Analysis of TRB's Research Needs Statements (RNS) Database for Records Related to Sustainability

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Introduction

The purpose of this analysis was to determine the extent to which the topic of sustainable transportation is addressed in the proposed research projects listed in the TRB Research Needs Statements (RNS) database (http://rns.trb.org/). The intention was to identify the type and scope of projects being proposed and which TRB committees are supporting sustainability-related research proposals in one or more areas. The results from this analysis should help the Committee on Transportation and Sustainability (ADD40) determine which proposed research needs to support, which committees to initially engage with, and where opportunities exist to propose new research projects.

Defining Sustainability

In order to determine which RNS records are addressing sustainability, and how well or to what degree, a definition of sustainability needed to be identified. While definitions of sustainability and sustainable development vary, most comprehensive definitions of sustainable development consider impacts in the three areas of environment, economy, and society (equity), sometimes referred to as the "three Es." Within those three widely agreed-upon sustainability dimensions, there are more specific sustainability topics, as identified in Table 1.

Beyond a definition of sustainability, we were also interested in identifying where in the transportation planning process sustainability is being addressed. Important functional areas of the transportation decision-making process are identified in Table 2.

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Table 1: Dimensions and Elements of Sustainable Transportation

Dimension	Area	A sustainable transportation system…
Environment	Health and Environmental Damage	minimizes activities that cause serious public health concerns and damage to the environment;
	Standards	maintains high environmental quality and human health standards throughout urban and rural areas;
	Noise	minimizes the production of noise;
	Land Use	minimizes the use of land;
	Emissions and Waste	limits emissions and waste to levels within the planet's ability to absorb them, and does not aggravate adverse global phenomena including climate change, stratospheric ozone depletion, and the spread of persistent organic pollutants;
	Renewable Resources	ensures that renewable resources are managed and used in ways that do not diminish the capacity of ecological systems to continue providing these resources;
	Non-renewable Resources	ensures that non-renewable resources are used at or below the rate of development of renewable substitutes;
	Energy	is powered by renewable energy sources; and
	Recycling	reuses and recycles its components.
Equity/Society	Access	provides access to goods, resources, and services while reducing the need to travel;
	Safety	operates safely; ensures the secure movement of people and goods;
	Intragenerational Equity	promotes equity between societies and groups within the current generation, specifically in relation to concerns for environmental justice; and
	Intergenerational Equity	promotes equity between generations.
Economy	Affordability	is affordable;
	Efficiency	operates efficiently to support a competitive economy;
	Social Cost	ensures that users pay the full social and environmental costs for their transportation decisions; and
	Employment	provides meaningful and well-paid employment opportunities.

Table 2: Domains and Functional Areas of Transportation Decision-Making

	Domain	
	"Planning"	**"Delivery"**
Functional Areas	Systems Planning	Construction
	Programming	Operations
	Project Development	Maintenance

Methodology

In order to locate records related to sustainability in the RNS database, we identified several terms or phrases to use when searching the database. In addition to obvious searches for "sustainable" and "sustainability" we identified terms that we considered broad enough to return results, but specific enough to avoid a large number of unrelated records. Our final list of search terms included:

- economic development;
- economy;
- environment;
- equity;
- society;
- sustainability; and
- sustainable.

Obviously, these are not the only search terms related to sustainability, and many others could be searched, including:

- conservation;
- preservation;
- energy;
- safety;
- health;
- and more.

For each record returned in the search, the problem, objective, and other relevant sections of the research description were reviewed for applicability to the areas of sustainability listed in Table 1. Up to three areas were assigned to each record, in order of most to least relevant, where possible. From there, a sustainability score was given. Primary and secondary areas of transportation decision-making were also identified. As scoring was a subjective part of the study, care was taken to ensure records were rated as consistently and fairly as possible; further details and suggestions for rating replication are discussed in Appendix A.

After determining which, if any, of the listed sustainability areas were clearly addressed in the RNS record, it was given up to a full point in each of the three sustainability dimensions (Environment, Economy, and Equity/Society); half points were given where some aspect of a sustainability dimension was addressed. For example, a record that only discussed safety issues would score 0.5 for its "Equity" score, whereas a record that clearly addressed multiple societal aspects, such as safety and access, or safety and access and intragenerational equity, was recognized as addressing equity/society in a more comprehensive way and was given a full point. All records received a score between 0 and 3 (up to 1 point in each category). It should also be noted that in some cases, a record's research focus may have the potential to impact sustainability beyond the dimension(s) indicated, but this was not explicitly discussed in the problem description, research objective, or other part of the research statement. For example, the record entitled "Modern Streetcars and Economic Development: The Rest of the Story," specifically discussed streetcar research that focuses solely on economic impact, even though streetcar promotion might also have environmental or even social impacts. For this reason, its total score was 0.5 (awarded in the "Economy" category). Thus, several of the proposed projects could have received a higher score if they were rewritten to broaden their scope. Later, we identify several proposed research projects that could benefit from a broadened scope of research.
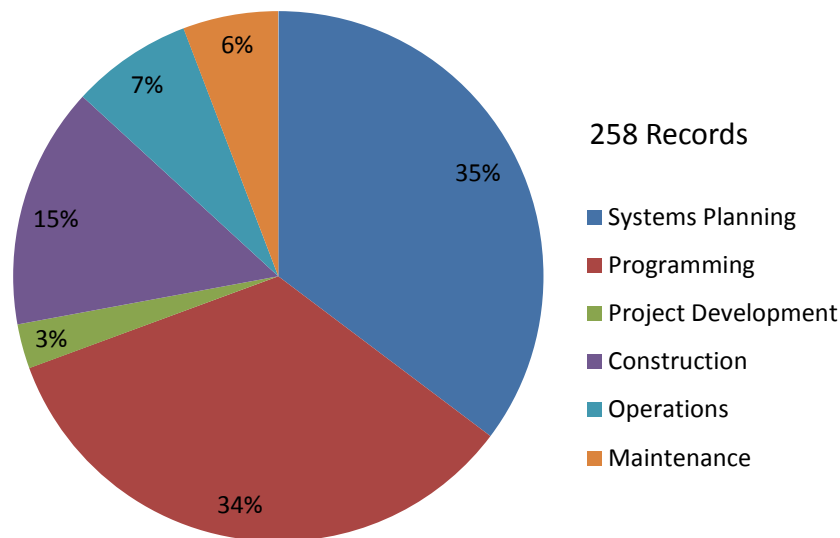
Results

