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A.M.I.S. and the Partitioning of Preference

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A.M.I.S.* and the Partitioning of Preference

***Analytic Minimum Impedance Surface**

PPGIS Conference
July 20, 2003
Portland State University
Portland, Oregon

Dr. Ted Grossardt
Community Transportation Innovation Academy
University of Kentucky Transportation Center
Lexington Kentucky

Partners

- **Dr. Keiron Bailey, University of Arizona**
– Preference Modeling
- **Joel Brumm, University of Kentucky**
– GIS Data Processing and Modeling
- **John Ripy, University of Kentucky**
– Internet Tools and Interface Designs
- **Dr. Len O'Connell, University of Kentucky**
– National Environmental Protection Act (NEPA)

Highway Planning and Design Process

PLANNING DIVISION

- ID Potential Area (Bypass, New Connector)
- ID and Map Potential Landscape Issues
- Define Potential Corridors (1000 ft. wide or more)
- Test at Public Meeting
- Revise, Repeat
- Hand Corridors to Design Division with

DESIGN DIVISION

- Determines Purpose and Need for Road
- Determines Alignment within Corridor
- Negotiates for Right of Way, Utilities
- Does EIS
- Negotiates Mitigation
- Lets Project for Bid by Highway Contractors

“Silent” Partners

CONSULTING FIRMS

- May Perform Many Planning Functions
- Have Their Own Culture and Identity
- Public Participation Defined by Law
- Legal Responsibility Still Adheres to State

RESOURCE AGENCIES

- Assigned by Law (NEPA) to Various Landscape Features
- Have Their Own Culture and Identity
- Their “Turf” Includes Feature Data, Feature Properties, and Advocacy for the Importance of Feature
- Public Participation Defined by Law (or not)

Transportation Routing Problem:

- How to Spend Large Amounts of Public \$\$\$ in a Place
- Often Legislative Origin
- Landscape is Imbued with Many Meanings
- Professionals Guess at Meanings, Create Plans
- Process Breeds Distrust by Public
- Projects Organize Resistance Groups
- Professionals Want to Minimize Controversy

Facilitation Practices

- Group Interaction Increases Understanding and Sometimes Agreement
 - More Significant with More Diverse Set of Participants (Barkhi et al. 1999)
- Primary Outcome of Process is Process
- Secondary Outcome is the “Answer”
- Pragmatics
 - Use Public’s Time Efficiently
 - Honor Their Input
 - Get Information Useful to Professional and Public (Bailey et al. 2001, Grossardt and Bailey 2002)

Systems to Support Public Involvement

- **Equality of Use:** who benefits from, and who does the work in, the application
- **Flexibility:** Allows people to change judgments. "Freezing' viewpoints is the best way of rendering them meaningless,"
- **New Competence:** Allows people to do something they could not do before
- **Double-level Language:**
 - "formal" level (e.g., a spreadsheet-tool) provides clarity, predictability, and a "common reference point"; the
 - "cultural" level provides room for interaction and interpretation, "doubt and imagination." (Robinson 1991, 36-45)

Decision Support Systems

- **Technical Systems May "De-Skill" Participants** (Greenbaum and Kyng 1991)
- **Complex Systems Not Used** (Briggs et al. 2003)
- **System Designers Are Ethnographers of Work** (Berg 1998)

Approach: Structured Public Involvement

- Build System that Encourages and Manages Public Preference as Input to Planning/Design Process
- Transparent Process
- Accountability and Legitimacy
- Ease of Use
- Accommodates Existing Required Process and Entities

A.M.I.S. Basics

- Proof of Concept for Large Group Input into GIS-Based Infrastructure Routing
- Many Landscape Features (~50)
- Many Group Participants (~25)
- Combined \$\$ and Non-\$\$ Features with Concept of “Impedance”
- Allowed Global Evaluation of Landscape through use of GIS

