Florida DOT - Enterprise GIS
Establishing a Business Case

presented at
GIS for Transportation Symposium

presented by
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Presentation Outline

- **Background**

- **Project Tasks – Approaches and Results**

- **Recommended FDOT Enterprise GIS approach**

- **Success Factors**

- **Strategic Plan**

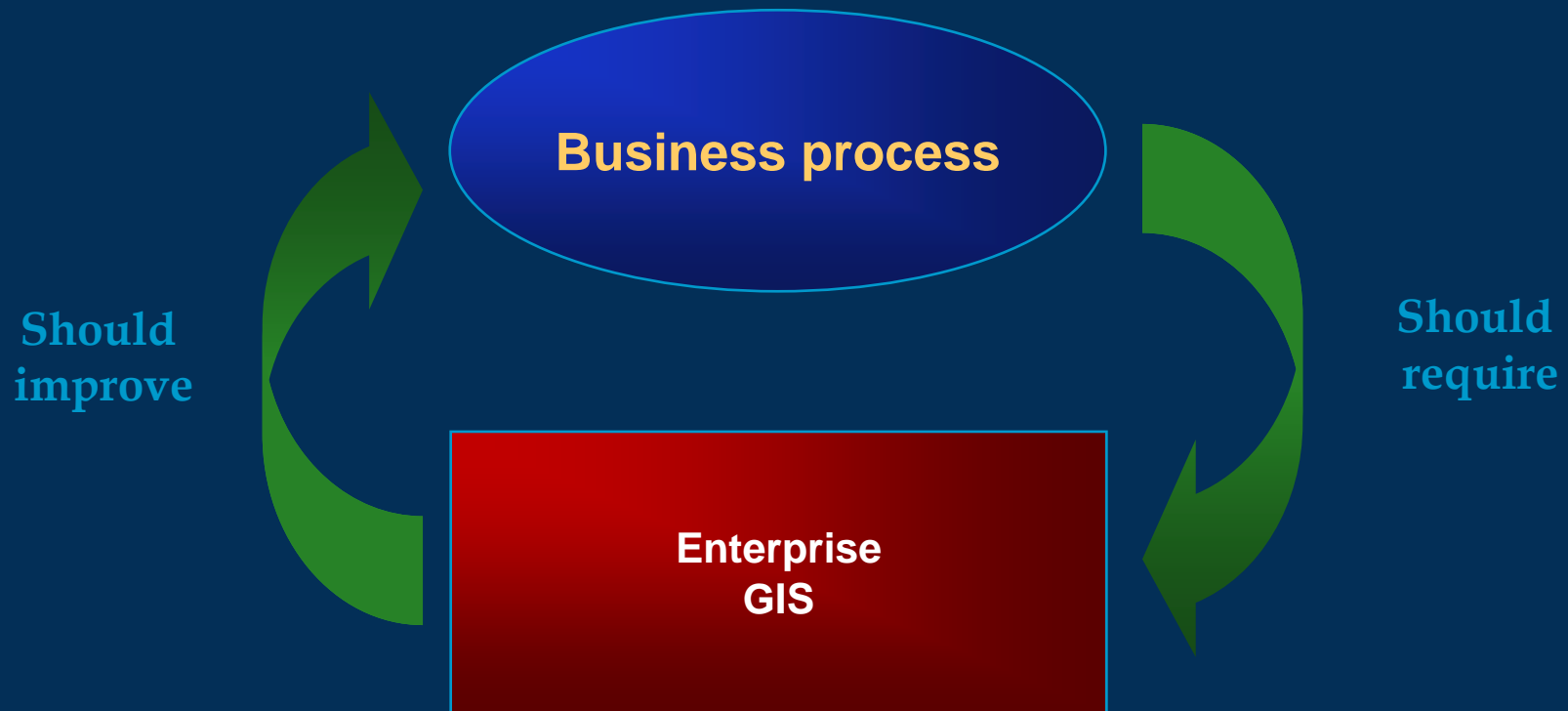- **Conclusions**

- **Next Steps**

Background

- **Major business processes require spatial information**

- **Varying Central office and district needs led to creation of multiple localized databases and applications**

- **Fractured GIS with little integration of information across functional areas and jurisdictions**

