Harvard
Prevention Research Center
on Nutrition and Physical Activity

Development, Reliability & Validity Testing of the Path Environment Audit Tool (PEAT)

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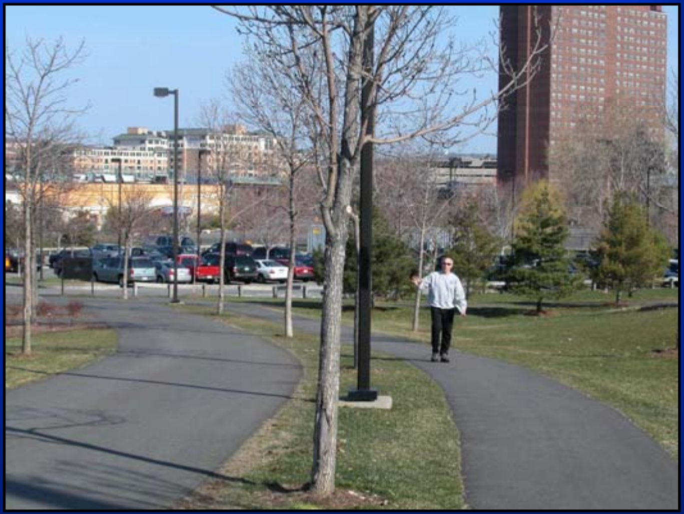

**Danehy Park:
Cambridge, MA**

Transdisciplinary Team

Harvard University
- Philip Troped
- Maren Fragala
- Steven Melly
- Steven Gortmaker

University of Connecticut
- Ellen Cromley

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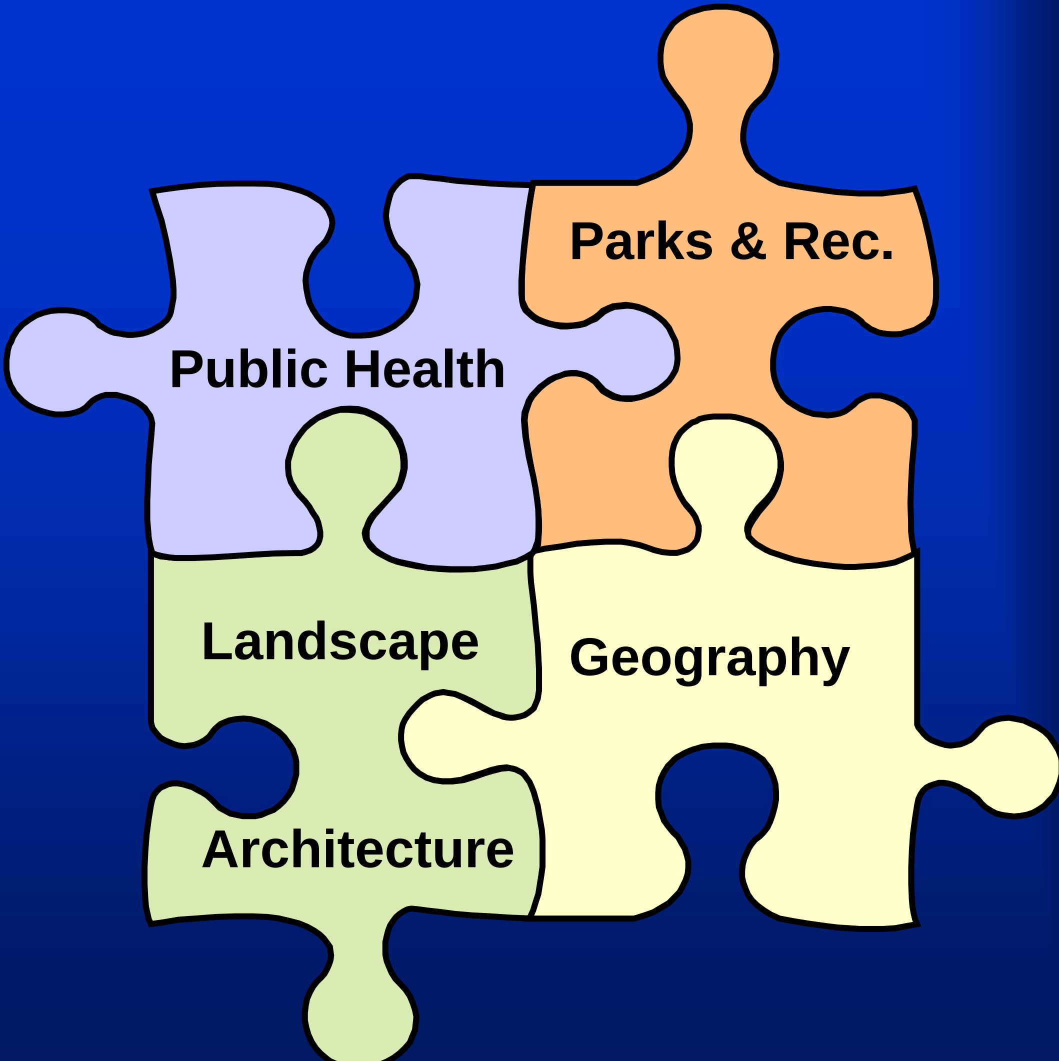
- Ross Brownson