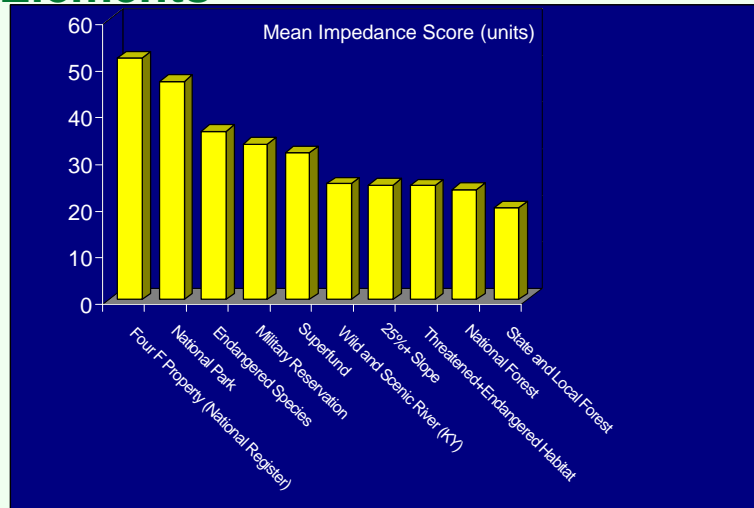
Background: Pilot Study

- Culturally Homogenous Captive Group
 - Shared Understanding of Situation
- One Interface (Face to Face)
 - Allowing Cross-Group Learning
 - Transparent Process
 - Data All Gathered at One Time
 - Data Gathered with One Method
- All Participants Shared in All Feature Evaluations

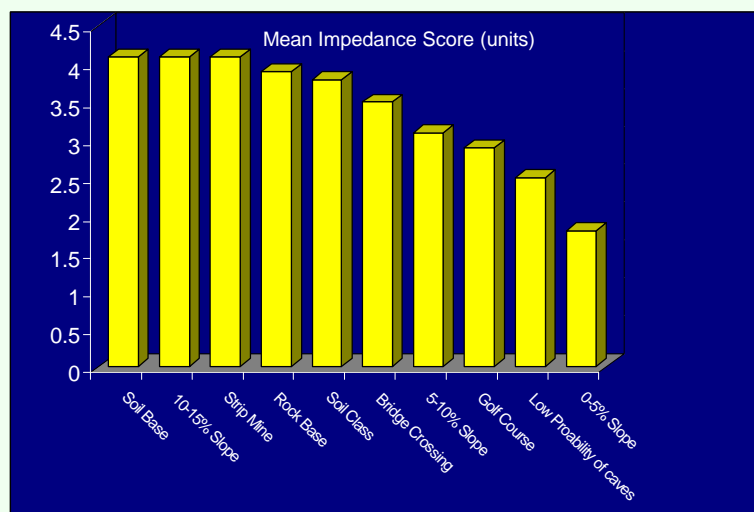
Example: Landscape Features and Categories

<i>Environmental</i>	<i>Man-made public features</i>	<i>Dirt and rock</i>	<i>Socioeconomic</i>	<i>Regulatory practices</i>
Unique habitat	Hospital	Oil and gas wells	Land value	Picnic area
Large viewshed	Water tank	Mine	Poverty rate	National properties register
Archaeological feature	School	Strip mine	Median income	State park
Historic feature	Public Water Supply	Quarry	Population growth rate	Wild and scenic river
Streams	Airport	15-25% Slope	Community impact	Public campground
Wetland	Sewage treatment	10-15% Slope		Wildlife management area
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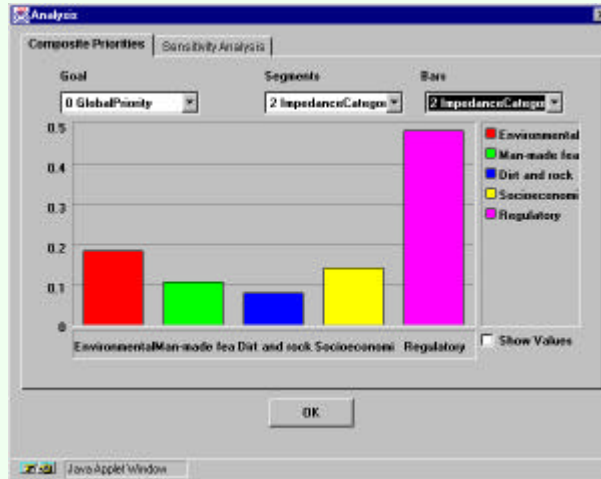
Results: Highest-Scoring Elements