Table 3 shows the number of records found when searching on each term, as well as the number of records that received a sustainability score and to what degree. Searches were performed between late August and late September, 2012, and so captured records entered into the RNS database up until September 13, 2012. A total of 325 unique records were found across all years based on this study's search terms. Of these records, 258 (79.4%) were found to be at least minimally related to sustainability (i.e., received a score of 0.5 or above).
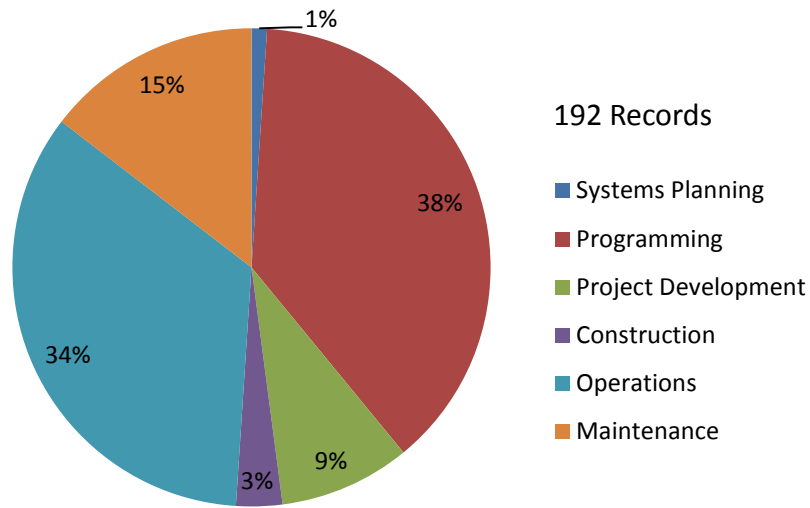
Table 3: Records Returned for Each Search Term

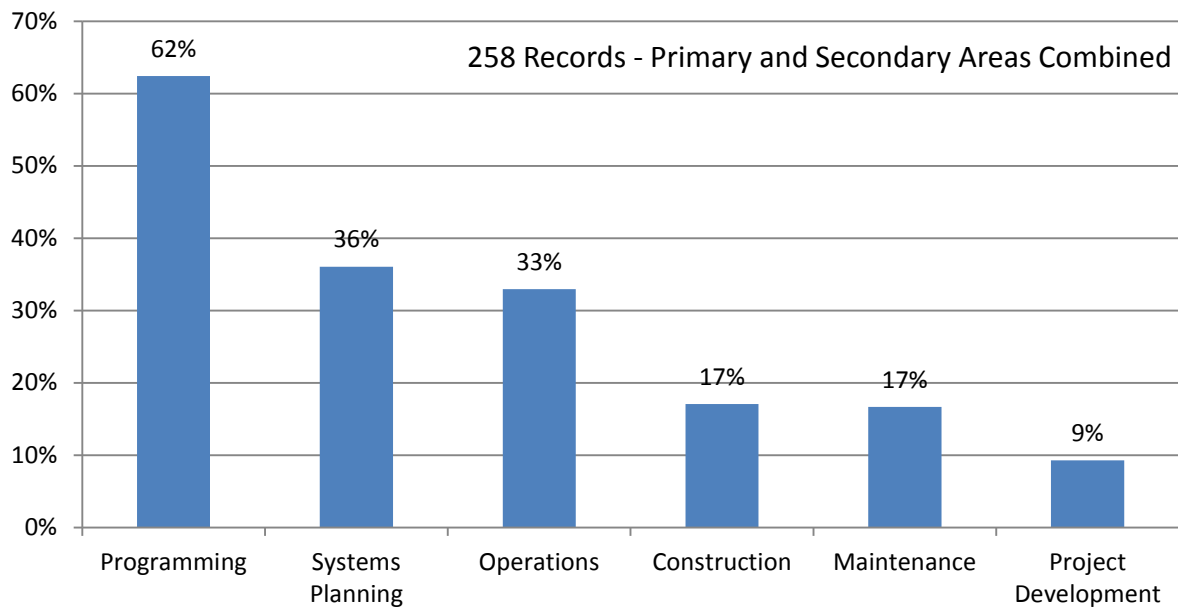| Search Term	No. of Records Found	Number of records that scored…							Avg. Score
		0	0.5	1	1.5	2	2.5	3	
Economic Development	20	0	7	7	2	4	0	0	1.08
Economy	55	10	17	19	6	2	1	0	0.78
Environment	186	40	76	45	15	8	1	1	0.68
Equity	50	11	12	12	8	6	1	0	0.89
Society	44	9	16	13	3	1	1	1	0.75
Sustainability	30	6	8	9	4	2	0	1	0.87
Sustainable	56	8	15	23	4	5	0	1	0.88