University of Texas
- Hope Hasbrouck



Presentation Aims

1. Briefly describe the development of the *Path Environment Audit Tool (PEAT)*
2. Summarize findings for PEAT reliability & validity testing
3. Discuss study strengths & limitations

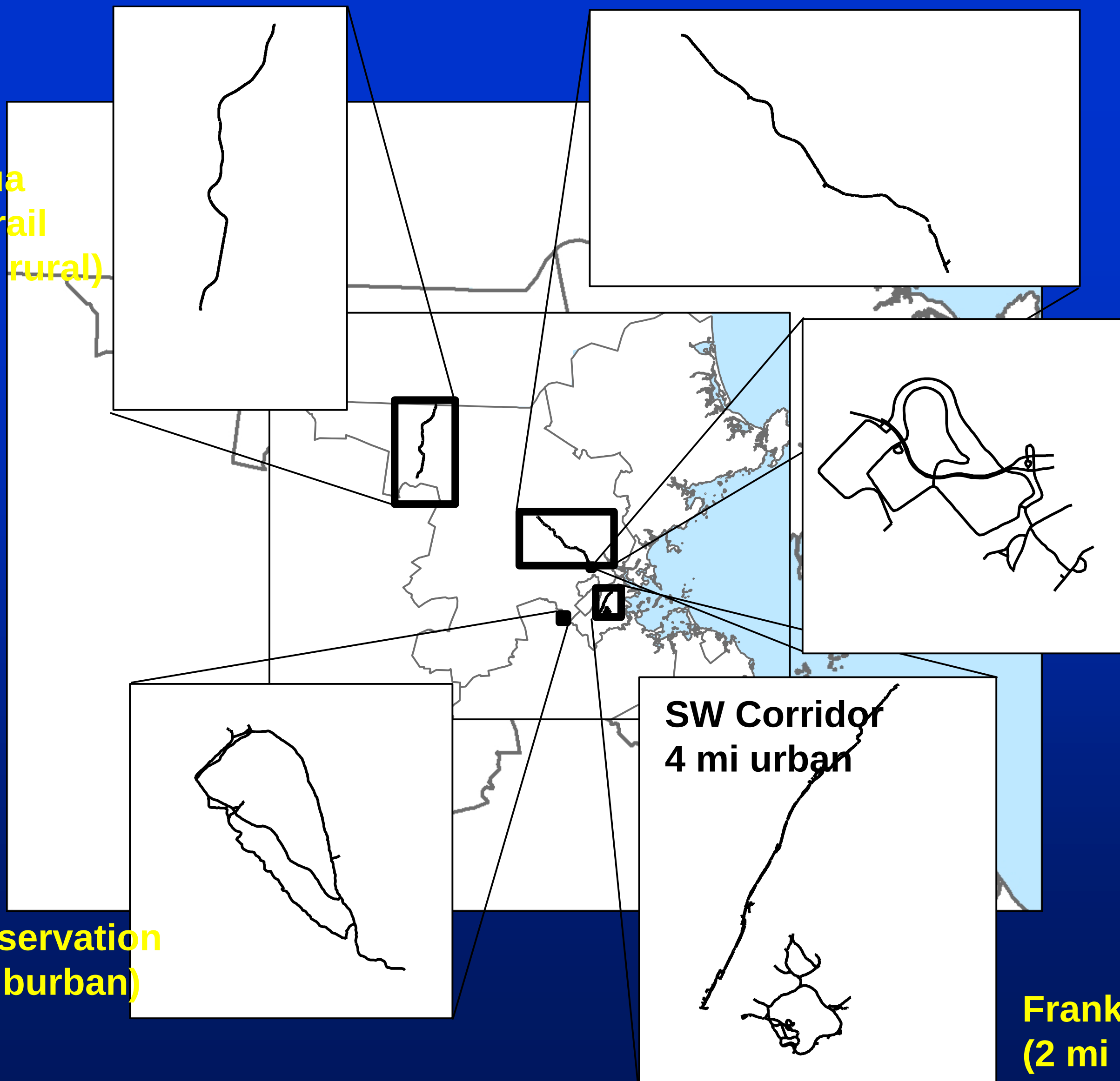
Study Rationale

- Growing interest in community trails & walking paths & evidence that they support PA in various settings (e.g., Brownson et al., AJPM, 2000)
- Trail development growing at rapid pace in U.S. (e.g., 12,650 miles of rail-trails)
- Little is known about trail characteristics that may influence use
- Reliable & valid tools to measure trail characteristics are needed $\Rightarrow$ ***Identified as ALR Research Priority***

Study Setting: 6 Trails in MA

Minuteman Bikew
(11 mi suburban)

Nashua
Rail Trail
(12 mi rural)



Danehy Park
(3 mi
urban/suburban)

Cutler Reservation
(1.6 mi suburban)

Franklin Park
(2 mi urban)

Methods: Key Steps

1) Collected detailed spatial data on trails with high-accuracy GPS unit
2) Developed *PEAT* tool using evidence-based approach & team consensus
3) Pre-tested tool & made modifications to items & protocol
4) Trained observers & collected data on *“PEAT”* segments at 6 sites
5) Conducted analyses to assess reliability & validity