- **Perceived need for integrated and standardized GIS implementation**
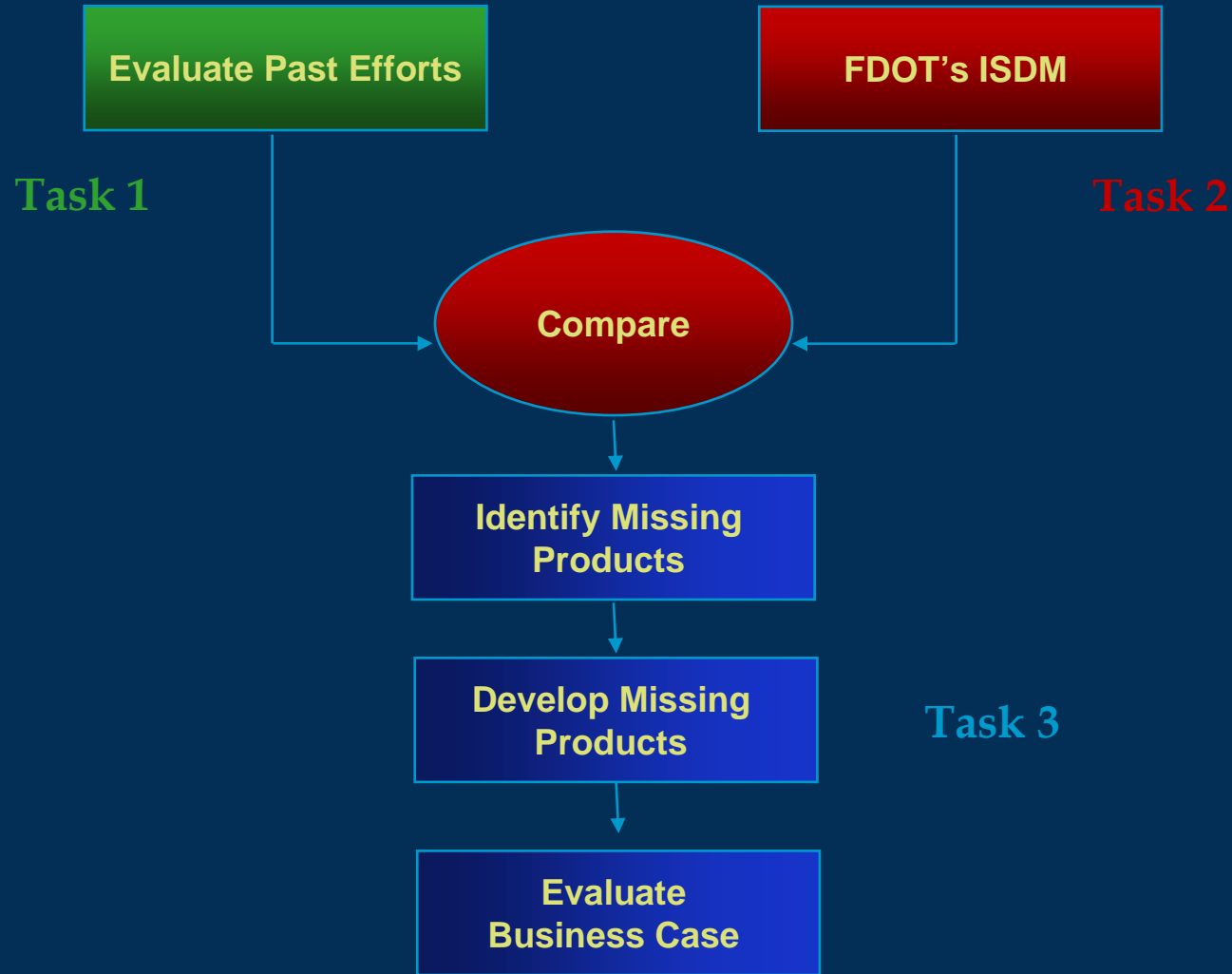
Implementation Phases

- **Phase 1 - Evaluate business case to determine whether to proceed with implementation of Enterprise GIS**

- **Phase 2 – Formulate pilots and develop implementation plan detailing steps for successful implementation of Enterprise GIS**

- **Phase 3 – Implement Enterprise GIS along with documented procedures and policies**

What is a Business Case?

- **Business needs should justify investment**

Business process

Should improve

Should require

Enterprise GIS

Project Methodology

Evaluate Past Efforts

FDOT's ISDM

Task 1

Task 2

Compare

Identify Missing Products

Develop Missing Products

Task 3

Evaluate Business Case

Task 1
Evaluate Past Efforts

- **Objective**
  - Assemble and review past FDOT literature/projects pertinent to concept of Enterprise GIS

- **Focus on**
  - **All past, present and proposed efforts involving Enterprise GIS, data coordination/stewardship between multiple functional areas**
  - **Reports, databases and applications**

- **Compiled using**
  - **Assistance from State GIS coordinator, GIS Functional Steering Committee, and FDOT web search**

Task 1
Literature Review

- Compiled approximately **60** projects/reports

- **Four** categories

  - **Category 1**
    - Projects that meet objectives of the research - related to Information System Development Methodology (ISDM) components

  - **Category 2**
    - Reference materials for current research and subsequent phases

  - **Category 3**
    - Applications that serve multiple functional areas or databases

  - **Category 4**
    - Other localized applications and research that do not fit into framework of Enterprise GIS

Task 1
Preliminary Observations

- Emphasis on the need for enterprise data sharing and coordination

- Recurring efforts between 1995 – 2007 - These efforts are now **occurring more prominently at district level.** Dominant localized development of applications

- Several projects are **application oriented** rather than **process oriented**

- The **definition of Enterprise GIS as it applies to FDOT** is inconsistent

- Software and hardware requirements in past studies are clearly **out of date**

- Indicate **need for a standardized base map** as a mechanism of exchange of information

- **Organizational structure and importance of institutional framework** was emphasized as critical for success in FDOT

- Stakeholder involvement has been limited

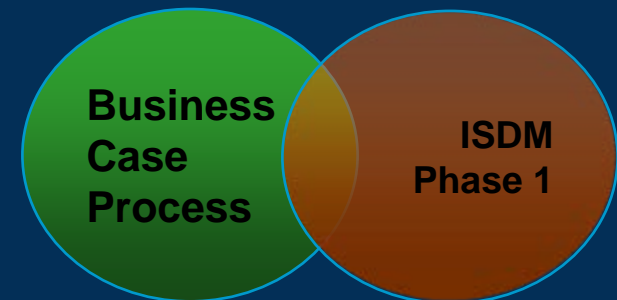# Task 2
Review Past Efforts Against ISDM