The area of transportation decision-making (Table 2) into which proposed research fell was noted and is shown in Figure 1 and Figure 2. Both the primary and secondary decision-making category were noted, as there was normally a distinct primary focus area, and sometimes (but not always) a secondary one (i.e., many records that focused on the construction phase also included the maintenance phase as a secondary focus). The percent of total records (of the 258 receiving a sustainability score above 0) addressing each decision-making area is shown in Figure 3.

258 Records

- Systems Planning
- Programming
- Project Development
- Construction
- Operations
- Maintenance

Figure 1: Percent of Records Addressing a Primary Decision-making Category

1%

15%

192 Records

- ■ Systems Planning
- ■ Programming
- ■ Project Development
- ■ Construction
- ■ Operations
- ■ Maintenance

38%

34%

3%

9%

Figure 2: Percent of Records Addressing a Secondary Decision-making Category

258 Records - Primary and Secondary Areas Combined

62%

36%

33%

17%

17%

9%

Programming | Systems Planning | Operations | Construction | Maintenance | Project Development

Figure 3: Percent of Records Addressing Categories of Decision-making

We were also interested in seeing whether the proportion of records addressing sustainability had increased since 2006 (the earliest year for records returned in our search). The number of records found in each year, as well as the total percent that received a sustainability score above zero, is shown in Figure 4.
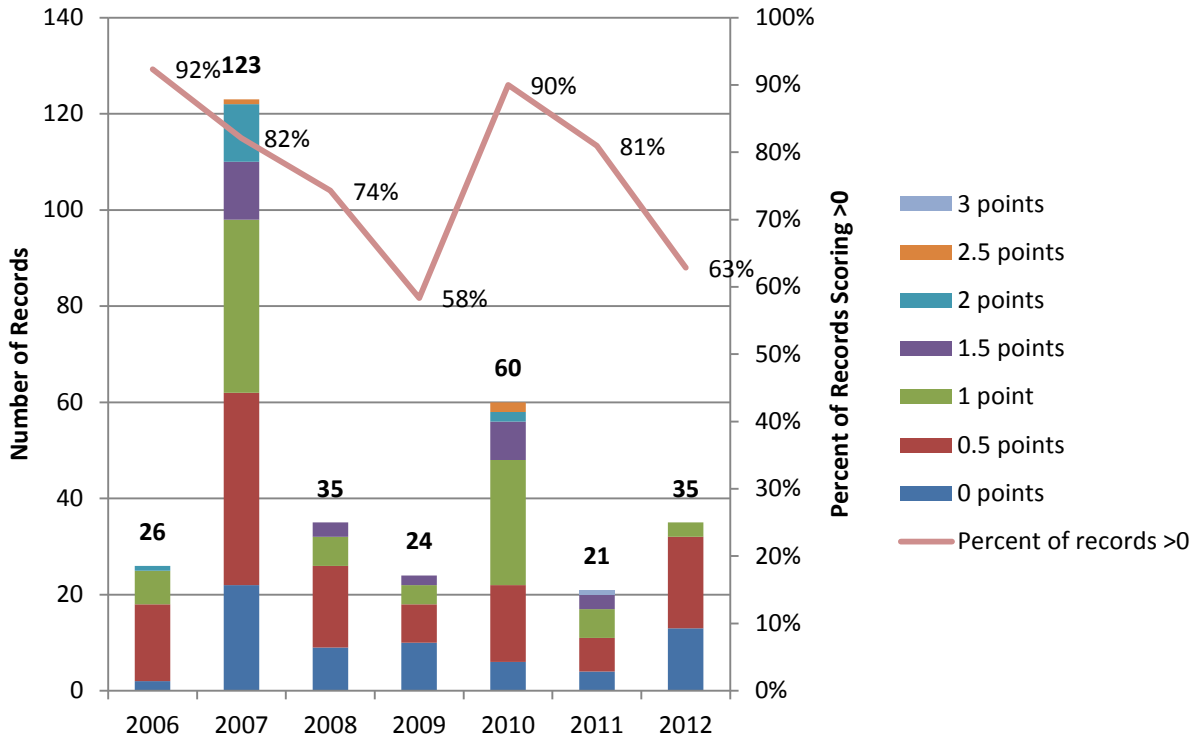
Figure 4: Number of Records per Year by Score and Percent of Records Related to Sustainability

Over the last six years there does not appear to have been a steady increase in the number of records that are related to sustainability (i.e., score at least a 0.5). This is probably largely due to the ancillary information in many RNS records that discuss the importance of a sustainability focus, even if the record itself does not specifically address an area of sustainability. In looking at 2012, this problem becomes even more apparent – records that scored 0 or 0.5 make up nearly all of the records found in the RNS search, suggesting that there has not been any significant change in attitudes toward sustainability across TRB committees. In other words, while there seems to be an overarching idea that transportation research should have some sustainability-related focus, individual records do not always address this explicitly in their goals or objectives. Perhaps this is partially due to the lack of an overall guiding definition of sustainability/sustainable transportation that all TRB committees can adopt.