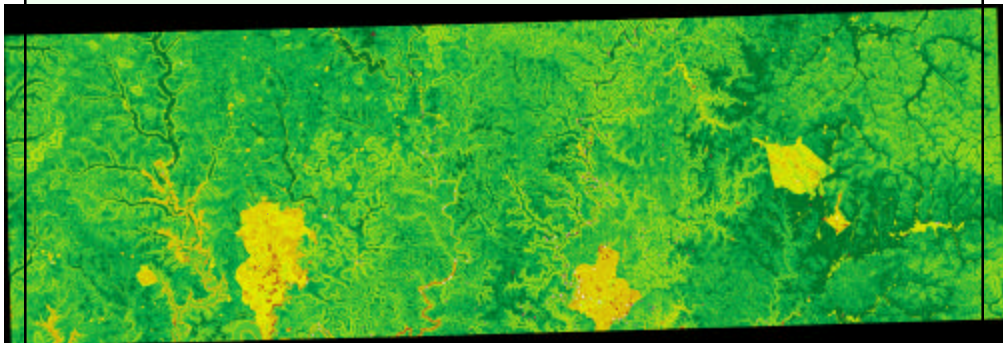
Results: Lowest-Scoring Elements



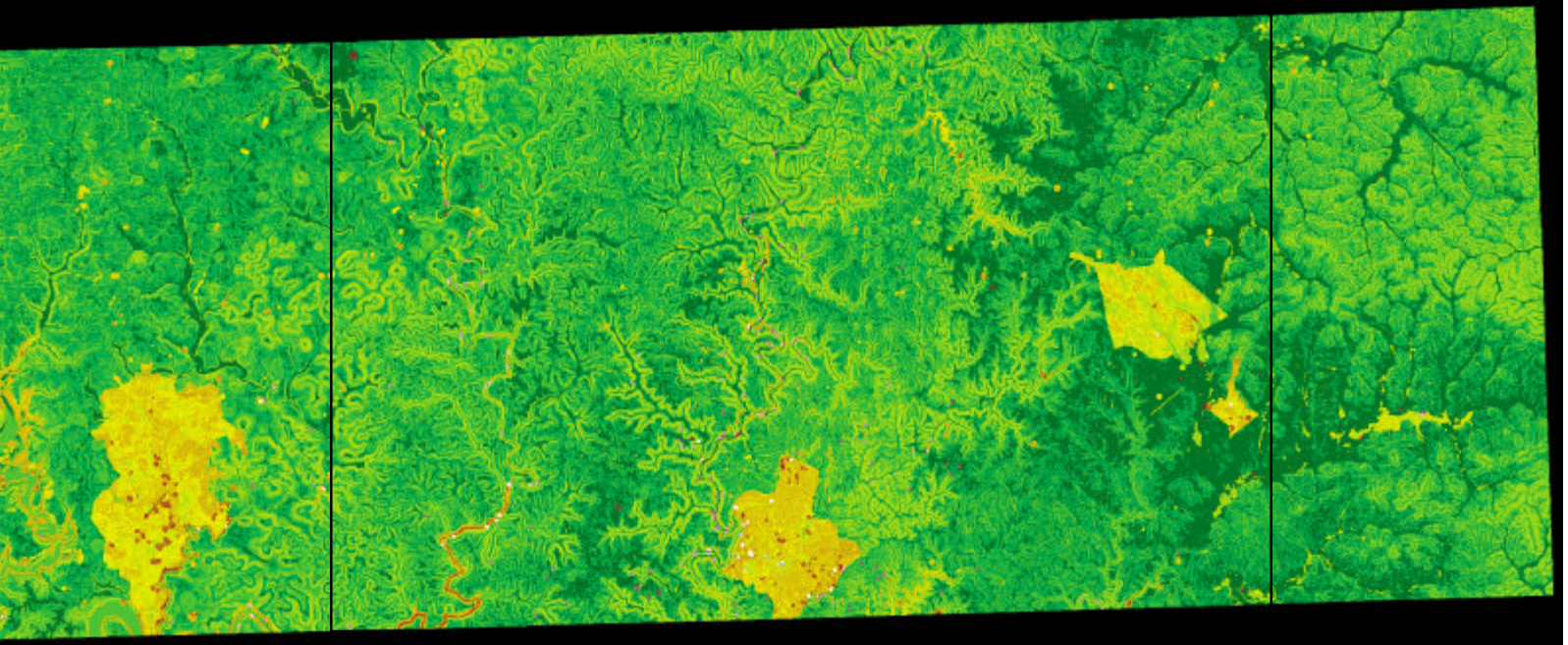
Adjustable Weights for Classes of Features