- **What is ISDM?**

  - **FDOT's Information Systems Development Methodology**

  - **Provides standardized structured process for application development**
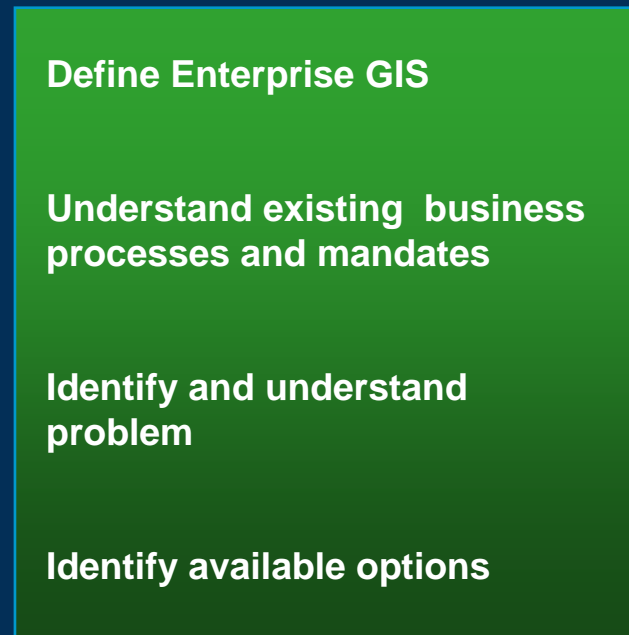
- **Current Phases in ISDM**

  - **Phase I: Identification and Assessment**
  - **Phase II: Planning**
  - **Phase III: User Requirement Analysis**
  - **Phase IV: System Design**
  - **Phase V: Construction**
  - **Phase VI: Implementation and**
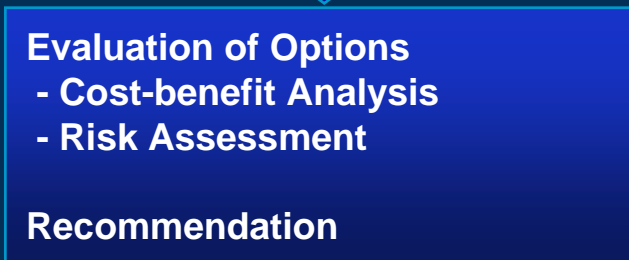 - **Phase VII: Production and System Maintenance**

Business Case Process — **ISDM Phase 1**

Task 2
Business Case Components

Define Enterprise GIS

Understand existing business processes and mandates

Identify and understand problem

Identify available options

ISDM – Phase 1

Evaluation of Options
- Cost-benefit Analysis
- Risk Assessment

Recommendation

Task 2
Evaluation of Past Efforts

Table 3.1   Summary Reference Matrix

Components for Establishing Business Case	GRIP - Georeferenced Information Portal	PAI reports	GIS-T Strategic Plan, Mission, Vision	FDOT Business Plans	A New Database Framework for Florida's Transportation Planning: Integrating Work Program, Multimodal Transportation Networks, Planning and Environmental Databases
1 Define Enterprise GIS	◗		◗		
2 Gather User needs, Requirements and Processes					
Business	◗	◗	◖	●	◗
Data	◗	◗			
Financial (sources and amounts)		◗			
Technology and Architecture	◕	◗			
3 Identification and Understanding of the Problem					
Business	◗	◗			●
Data	◕	◗			◗
Financial					
Technology and Architecture					
4 Identify Available Options					

◕ - Document refers to the product but cannot be used

◗ - Material is appropriate to the product but has to be updated/reviewed or supplemented

● - Material is appropriate to the product and can be used directly

Task 2
Identified Missing Products

- **Definition of Enterprise GIS as it applies to FDOT**

- **Business needs assessment**

- **Understanding of the problem**

- **Evaluation of the available options (ISDM – Phase 1)**

- **FDOT specific success factors (ISDM – Phase 1)**

Task 3
Business Needs Assessment

- **Past studies**
  - Different functional areas with varying objectives
  - Need to tie them together

- **Conducted stakeholder interviews to**
  - Understand their **business mandates**
  - Understand the **enterprise data flows** required by those mandates
  - Understand how **Enterprise GIS can assist in complementing** such data flows
  - Understand stakeholder **perspectives on Enterprise GIS**

Task 3
Stakeholder Interviews

- **Central Office**
  - **Planning**
    - Systems, Statistics and Environmental Management
  - **Design**
    - Roadway Design, Estimates, Engineering/CADD, Structures and Surveying and Mapping
  - **Maintenance**
  - **Construction**
  - **Materials**
  - **Performance measures**
  - **Traffic Engineering and Operations Office – ITS Office**
  - **Office of Information Systems**

- **Sample District (District 4)**
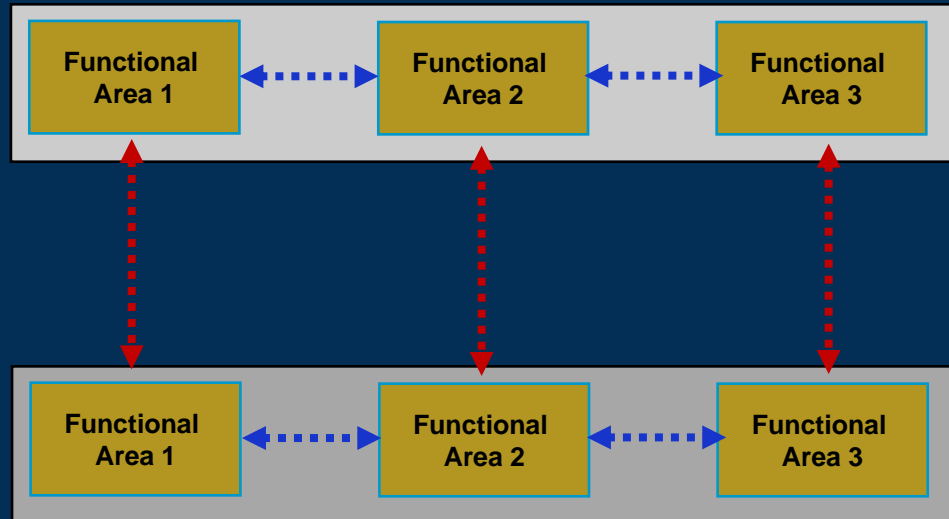 - **GIS Coordinator, Planning, Design, Maintenance and Construction**

