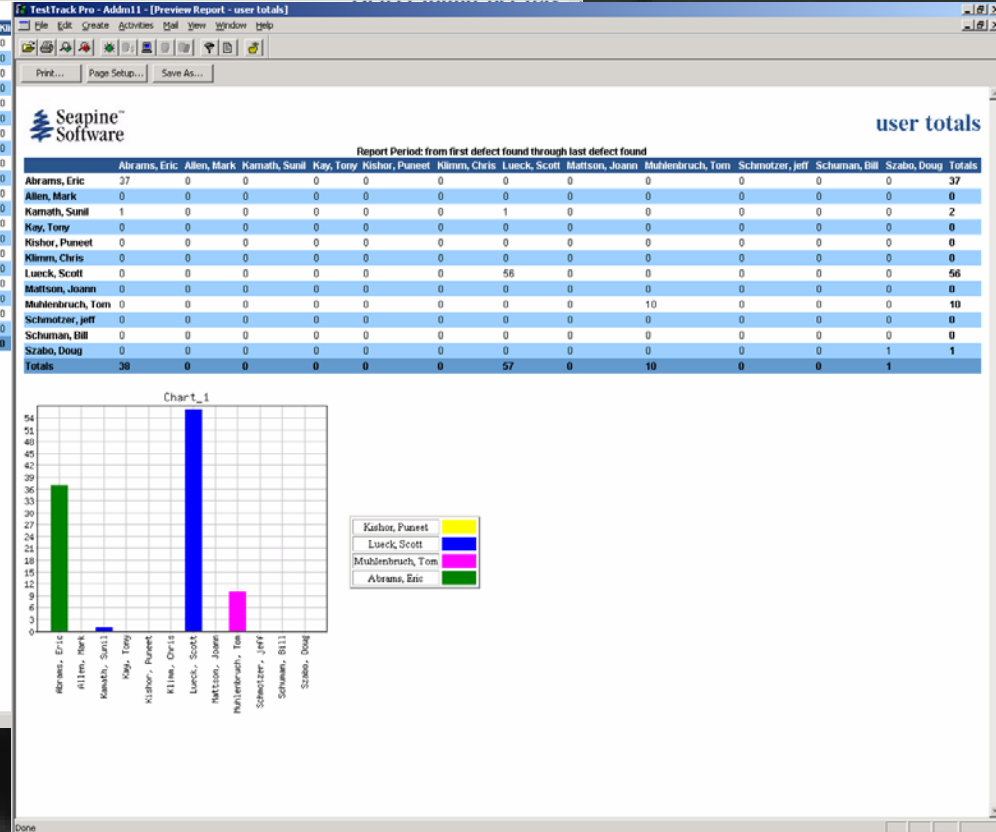
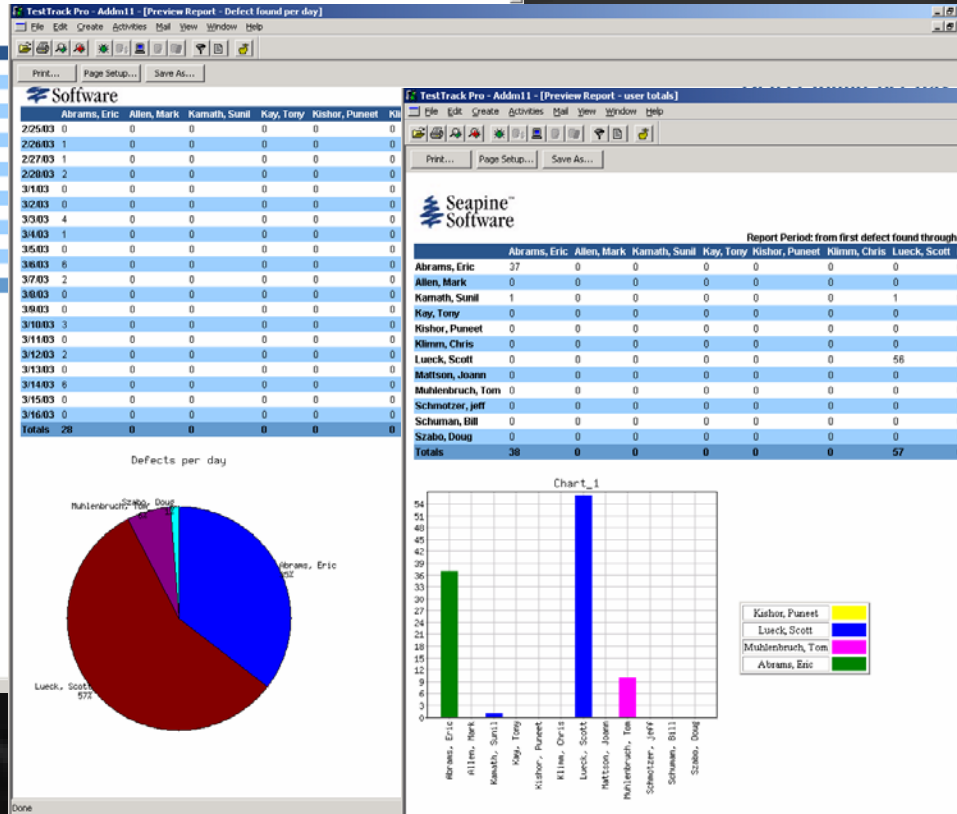