Analytic Minimum Impedance Surface



Analytic Minimum Impedance Surface



Properties of Current Landscape Assessment

- Wide Variety of Public Groups and Interpretations
- Face-to-face and Remote Interfaces
- Professional/Legal Partitioning of Landscape:
 - Feature Data
 - Responsibility
 - Meaning
- Partitions Must be Re-Assembled by SHA
 - (on what basis?)
- Goal is Low-Impedance Corridors, not Specific Alignments

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Dept. of Interior

Fish and Wildlife

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				Military

Two Forms of Landscape Evaluation

- Within Resource Agency and Resource Class
 - Eg. What constitutes historic? How historic?
- Across Resource Classes and Agencies
 - Eg. How do National Register Eligible properties compare to wetlands or T & E habitat?

Two Resulting Approaches to Evaluation

- Within Resource Types: Formal Criteria-Based
 - EG. National Register Eligibility
 - Associated with Important Events
 - Associated with Important People
 - Embody Distinctive Style
 - Potential Source of Historic Information
- Between Resource Types: “Judgement”
 - SHA
 - Public Meetings
 - Local Elected Officials

Current NR-SHPO Public Input

- Within Resource Agency
 - National Register Eligibility: Public can endorse or oppose registration, but eligibility is determined by SHPO. Eligibility (not registration) relevant in Federal projects (effectively all highway construction).

Current Overall Public Input

- **Between Resources and Resource Agencies**
 - Current Practice: SHA (or contractors) weigh relative merits of features in deciding planning corridors
 - Section 4(f) properties negotiated on case-by-case basis when necessary (at detailed alignment phase)
 - Cases go to court (what is a historic farm?)

Other Current Strategies for Public Input

- “Here’s the map, you draw the line”
 - Problems:
 - Insufficient shared local knowledge
 - Insufficient professional knowledge
 - Forces people to positions instead of interests
 - Limits participation: who draws the line? How many?

Other Current Strategies for Public Input

- Apply Explicit Criteria (cost, congestion, economic development) to Options or Features
 - Problems:
 - Difficult to conceptualize criteria
 - Complicated to apply to landscape features (slow)
 - May be proxy for other, non-explicit criteria (the real preference criteria)
 - Dominated by quantified criteria

Operational Properties of Unsuccessful Group Systems

- Customized to Managers (Output), not User Base (Input)
- Requires Professionals to Operate and Use
- Not Mission-Critical to Any Agency
- Complex to Use

Challenge: Operational Properties

- Accessible by Public and Professionals
- Simple Routines for Professionals
- Output is Part of Planning and Design Routine
- Information Exchange is Useful to Public
 - Resource Agency Outreach
 - Public Input

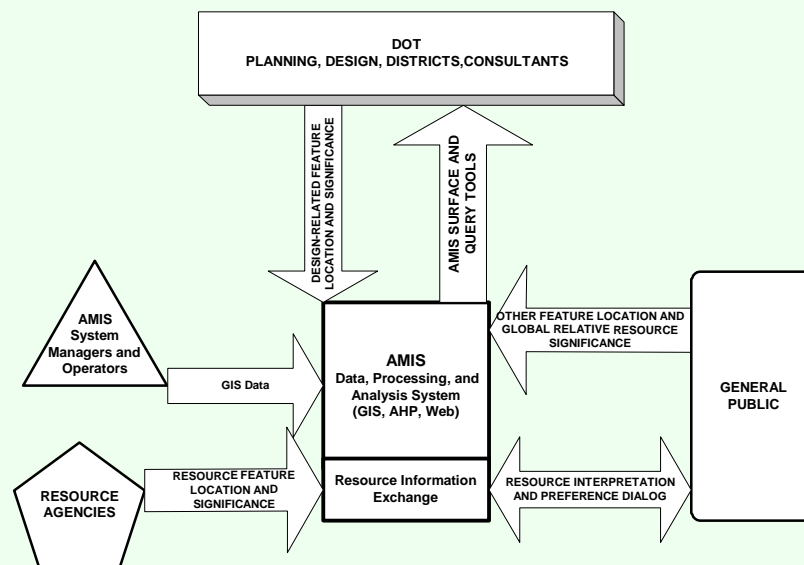
Boundary Objects

- Structure the Interactions Between Individuals in the Organization
- Facilitate Distributed Cognition
- "Enlist and Organize Group Participation"
(Henderson 1991, 448).
- Not "executable code but rather heuristic and vague devices to be interpreted and instantiated, maybe even by means of intelligent improvisation.... [They are not plans but] resources for situated action." Simone and Schmidt (1993, 95)