Task 3
Data Flow Mapping

- **Data Flow Maps**
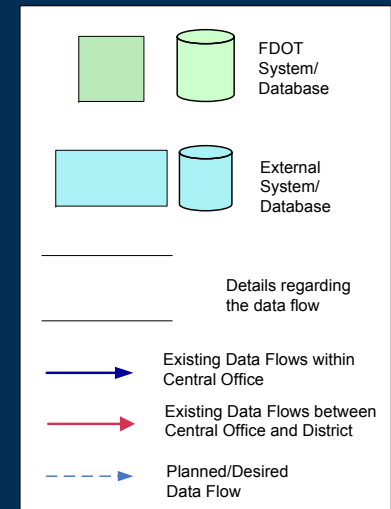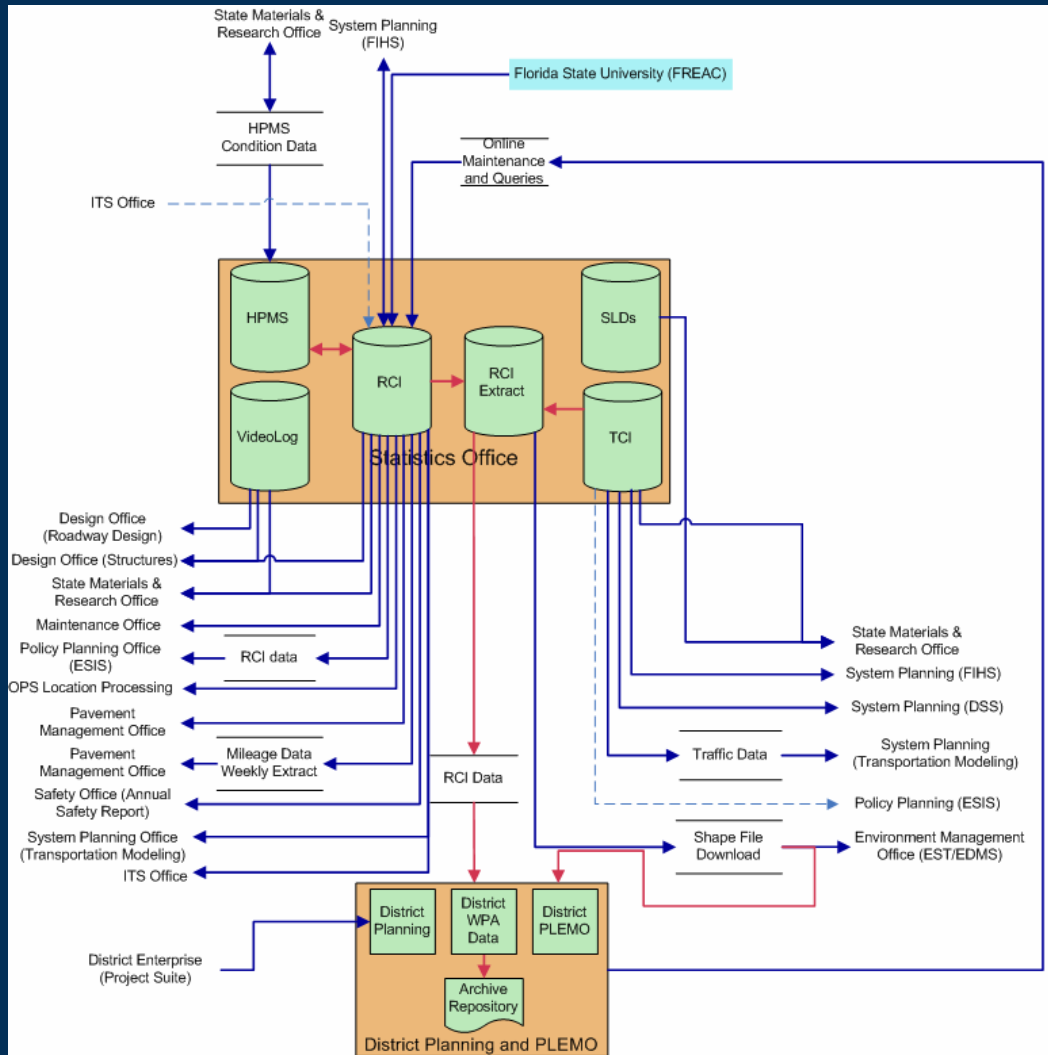 - **Visual representation of enterprise data flows**