Figure 5 shows how the 325 records scored in each of the three dimensions. Not surprisingly, many records addressed only one sustainability area, and therefore received only 0.5 points, while there were very few records in which research took a more holistic approach and addressed all three. Figure 6 displays each record ranked by score.
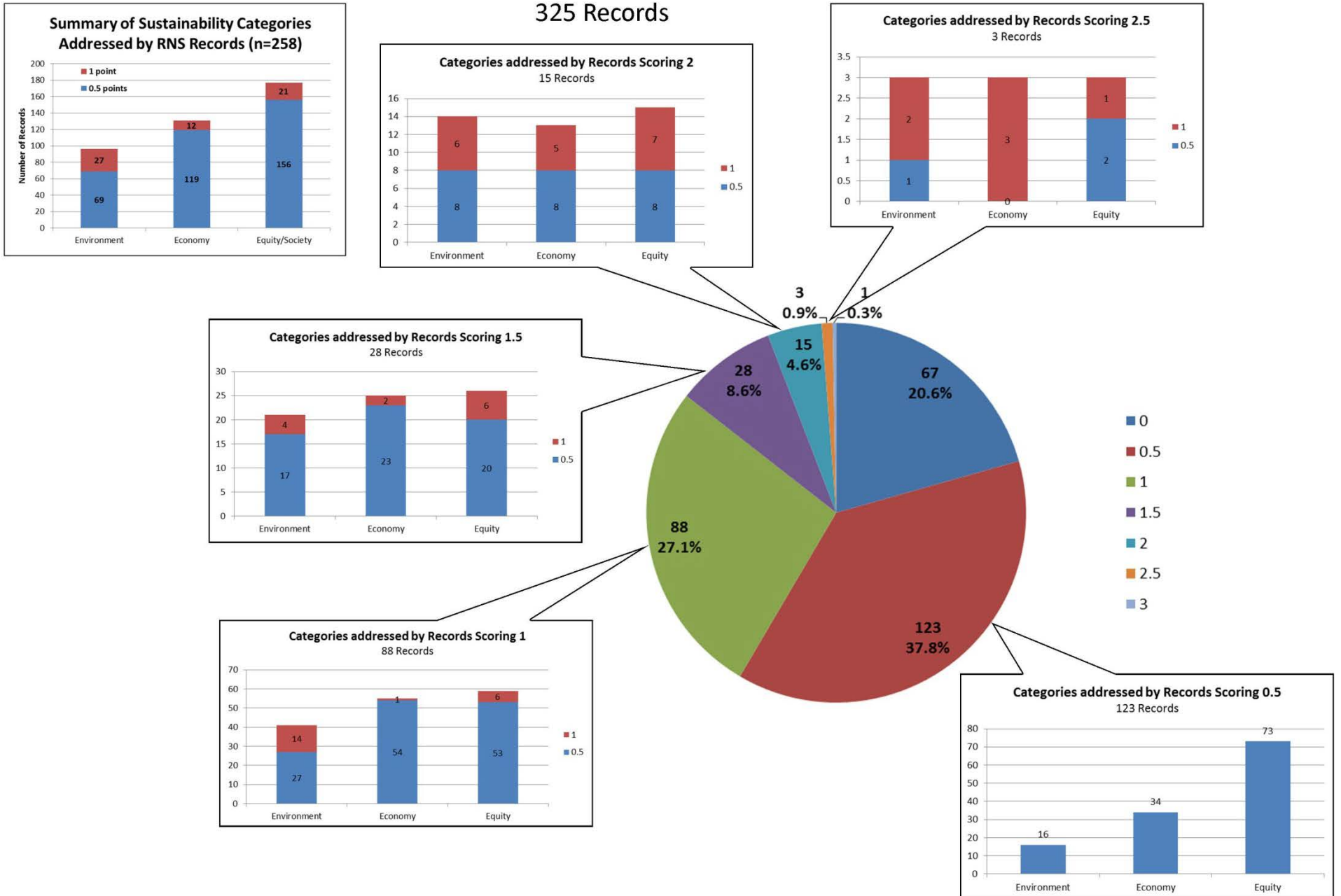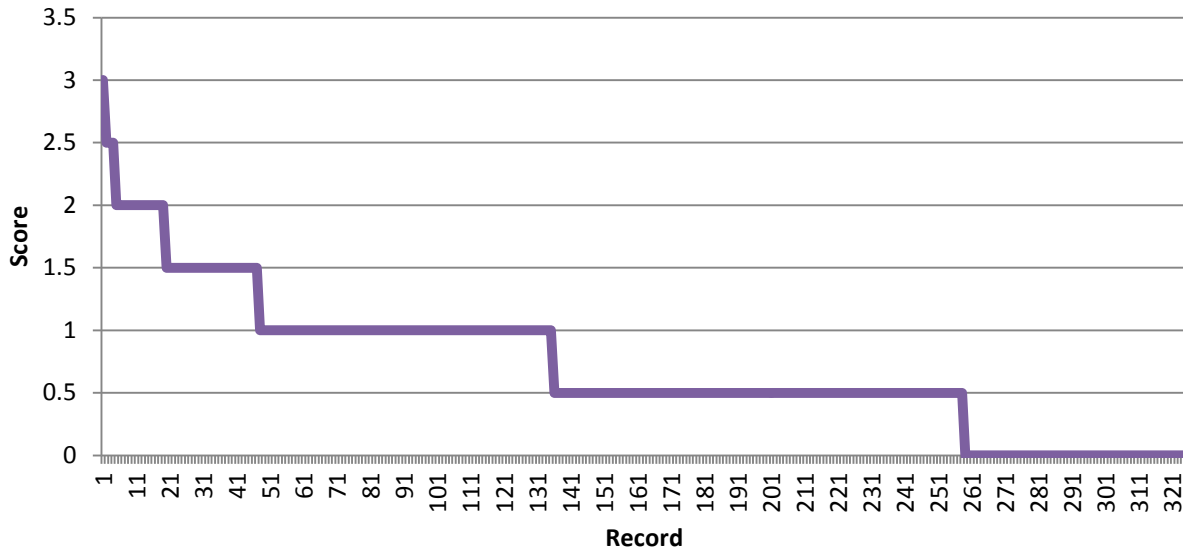
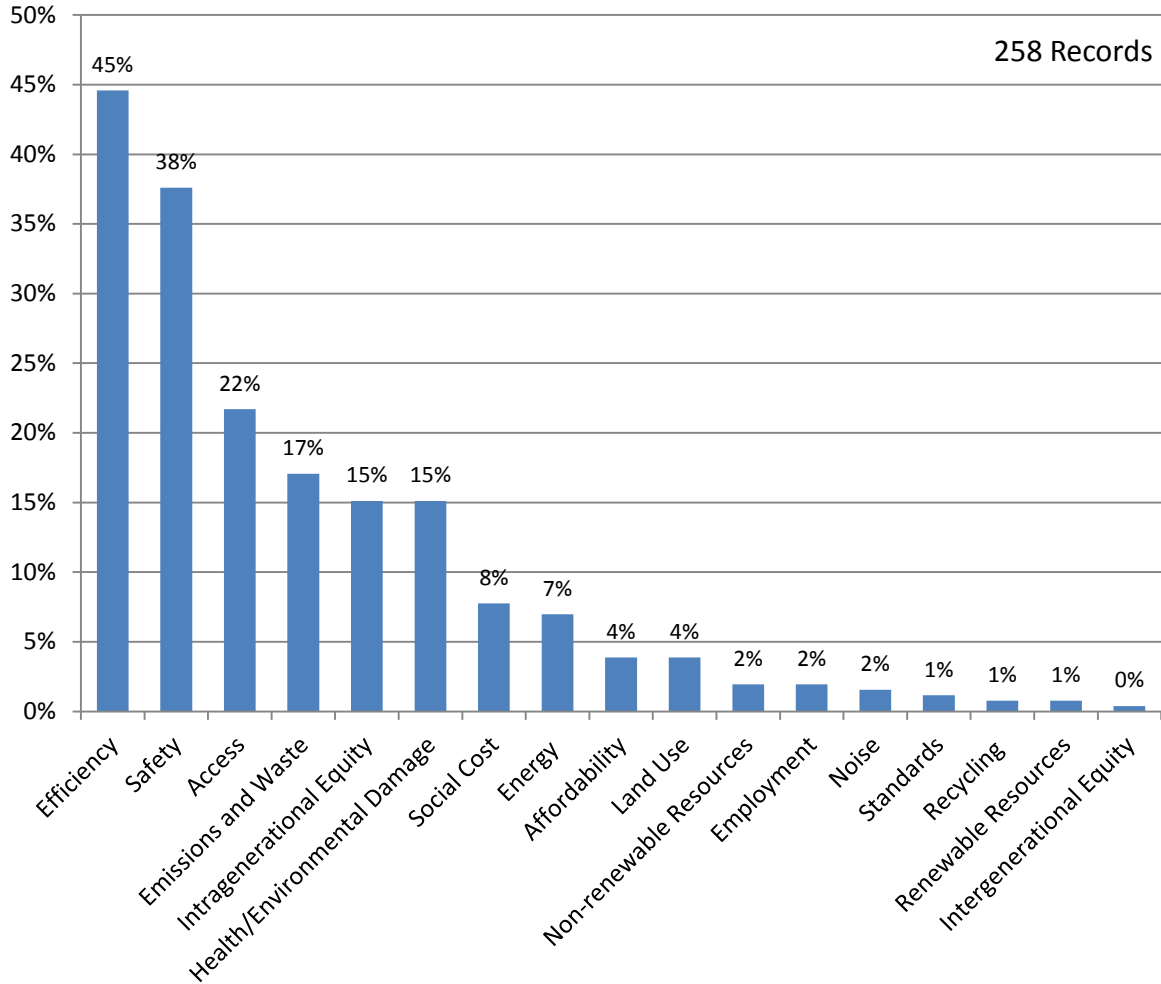**Figure 5: Records by Sustainability Score**