AMIS as “Boundary Object”

- Structures Relationship between Public and Transportation Agency
- Facilitates Distributed Cognition
- Enlists and Organizes Participation
- Used as Heuristic to Evaluate Situation

Proposed Information System Schematic



Two Interface Methods

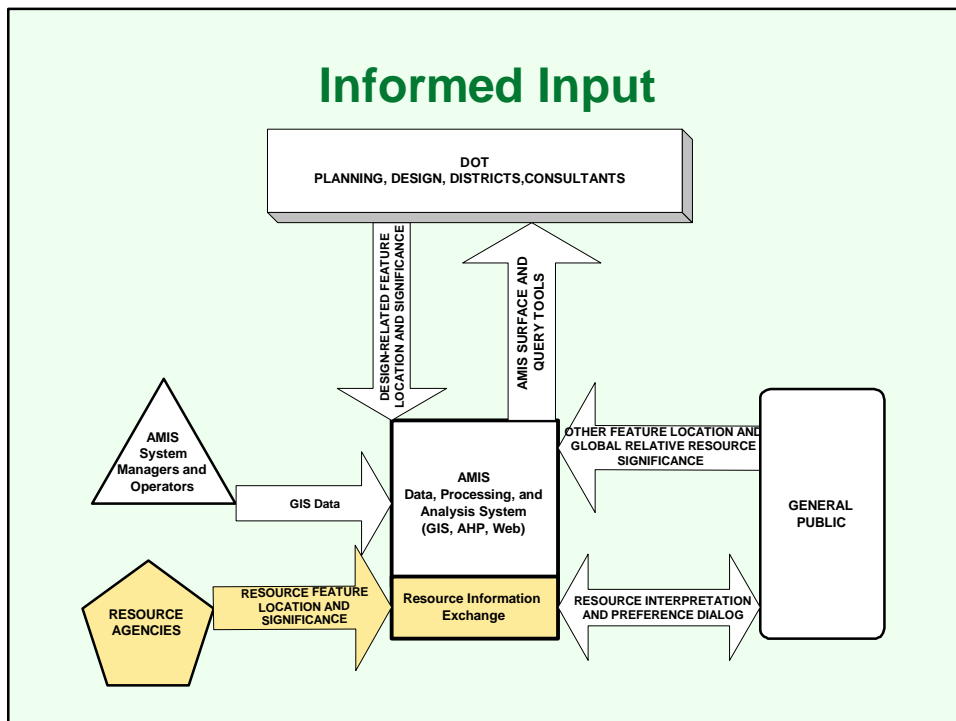
- **Synchronous:** Face-to-Face Public Meetings/Hands-on Information Sharing and Preference Gathering
- **Asynchronous:** Remote/Web-based Information Sharing and Preference Gathering

Process Steps

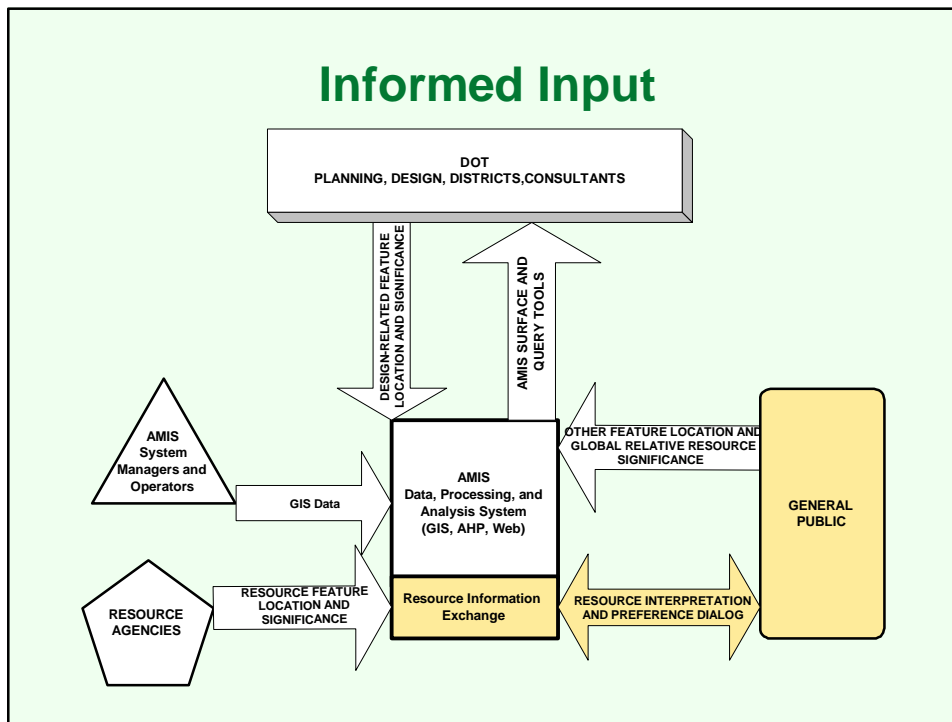
- Information Exchange/Dialog
- Preference Gathering
- Preference Processing and Analysis
- Analysis and Feedback