- **Enterprise Data Flows**

Central Office

Functional Area 1	◄┈┈►	Functional Area 2	◄┈┈►	Functional Area 3

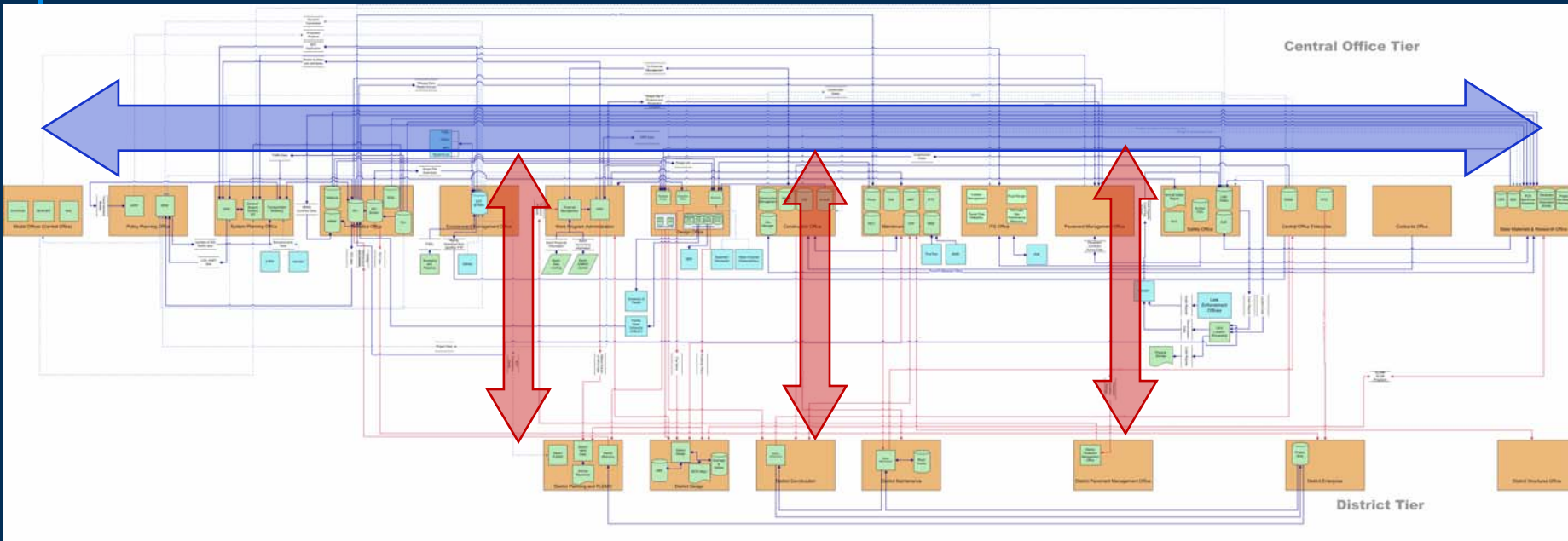| Functional Area 1	◄┈┈►	Functional Area 2	◄┈┈►	Functional Area 3

Districts

Task 3
Department wide Data Flow Map

Task 3
Business Needs Assessment

- **Observations from data flow maps**

  - Several CO→CO and CO→District spatial data flows

  - Several inter-departmental data flows are based on **informal methods of sharing**

  - **No specific standards** for collecting, sharing or representing spatial data within the Department

  - **Several desired data flows/processes** cannot be accommodated through existing framework

  - **Multiple sources of similar datasets** with no formal coordination

  - Several **data flows involve existing enterprise databases**

  - **No single reliable source** for common data layers

  - Offices that are not currently using GIS could **benefit from incorporating GIS** into their processes

Task 3
Problem Identification

- **Different data needs and applications**
  - Across organizational units, functional areas and districts

- **Legacy databases and data collection practices**
  - Data collection and storage protocols based on requirements of an individual unit

- **Need of formal coordination of key common data** used by both districts and Central office
  - Several versions from several sources – varying accuracies and scales

- **Need of clear organizational home** for Enterprise GIS staff
  - Pseudo structure through GIS Coordinators and Steering Committees

- **No standard location ID for tracking projects**
  - From planning through construction and maintenance

Task 3
Problem Identification (Cont.)

- **No formal spatial data standards (projections, scale, resolution, accuracy, attribution, security and documentation)**
  - Current standards focus on application development
  - Inconsistent data quality, geographic scale and accuracy
  - Inconsistent feature resolution (e.g., representing an interchange as a single node vs. showing all ramps)

- **Fundamental differences in GIS vs. CAD data models**
  - GIS as a geo-repository for CAD drawings
  - Lack of interoperability standards

- **Difficulty sharing data with external partners**
  - Beyond FDOT firewall

Task 3
Define FDOT Enterprise GIS

- **Inconsistent definition of term**
  - **Ranges from 'one central foundation' to 'no standards or protocols'**

- **Inconsistent perception of the concept**
  - **Monstrous database vs. utopian idea**

- **Defined as**
  - " Enterprise Geographic Information Systems (GIS) is an organization-wide framework for Department communication and collaboration of shared geospatial data and GIS resources that enhances existing business processes and provides an efficient way to plan, analyze, and manage transportation infrastructure and related elements. "

Task 3
Define FDOT Enterprise GIS

- Terminology defined

  - Framework
    - Institutional and technical

  - Communication and collaboration
    - Communication and collaborate across functional areas

  - Shared GIS
    - GIS datasets, i.e., Unified Basemap, local data warehouses and applications

  - Structured Integration
    - Develop and deploy EGIS using systematic design stages

  - GIS Components
    - Data, hardware, software, procedures and personnel

  - Complements existing business process
    - Adds value to existing processes

Task 3
Define FDOT Enterprise GIS

- ## Characteristics

  - Standards Driven

  - Interoperable Technologies

  - Integrated and Shared GIS Datasets and Functionality

  - Supports cross-departmental, multipurpose operations and business critical systems

  - Comprehensive governance structure ensures data consistency, quality, and reliability

  - Sustainable institutional framework to provide resource support

  - Comprehensive metadata for enterprise GIS layers

  - Extensible and scalable design to facilitate adding departments, users, groups at various levels of government as well as the public