Figure 6: Sustainability Score for All Records

Of the 258 records that were assessed as being related to sustainability in at least one area, those records were broken down into which Sustainability Areas (Table 1) they covered (up to three per record, assigned by best judgment based on RNS record content) – see Figure 7.

The majority of the records that addressed sustainability in some way (a minimum score of 0.5) did so in the areas of economic efficiency or safety. The breadth of these categories may be one reason for the large number of records that addressed them. Efficiency, for example, was considered to be addressed whether the record was proposing ways to increase efficiency for an entire transportation system or research on one particular material that might make construction more cost efficient.

Surprisingly, several environmental topics such as recycling and renewable energy were infrequently addressed across RNS records, and only one record directly addressed the issue of intergenerational equity, despite this being a major component of many sustainability definitions (i.e., preserving resources for future generations). By identifying areas where a sustainability focus is lacking, Figure 7 provides some indication of where additional research may be needed to broaden the portfolio of TRB research targeted at sustainable development.

Figure 7: Percent of Records (scoring 0.5 and above) that Address Sustainability Areas

Figure 8 shows how many of the three sustainability dimensions (or 3 Es) were addressed by each record (not including those which scored zero).
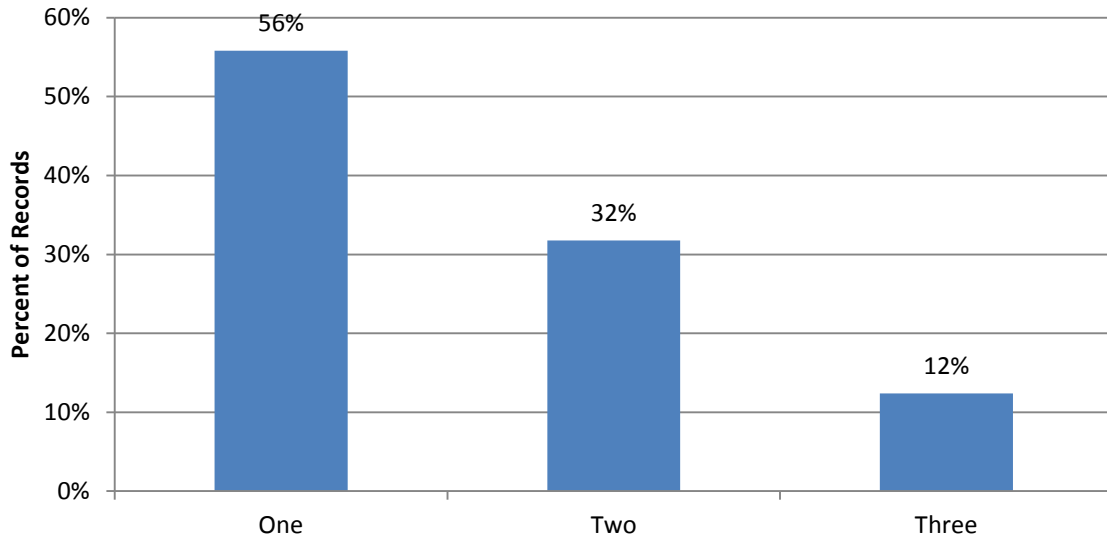
Figure 8: Percent of Records that Address One or More of the 3 Es

As seen in the above figures, very few records (12.4%) focused their research in a way that addressed sustainability holistically. Of those records that did address all three dimensions of sustainability in some way, only one record received a full point in each dimension (Figure 9).
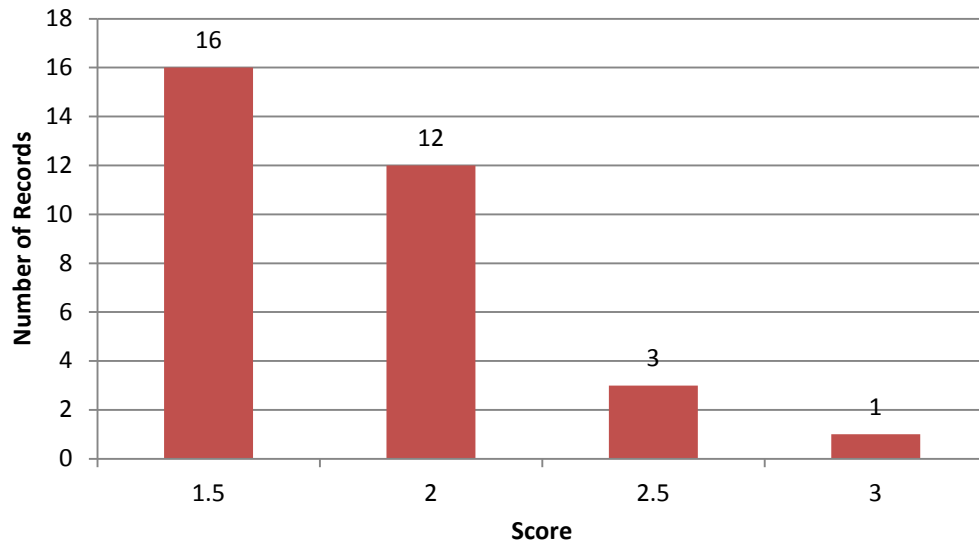

Figure 9: Scores for Records that Address All of the 3 Es

Table 4 lists the records, and associated committees, that received top scores (2 or greater with at least 0.5 points in each category). These records can be seen as taking a holistic approach to sustainable transportation and also highlight the TRB committees that are actively thinking about research in this area. The Committee on Transportation and Sustainability is not listed in the table since at the time of this analysis it did not have any active research statements in the RNS database.[3]

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[3] The Committee on Transportation and Sustainability has co-sponsored three research needs statements that were developed by the TRB Committee for Social and Economic Factors (ADD20) and Health + Transportation

Figure 10 provides a high-level summary of the approaches/analysis tools discussed in the research statements listed in Table 4 and links these with an application or problem area. This summary shows that there is a need for research that helps transportation agencies make informed decisions about how a proposed project or transportation-related development might impact the economy, society, and/or the environment.