Informed Input (Dialog)

- Public Meetings
 - Face-to-face Discussions
- Remote Access
 - Resource Agency Information
 - Public Information Input Mechanism



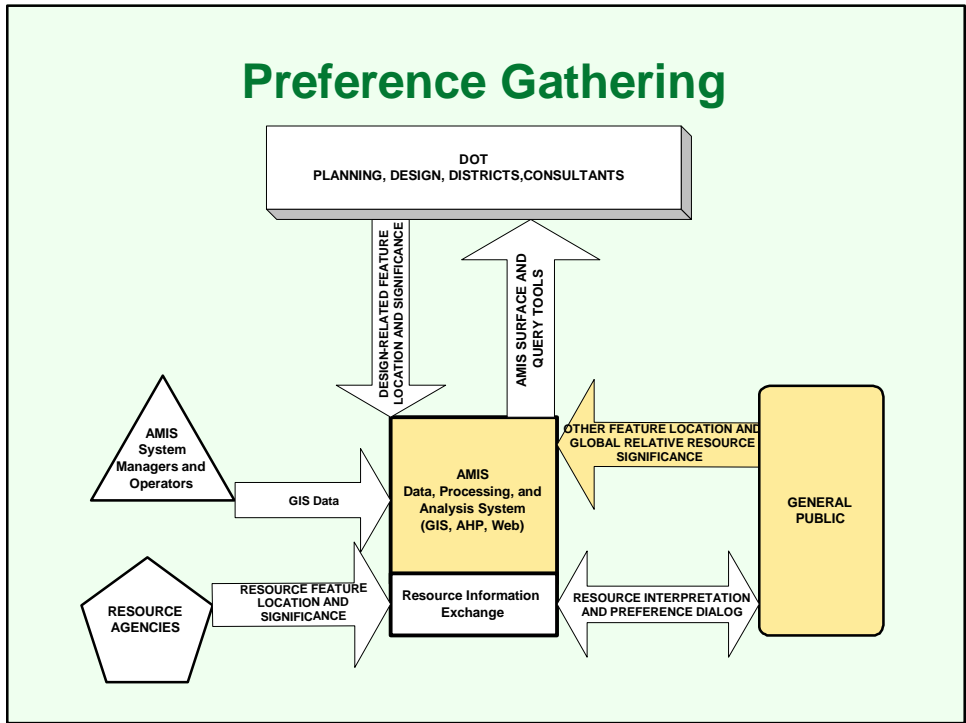
Informed Input



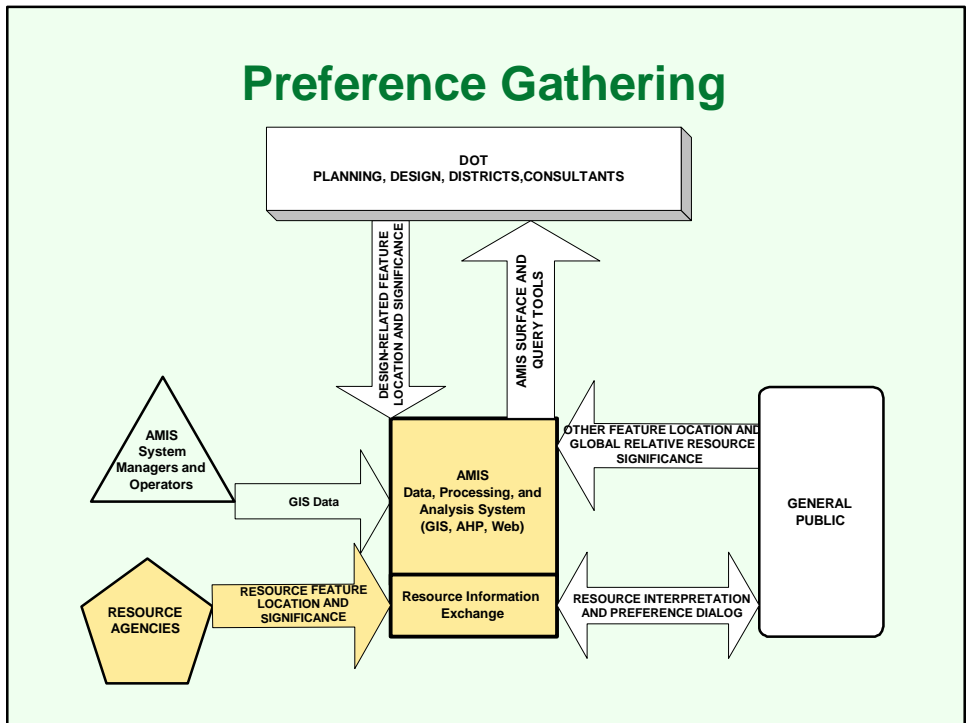
Preference Gathering Tools

- Integrated Cross-Functional Group Softwares
 - Public Meetings (Synchronous)
 - Discussion + Automated Input Gathering
 - Computer
 - RF Keypads
 - Website (Asynchronous)
 - Browser GIS Functions
 - Group Software Input Interface