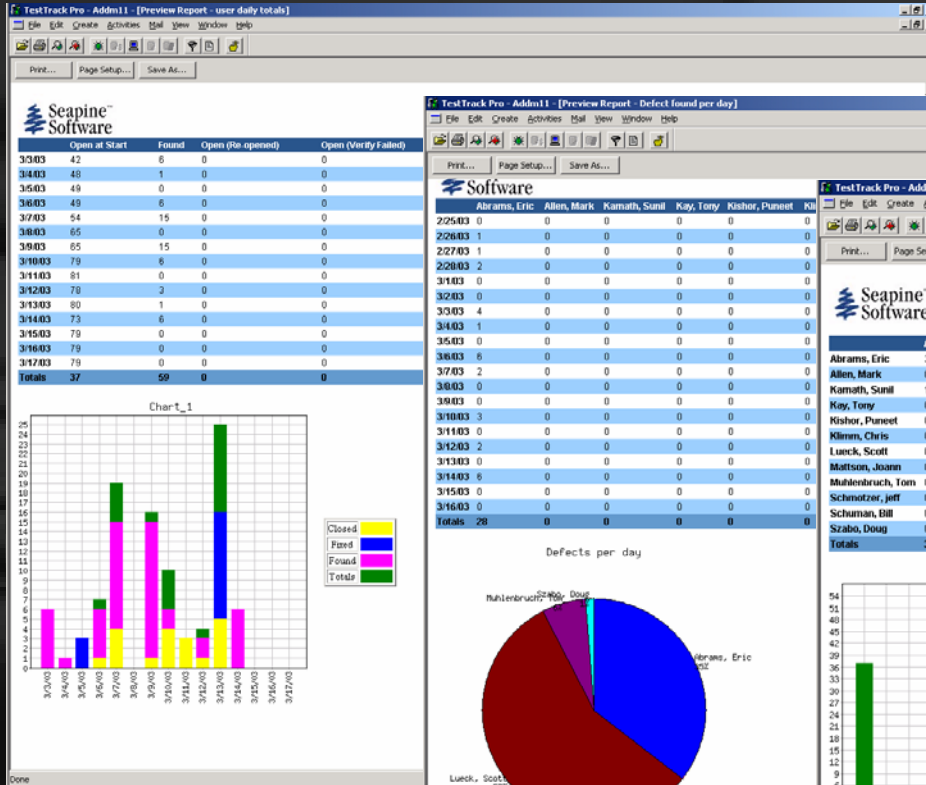
2. Roadway Configurations