The majority of the tools mentioned in high-scoring records were economic in nature (cost benefit analysis, other economic analysis, pricing strategies, etc.) regardless of the sustainability dimension the 'problem' most clearly addresses. As verified in the RNS records' content, this was often due to an attempt to integrate other considerations into a tool or approach that has traditionally had a more one-dimensional application. For example, the record "Analysis of Social Costs and Benefits of Advanced Biofuels and Other Low Carbon Fuels" suggests building social/equity considerations into economic models to evaluate low carbon fuel standards, thus integrating all three dimensions into the proposed cost benefit model.

Furthermore, the problems identified as well as the tools to address them vary greatly in focus and scope, perhaps suggesting a need for better guidance as to what tools are appropriate for which applications, and which tools may be able to support a more comprehensive or holistic analysis.

In addition to these top-scoring records, an additional number of records were identified as being the next best tier in terms of their score and/or their attention to all three sustainability dimensions. These are displayed in Table 5. These records represent those that are almost on the same level as the top scoring records, but needed either a broader scope or a more explicit focus on one or more of the areas of sustainability to be ranked higher. While almost every record found could be modified in some way to better address one or more areas of sustainability, these proposals are the ones that could most easily be modified to achieve a more holistic, sustainability-driven research focus. In general, these records fell into two categories:
- those that address two sustainability dimensions in a complete and explicit way but could expand their described research impacts to include the third dimension; and
- those that address a sustainability area within each overarching sustainability dimension in a limited manner (i.e., only address the issue of safety in the 'Equity' category), and that might easily be modified to include one or more additional areas within each dimension (i.e., safety *and* access).

(AD50-01). These three research needs statements were uploaded (on 9/13/12) after the RNS database was searched as part of the analysis described in this paper.

Table 4: Top Scoring Records and TRB Committees

Committee	Record Title	Sustainability Score			
		Envi.	Econ.	Eq.	Total
AFH30, Emerging Technology for Design and Construction	Research Program to Develop a Sustainable Decision Making Tool for Transportation Applications Based on Life Cycle Assessment	1	1	1	**3**
A0020T, Special Task Force on Climate Change and Energy	Analysis of Social Costs and Benefits of Advanced Biofuels and Other Low Carbon Fuels	1	1	0.5	**2.5**
	Analysis of Synergies between Transit, Land Use, and Pricing Strategies to Reduce Greenhouse Gas Emissions	1	1	0.5	**2.5**
	Quantify and Incorporate Environmental Benefits into Life Cycle Costing Models for Common Roadway Construction Practices	1	0.5	0.5	**2**
AP010, Transit Management and Performance	Performance Measures for Societal Goals	0.5	1	1	**2.5**
	Innovative Applications of Sustainability Performance Measures for Transit Planning	0.5	0.5	1	**2**
ADA40, Transportation Needs of National Parks and Public Lands	The Economic Impact of Public Lands Transportation Systems on Gateway Communities	1	0.5	0.5	**2**
	The Economic Impact of Transportation Systems on Gateway Communities	0.5	1	0.5	**2**
ADB40, Transportation Demand Forecasting	Policy Sensitivity: Trip-Based vs. Tour- and Activity-Based Models	0.5	0.5	1	**2**
ADC10, Environmental Analysis in Transportation	Analysis of Property Value Impacts of Transportation Projects	0.5	1	0.5	**2**
ADC70, Transportation Energy	Potential Travel Responses to Alternative Highway Pricing and Financing Systems and the Impact of Fuel Consumption and Greenhouse Gas Emissions	0.5	1	0.5	**2**
ADD30, Transportation and Land Development	Parking Strategies to Reduce Environmental Impacts and Improve Place	1	0.5	0.5	**2**
ADD50, Environmental Justice in Transportation	Establishing Equity Measures for Environmental Justice Cost-Benefit Analyses	0.5	0.5	1	**2**
AFB40, Landscape and Environmental Design	Early and Continuous Scoping and Stakeholder Involvement	0.5	0.5	1	**2**
AHB70, Access Management	Determining The Economic Value of Roadway Access Management	0.5	1	0.5	**2**
AW030, Marine Environment	Controlling Air Emissions At Marine Port Terminal Operations	1	0.5	0.5	**2**
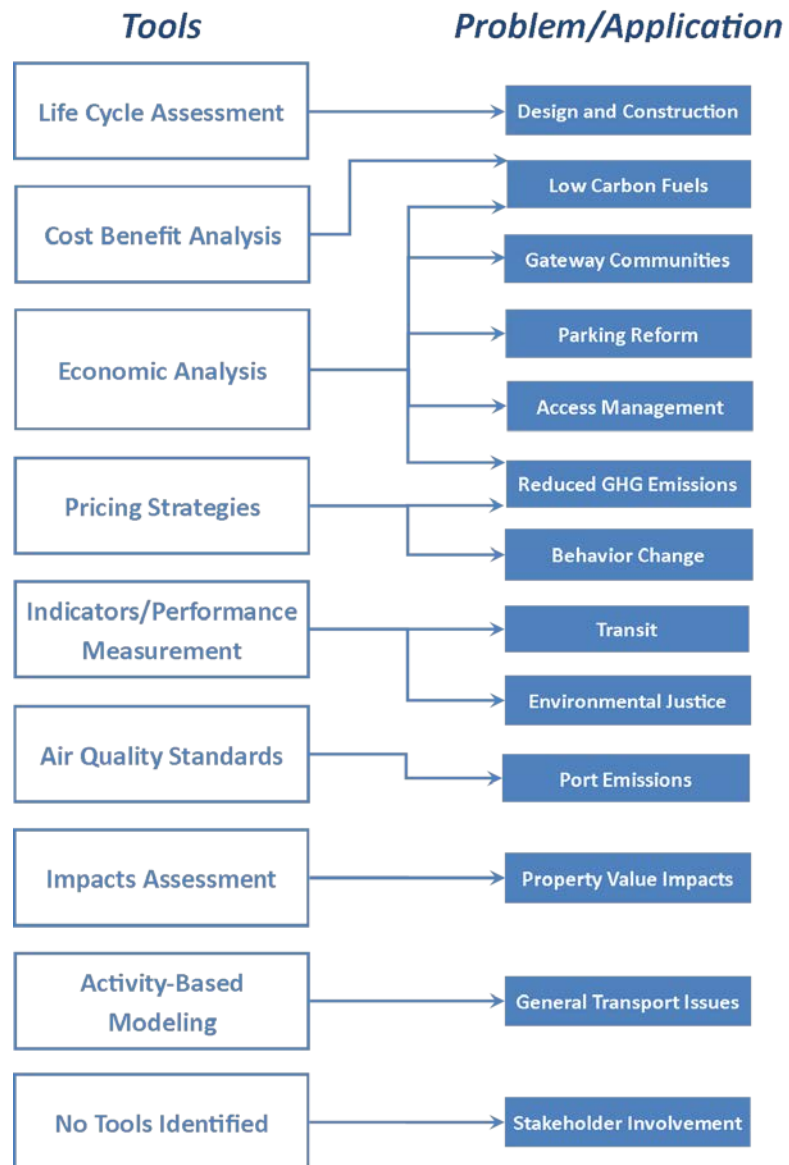
Figure 10: Problem Areas and Applicable Tools Found in Top-Scoring Records