  - Supports visualization, analysis, and decision-making

  - Contains tools to support data download, mapping, querying, and reporting
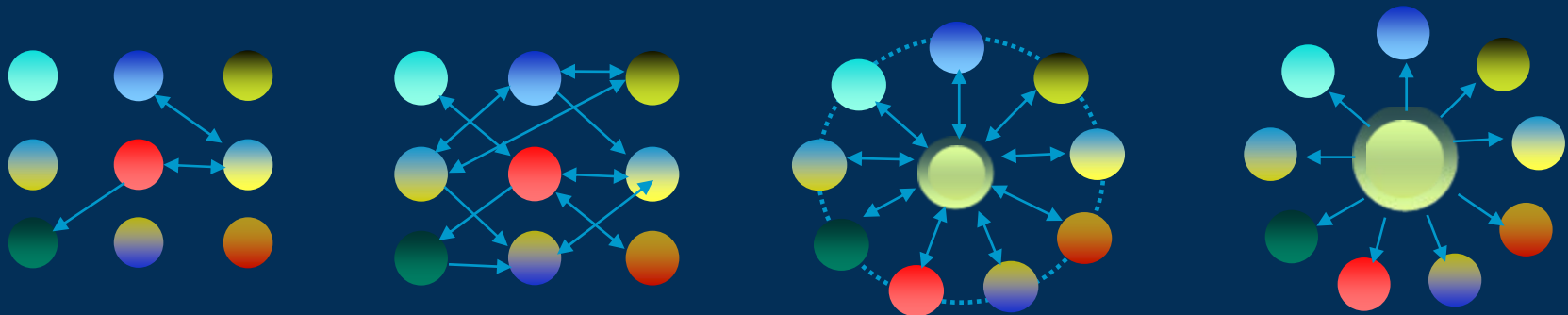
- ## Several implementation options

Task 3
Enterprise GIS Implementation Options

- **Option 1 -** No Build Case: status quo

- **Option 2 -** Pseudo-Enterprise GIS: ad-hoc data sharing

- **Option 3 -** Enterprise GIS: Distributed data storage with enterprise standards

- **Option 4 -** Enterprise GIS: Centralized data repository

Task 3
Characteristics of Four Options

	Option 1 Status Quo	Option 2 Pseudo	Option 3 Distributed	Option 4 Centralized
Data Standards	No	Some	Yes	Yes
Data Sharing Rule Enforcement	Individual working relationships	Up to individual users to follow rules	Contact Data Owner for data	Direct data access
Data Stewardship and Responsibility	Data owner's responsibility	Data Owner's responsibility	Some remains in stewardship with owners; others centrally managed	Central management
Data Sharing Mechanism	Based on individual working relationships	Ad Hoc data sharing	Metadata clearing house & data warehouse	Central data repository

Task 3
Methodology for Option Evaluation

- **Cost-Benefit Analysis**

  - Identifying costs by time period

  - Calculating benefits by time period

  - Comparing costs and benefits

  - Calculating cost-benefit ratios

- **Risk Analysis**

  - Identify types of risks

  - Discuss risk elements

  - Describe mitigating factors

  - Score likelihood and seriousness of risk

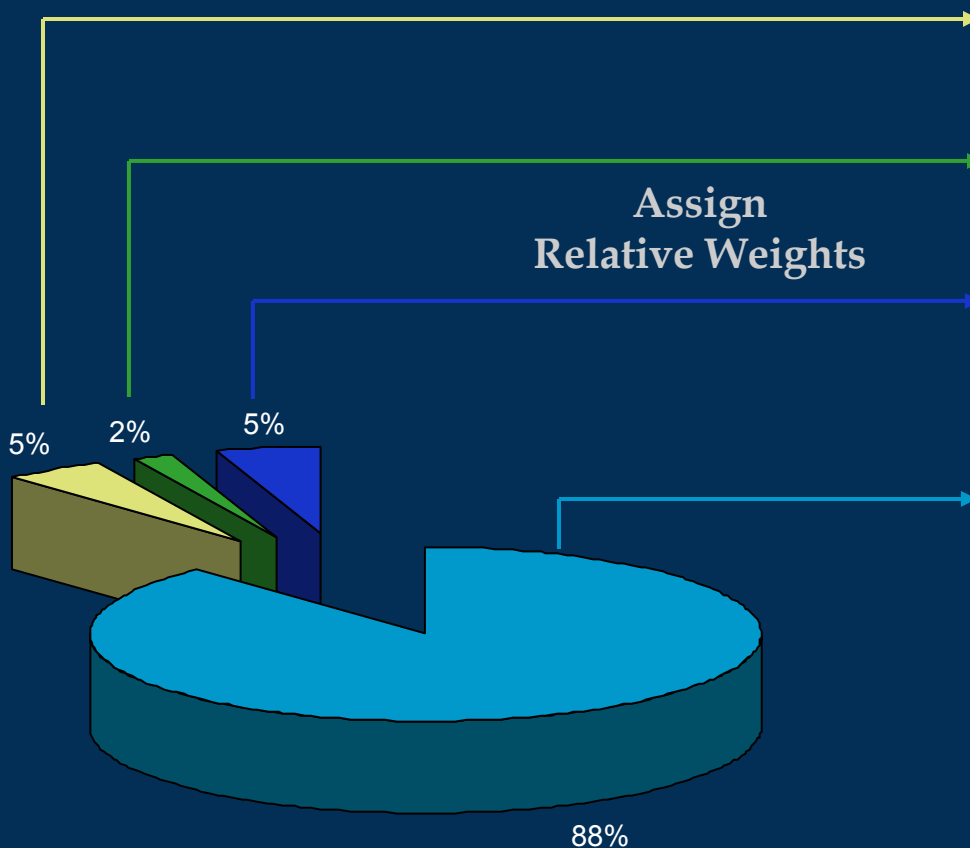 - Summarize score to evaluate overall risk