3. Temporality

Identify Test Scripts: Risk vs. Test Matrix

Test Scripts ->	Risks		Test Scripts ->																	
	TS01 - Manage Users	TS02 - Manage Transactions	TS03 - Manage Features	TS04 - Manage Maps	TS05 - Manage Groups	TS06 - Manage Reports	TS07 - Manage Domains	TS08 - Manage Domains	TS09 - Manage Domains	TS10 - Manage Domains	TS11 - Manage Domains	TS12 - Manage Domains	TS13 - Manage Domains	TS14 - Manage Domains	TS15 - Manage Domains	TS16 - Manage Domains	TS17 - Manage Domains	TS18 - Manage Domains		
Functional Testing	Detailed Test Scenario	2.1.1 - Set Up Transaction																		
		2.1.2 - Add TIME from New Source																		
		2.1.3 - Add Anchor Point																		
		2.1.4 - Edit TIME																		
		2.1.5 - Edit Anchor Point Feature																		
		2.1.6 - Edit Anchor Section Feature																		
		2.2.2 - Delete LRS Features																		
		2.1.11 - Commit Data																		
		2.2.5 - Anchor Section Length																		
		2.2.6 - Alter Condition Precedence																		
		Change Matrix	2.1.1 - Set Map Windows																	
			2.1.2 - Set Data Windows																	
			2.1.3 - Link Map Data Windows																	
			2.1.4 - Set Filter Temporal Display																	
			2.1.5 - Show Other Transactions																	
	2.1.6 - Show News																			
	2.2.3 - Create Default GWS Templates																			
	2.2.2 - Modify Default GWS Templates																			
	2.2.3 - Create Reunion Set																			
	2.1.1 - Activate Reunion Set																			
	2.1.2 - Validate Reunion Set Data																			
	2.1.3 - Close/Re-Use GWS																			
	2.1.4 - Commit Reunion Set																			
	2.1.X - Discard a Reunion Set																			
	2.2.1 - Change Default Group Settings																			
	2.2.2 - Show Other Transactions																			
	2.2.4 - Main Map Transaction Domain																			
	2.2.5 - Main Map Measurement Methods																			
	2.2.9 - Create ReunionSet Type																			
	2.2.7 - Modify ReunionSet Type Defaults																			
	2.2.8 - Start Transaction without Reunion Set																			
	2.2.9 - Change Maintenance State																			
	Change Scenario	2.2.1 - Re-use a Domain Value																		
		2.2.2 - Correction Error																		
		2.2.3 - Modify Domain Value																		
Business Cycle Testing	37 - Feature Life cycle - Conceptual (Pre-landscapes)																			
	37 - Feature Life cycle - Construction																			
	38 - Feature Life cycle - Operations																			
	38 - Feature Life cycle - Retired																			
Business Cycle Testing	Recovery Config	39 - Loop																		
		39 - Short circuit modes																		
		39 - Horseshoe Roads																		
		39 - Circular Road																		
	Map and Change Management	40 - Rotary Intersection																		
		Set database view as historic and real world view as historic. (Historic Reunion Set)																		
		Set database view to historic and real world view to present/future																		
		Show future state and pending change s.																		
Change Matrix	41 - Show ability to query when and why change occurred																			
	41 - Show the ability to capture and report database history.																			
	41 - Show the ability to capture and report LRS metadata																			
	41 - Ability to capture and query evolution. Create future and pending features.																			
Change Matrix	42 - User Interface Testing																			
	42 - Performance Profiling																			
	42 - Recovery Testing																			

Developing a Test Plan: Mitigate Risks



Bug Tracking – Defect Status by Day

Bug Tracking – Found

Bug Tracking Database – Defect status by “Assigned To”

Test Results: A Look at the IDOT LRS – Test Build 1

Lets Look at:

Maintain Linear Datum

Long Term Transaction Management

Temporal Filters (System and Real World)

Conclusion: Around the Corner

Thanks for Listening !!!

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