GPS Data Collection

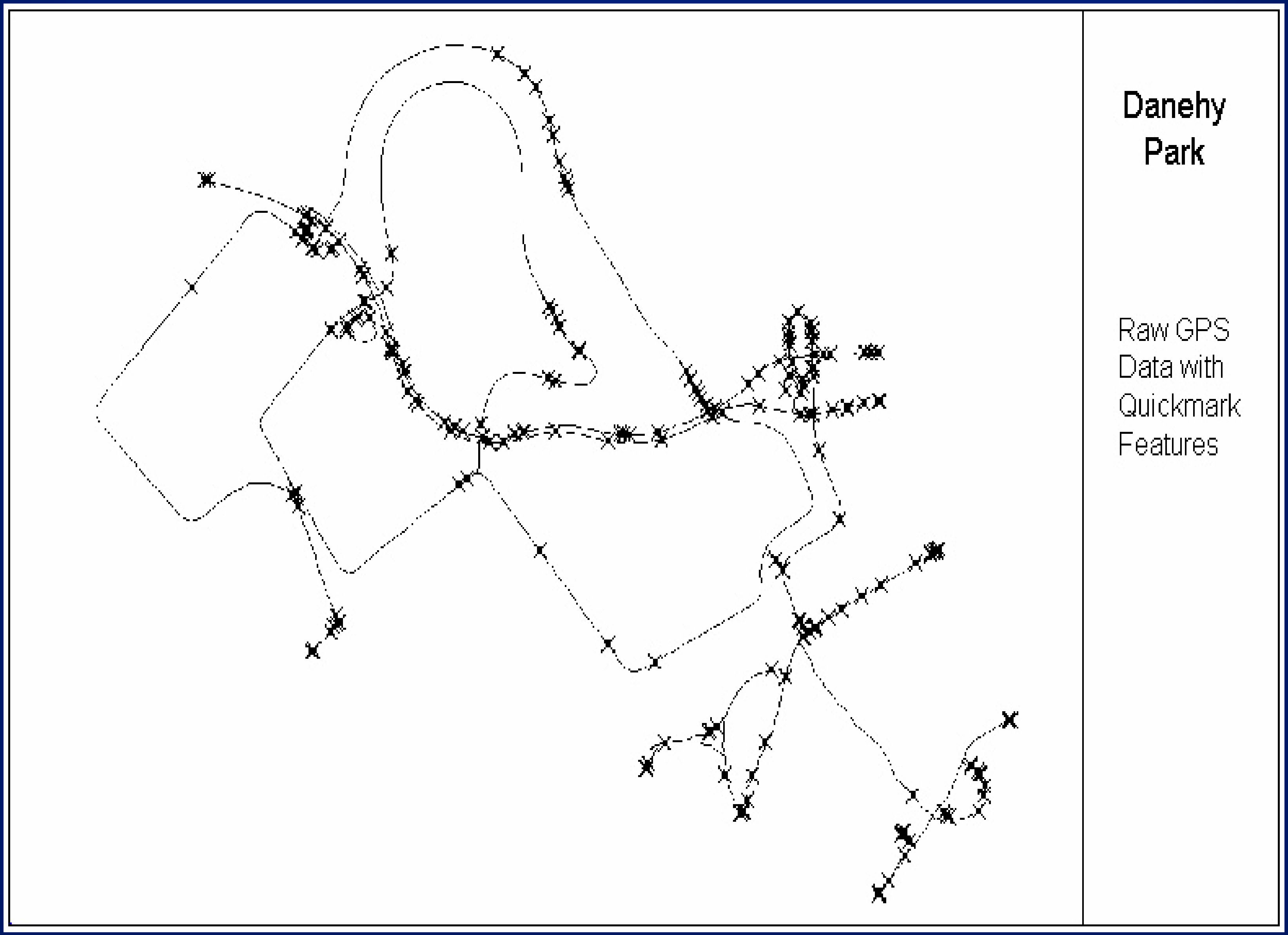
- **Aim -** obtain accurate spatial data on trail attributes (e.g., surface type) & amenities (e.g., lighting)
- 3-4 person teams walked over 40 miles of paths
- Collected data on point attributes using QuickMark feature