Task 3
Calculating Costs

COSTS

- **Hardware/Software/ Infrastructure**

- **Training**

- **Application programming**

- **Data**

Assign Relative Weights

5% 2% 5%

88%

Typical Transportation Agency's GIS Spending
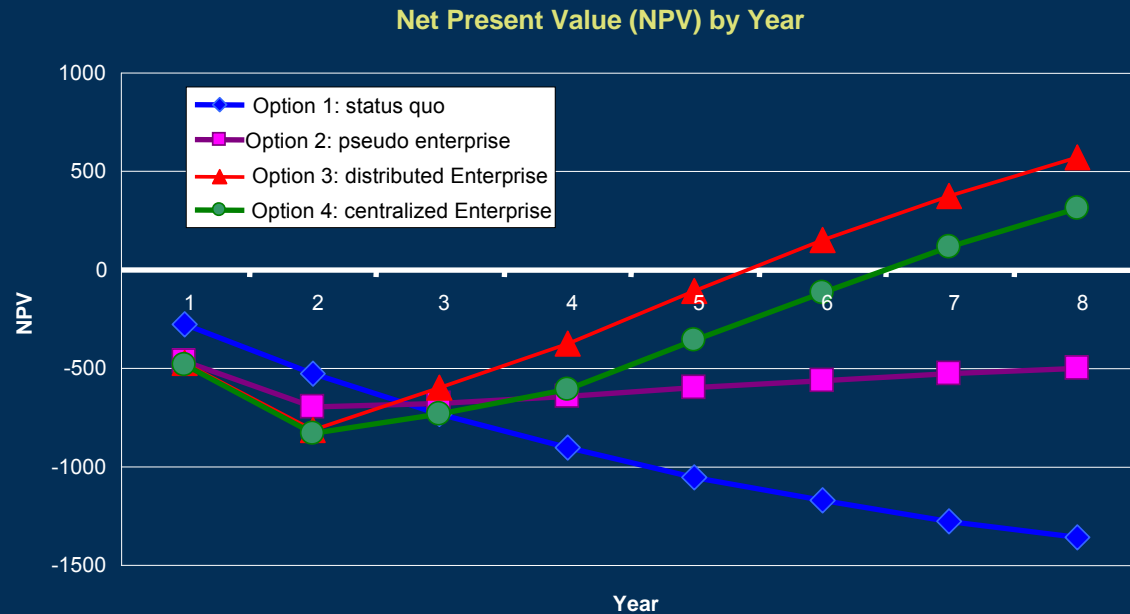
Calculating Benefits

BENEFITS

- **Organizational**
  - **Improve efficiency**
  - **Improve productivity**
  - **Enhance decision making**

- **Savings**
  - **Reduction in workload**
  - **Elimination of redundant expenditures**

- **External Benefits**

Task 3
Calculating Net Present Value

Net Present Value (NPV) by Year

- **Options 1 and 2 provide limited benefits**
  - Unlikely to exceed additional costs associated with approach

- **Options 3 and 4 will eventually provide a positive benefit**
  - Once the initial costs are recovered

Task 3
Risk Assessment - Define Risks

- **Financial**

  - Is the implementation adequately funded?

  - What is the implied cost of failure?

- **Organizational**

  - How are data ownership issues addressed?

  - Does implementation have managerial/user support?

  - Can user have immediate access to other people's data?

- **Project**

  - How complex is the implementation?

  - Is the project well defined?

Task 3
Risk Assessment - Define Risks

- **Project (cont.)**

  - Are proven methods being used?

  - Is there built-in accountability and quality control?

  - Can it be completed on schedule and within budget?

- **Technical**

  - Is implementation technically feasible?

  - Is there data consistency across all of the databases?

  - Will existing applications be compatible?

  - Will the existing network infrastructure be sufficient?

  - Are there constraints regarding use of the Enterprise GIS?

 - Does the existing staff have the knowledge to support it?

Risk Assessment Matrix

Risk	Description	Impact(s)	Relative Impact	Probabilty for Each Option				Mitigation Strategy
				Option 1	Option 2	Option 3	Option 4	
Financial								
Funding	Is there sufficient funding? Have all the costs been assessed?	Implementation may not be completed within defined cost	3	1	2	4	5	Increase funding; Reduce functionality.
Negative benefits	What if continued investement would yeild no benefits or negative benefts	investment be wasted	4	5	4	2	1	Improved strategic planning
Risk of Failure	What is the implication of not completing the project?	Investment in the project may be partially or totally lost	3	1	2	3	4	Document implications of failure and explain to stakeholders
Organizational								
Loss of Ownership	Data stewards my feel that they are losing ownership of data	Stewards may oppose implementation	5	0	1	3	5	Write agreements to formalize data ownership
Stakeholder Not Buy-In	Does the implementation have managerial/user support?	Without buy-in, stakeholders will not be committed to the implementation	4	1	3	3	2	Early and continual involvement of stakeholders;Stakeholders sign-off on major decisions and at milestones.
Stagnation	Does the Enterprise GIS provide opportunity for innovation?	No development or innovation is undertaken;Databases are not maintained and used.	2	5	4	3	3	Promote benefits of Enterprise GIS;Implement Option 3 or 4.
Failure to follow standards		Data will not be maintained at required standards	3	5	4	3	2	Fully document standards that need to be followed;Setup mechanism to enforce standards.
Database Knowledge	Knowledge regarding the data contained within the database is only known to a few individuals, and may be lost when individuals leave	Hard to determine data that is available	4	4	4	2	1	Fully document database designs, including metadata; Train individuals to expand database knowledge.
Data Access	Can user access data when it is needed?	Cannot access data owned by other people	4	5	4	2	1	Centralize data that is commonly being utilized across functional areas or district offices