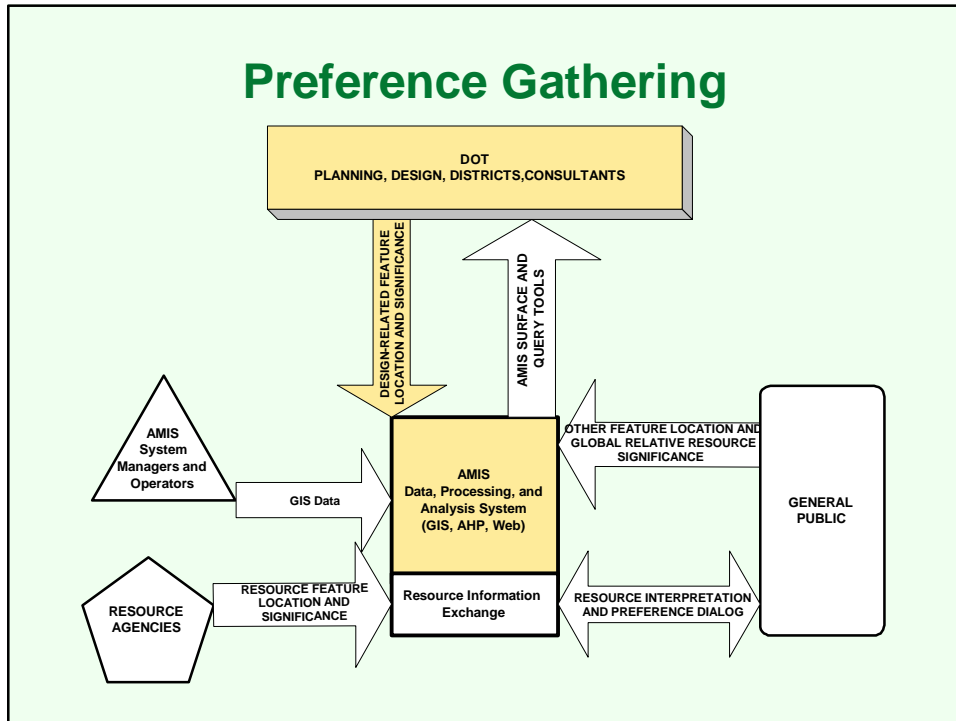
Preference Gathering



Preference Gathering



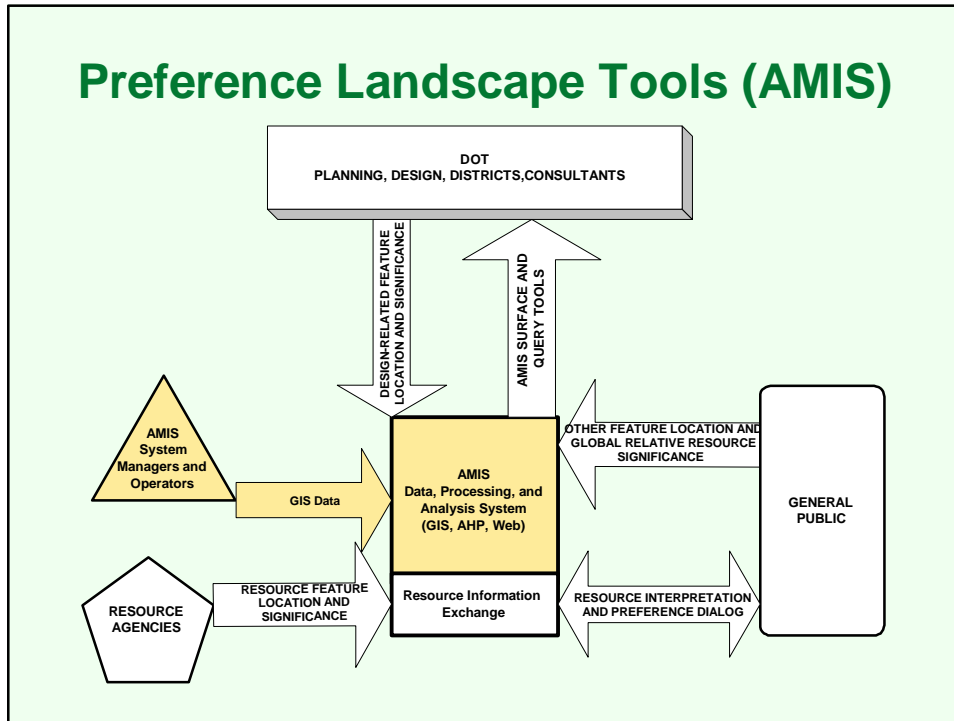
Preference Gathering



Preference Analysis Tools

- Analytic Hierarchy
- GIS
- Web-enabled GIS

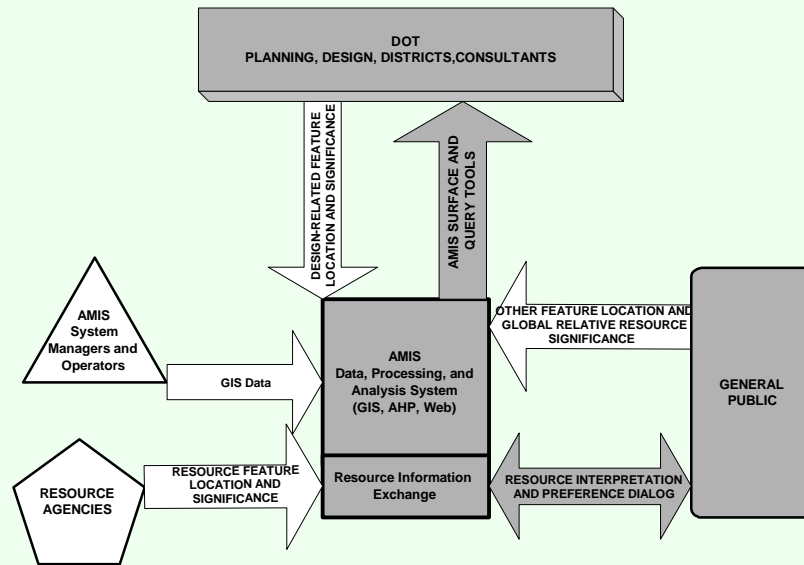
Preference Landscape Tools (AMIS)



Analysis and Feedback Tools

- Internet-based GIS Functions
 - Professional Analysis Tools
 - Corridor Exploration and Rating
 - Public Scanning Tools
 - Preference Surface
 - Information about Possible Corridors
- Public Meeting Context
 - Real-time 'Exploration'
 - Conditional on GIS data availability

Analysis and Feedback Flows



Research Questions

- How do synchronous, asynchronous, and conventional (survey) preference gathering modes compare in this context?
- How do professional and general public preferences compare?
- How do different subsets preference maps compare?

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