GPS Data Collection at Franklin Park, Boston, MA

GPS Data – Primary Uses

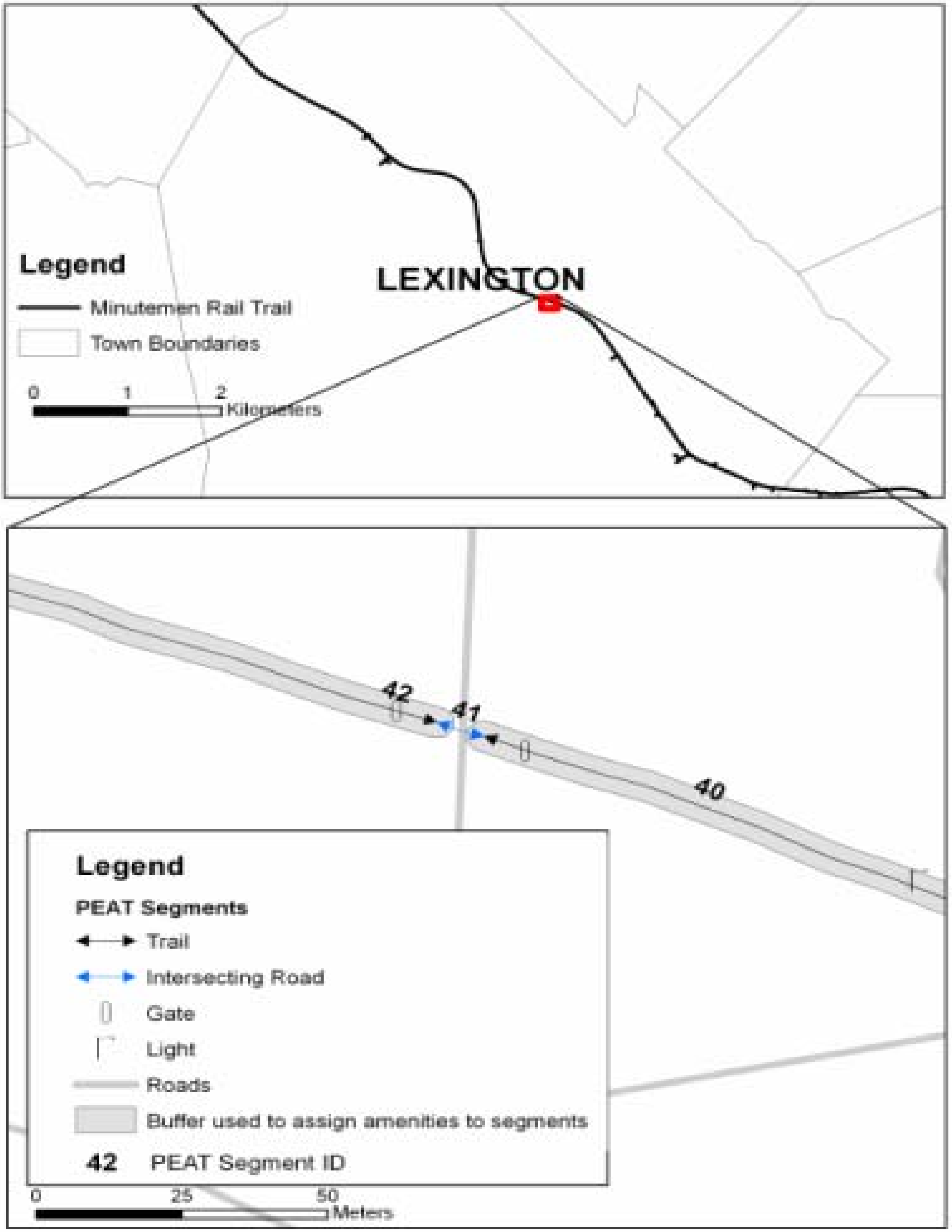
1. Spatial framework for GIS trails database
2. Geographic unit of observation for *PEAT*
   - *T*rail & intersecting road segments (mean distance trail segments ~283 meters)
3. Accurate maps of trails for PEAT data collection
4. “Gold-standard” amenity/design measures

Raw GPS Data - Danehy Park



Minuteman Bikeway

Sample of PEAT Segments & Buffer Used to Create GPS Measures



The "Big Picture" of PEAT

- One of 3 data sources used to characterize trails & local neighborhood environment
  - Along with GPS data & existing GIS data layers
- Integrated into comprehensive GIS database
- Created computer-based tool for PEAT (tablet PC)

PEAT Development

General Approach

- Develop measures based on research & practice guidelines from multiple disciplines

Specific Strategies

- Conduct brief literature review
  - 28 articles, design manuals, etc.
- Conduct intercept surveys with 73 adult trail users at FP & MB (“likes”/”dislikes”)
- Input & consensus from transdisciplinary team

PEAT

- Intersecting Road Module (6 items)
- Items in 3 Domains (PEAT trail segments)
  - Design Features (11 items)
  - Amenities (16 items)
  - Aesthetics/Maintenance (7 items)