Conclusions from Risk Assessment
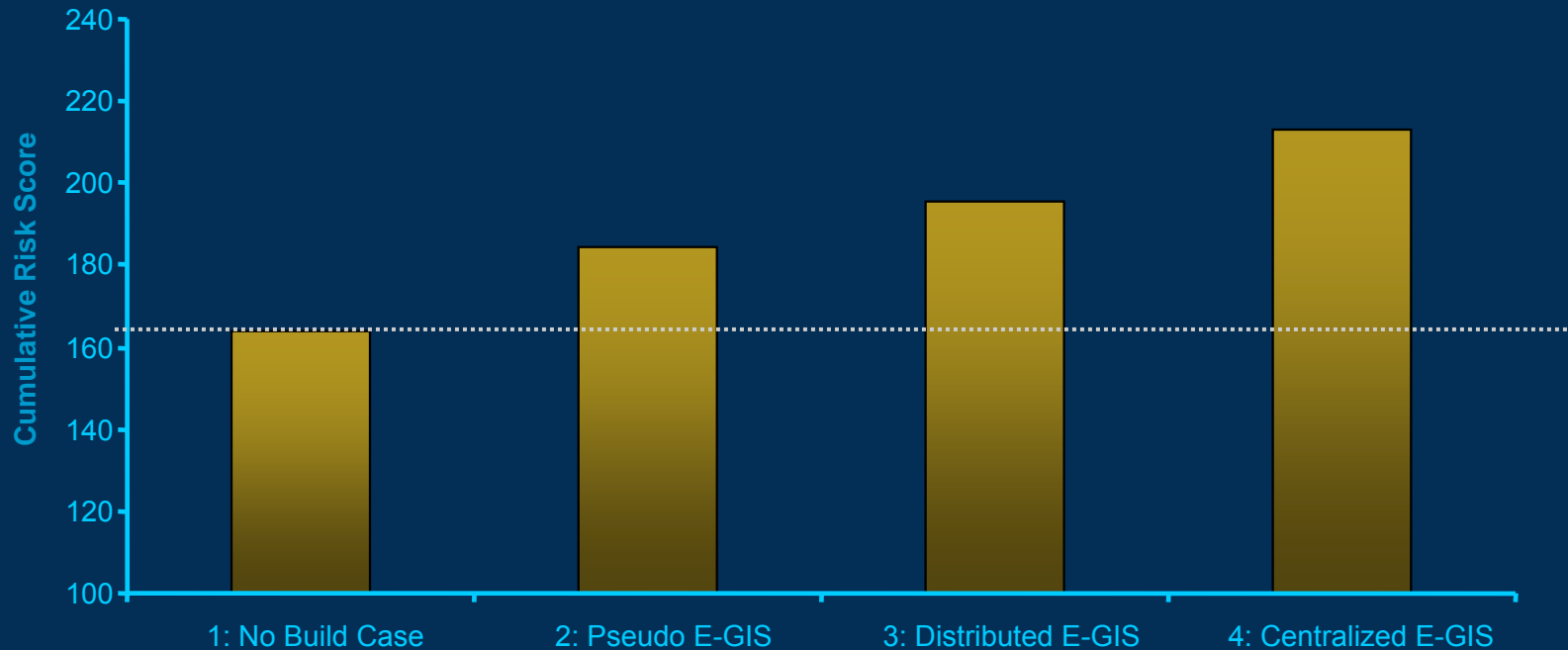
- **Risks associated with all options including no-build**

- **Increase from one option to another is not significantly high**

Recommendation – Option 3

- Data can still be **centrally accessible** in an enterprise environment while allowing for **distributed ownership and maintenance of data**

    - Lower impact of implementation on the organization

    - Will not require much changes to existing business process

- Expected Organizational Roles

    - **IT Services:** continue to deliver and maintain DOT wide GIS solutions with department based solutions;

    - **The GIS Steering Committee:** provides oversight to enable the long term growth of the Enterprise GIS;

    - **The GIS Coordinator:** oversees the overall professional direction and enterprise GIS project work and management

Success Factors

- Clear **definition** of the initiative

- Establishing **project champion**

- Acquiring **sustained** management and stakeholder **support**

- Building channels for **good communication**

- Establishing clear **designation of data stewardship**

- Choosing the **right technology** and building the **right team**

- Start with small, easily accomplished **tasks**

- Think proactively about **organizational structure and the institutional support** for GIS

Strategic Plan

- **Current plan being updated to include measurable objectives**

- <u>**Vision:**</u>
  - GIS is the standard method of providing useful and usable information by the year 2010.

- <u>**Mission:**</u>
  - Promote and ensure consistent and efficient use of GIS

- <u>**Goals:**</u>
  1. Establish a Statewide Clearinghouse of GIS Applications and Data
  2. Minimize duplication and maximize uniformity of GIS data
  3. Establish clear and formal lines of communication within the FDOT GIS Community
  4. Define criteria and requirements for Local, Enterprise and External (Internet) GIS
  5. Establish a GIS Training and Support Program
  6. Leverage Department and Statewide Resources to drive efficiencies
  7. Establish a Data Stewardship Model for FODT

Conclusions

- **Past efforts and current research re-emphasize the need for formal integration of systems and processes**

- **Continued investment in existing processes would lead to increased inefficiencies and negative benefits**

- **Distributed Enterprise GIS implementation was identified as the most beneficial option with moderate risk**

- **Emphasized the need for strong management support and stakeholder involvement**

Next Steps

- **Obtain approval from Functional and Management Steering Committees**

  - Adopt a common definition of an Enterprise GIS

  - Proceed with Recommended Enterprise GIS Implementation Option

  - Develop an updated Strategic Plan

- **Present recommendations to Executive Committee for approval**

- **Proceed with subsequent phases**

Questions/Comments

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