The Path to PEAT

PEAT Data Collection

- Two observers separately conducted observations of trail & intersecting road segments at 6 sites - *June 2004*
  - ~180 trail segments; 44 intersecting road segments
  - 30+ hours of auditing per observer
- Equipment: tablet PC with *PEAT* tool, detailed maps from GPS, Garmin GPS to identify end-points of segments
- Observers accompanied by RA - assisted with maps (verifying segment IDs) & operating hand-held GPS

Data Analyses

Inter-observer reliability

- Kappa coefficients (k)
- Intraclass correlation coefficients (ICCs)

Intrasite variability

- Spearman correlations for attributes between adjacent trail segments

Validity

- Kappa coefficients with GPS items as “gold-standard” (assessed for *both* observers)

Results

PEAT Inter-Observer Reliability: Design

Item Prevalence (%)	Observed agreement	Kappa (adjectival rating)*
Vertical clearance (33%)	0.71	0.43 (moderate)
Shoulder (71%)	0.75	0.23 (fair)
Road adjacent (43%)	0.77	0.54 (moderate)
Access points (52%)	0.82	0.63 (substantial)
Gate or bollard (42%)	0.86	0.69 (substantial)
Viewpoint (13%)	0.92	0.66 (substantial)

* Landis, J.R. and G.G. Koch, *The measurement of observer agreement for categorical data.* Biometrics, 1977. **33**(1): p. 159-74.

PEAT Inter-Observer Reliability: Design (cont.)

Design Item	Scale	Observed Agreement	ICC
Surface condition	1 = very poor; 5=excellent	0.38	0.52
Slope	1=flat or gentle; 3=steep	0.75	0.63
Cross slope	1=flat or gentle; 3=steep	0.98	-0.01
Sufficient sight distance	1=no (none); 3=yes(all)	0.58	0.56
Vegetative cover	1=continuous lateral visibility; 3=no lateral visibility	0.34	0.32

PEAT Inter-Observer Reliability: Amenities

Amenity Prevalence	Observed Agreement	Kappa
Lights (19%)	0.94	0.81
Phone (3%)	0.98	0.49
Emergency call boxes (6%)	0.96	0.61
Restrooms (6%)	0.96	0.61
Benches (30%)	0.82	0.59
Picnic tables (12%)	0.96	0.81
Drinking fountain (6%)	0.98	0.79
Garbage can (40%)	0.91	0.82

PEAT Inter-Observer Reliability: Amenities (cont.)

Amenity Prevalence	Observed Agreement	Kappa
Signs (76%)	0.88	0.70
Parking (12%)	0.88	0.52
Bike racks (15%)	0.95	0.76
Services (4%)	0.99	0.92
Public transit stop/station (4%)	0.98	0.70
Cultural/civic destination (17%)	0.86	0.38
Presence of dogs (9%)	0.91	0.46

Inter-Observer Reliability: Aesthetics/Maintenance

Item (mean)	Observed Agreement	ICC
Glass (1.14)	**0.87**	**-0.02**
Litter (2.00)	0.49	0.03
Graffitti (1.76)	0.51	0.50
Vandalism (1.16)	**0.85**	**0.09**
Odor (1.11)	**0.74**	**-0.04**
Noise (2.12)	0.60	0.40
Dog/animal droppings (1.15)	**0.89**	**0.07**
Scale: 1=none; 2=a little; 3=some; 4 =a lot		

Site-Specific Correlations Between Adjacent Trail Segments

	Cutler	Danehy Park	Franklin Park	Minuteman Bikeway	Nashua River Rail Trail	SW Corridor
	(n =13)	(n = 13)	(n = 28)	(n = 55)	(n = 47)	(n = 21)
Surface condition (5-point scale)	0.29 (0.34)	0.41 (0.17)	0.20 (0.31)	0.50 (0.0001)	0.50 (0.0004)	0.22 (0.34)
Glass (4-point scale)	(all = 1) No variation	-0.08 (0.79)	0.43 (0.02)	0.12 (0.38)	-0.04 (0.77)	-0.11 (0.65)

*Validation of PEAT Items – Using GPS Measures**

Item (presence of:)	Observed Agreement	Kappa
Access point	0.86	0.72
Gate or bollard	0.85	0.69
Lighting	0.88	0.68
Phone	0.97	-0.01
Emergency call box	0.94	0.25
Bench/seating	0.84	0.59
Picnic table	0.95	0.74
Drinking fountain	0.96	0.57
Garbage can	0.91	0.80
Exercise/play equipment	0.77	0.22

*Observer #1

Strengths & Limitations

Strengths

- Valid spatial framework established for trails & audit tool observations
- Conceptualization of trails as series of segments
- Comprehensiveness of PEAT for initial testing

Limitations

- Insufficient sample size to evaluate certain sub-items
- Reasons for low reliability not apparent in all cases

Conclusions

- PEAT demonstrated fairly good reliability & validity
- Appears ready for use by researchers & practitioners
- Further refinements of PEAT may be advantageous, including design of a shorter instrument
- Overall approach to developing GIS & measuring trail characteristics sound from spatial standpoint
  - Similar approaches could be adopted by others studying trails/paths

Sincere Thanks To...

- F. Tyler Huffman (UConn) - GPS data collection
- Local Boston consultants Aldo Gherin, Jim Purdy, and Deneen Crosby - PEAT development
- Bhavna Babani & Joseph Allen - PEAT data collection