Table 5: "Second-tier" Records Targeted as Easily-modified for a Stronger Sustainability Focus

Committee	Record Title	Sustainability Score			
		Envi.	*Econ.*	*Eq.*	*Total*
ADD30, Transportation and Land Development	Investigating the Disaggregate Travel Behavior Effects of the Built Environment	1	0	1	*2**
ADD50, Environmental Justice in Transportation	Economic Viability and Community Impact Assessments in Transportation Decision Making	0	1	1	*2**
A0020T, Special Task Force on Climate Change and Energy	Driving and the Built Environment Part II	1	0	1	*2**
	Improved Modal Operating Profiles for Comparisons with Transit	0.5	0.5	0.5	*1.5*
AHD65, Winter Maintenance	Demonstrating A Systematic, Multi-Criteria Approach to Deicer Selection	0.5	0.5	0.5	*1.5*
	Effect of Solar Loading and Radiational Cooling on Pavement Surface Temperature	0.5	0.5	0.5	*1.5*
	Winter Road Maintenance Research Roadmap	0.5	0.5	0.5	*1.5*
AHB30, Vehicle-Highway Automation	Vehicle-Highway Automation - Policy Implications	0.5	0.5	0.5	*1.5*
	Automated Vehicle Guidance for Mobility Services	0.5	0.5	0.5	*1.5*
ANF10, Pedestrians	Effects of Pedestrian Improvements on Transit Ridership and Customer Satisfaction	0.5	0.5	0.5	*1.5*
	Synthesis of Pedestrian Infrastructure Assessment Methods and Tools	0.5	0.5	0.5	*1.5*
ABE30, Transportation Issues in Major U.S. Cities	Major Cities' Adaptation to Global Climate Change	0.5	0.5	0.5	*1.5*
AFB50T, Task Force on Context Sensitive Design/Solutions (CSD/CSS)	CSS and Sustainability in Transportation	0.5	0.5	0.5	*1.5*
AHB15, Intelligent Transportation Systems	Analyze the Issues that Influence Widespread Deployability of Automated Transportation Systems, such as Human Attitudes Toward Automation and Impacts on Transportation and Community Development	0.5	0.5	0.5	*1.5*
AHB35, High-Occupancy Vehicle, High-Occupancy Toll, and Managed Lanes	Ridesharing as a Complement to Transit	0.5	0.5	0.5	*1.5*
AHD10, Maintenance and Operations Management	Development of National Service Level Criteria for the Interstate and National Highway System	0.5	0.5	0.5	*1.5*
ANF20, Bicycle Transportation	Methodology for Bicycle Network Analysis	0.5	0.5	0.5	*1.5*
AR010, Intercity Passenger Rail	Estimating Density of Rail Use in Planning for Intercity Rail Networks	0.5	0.5	0.5	*1.5*
AT045, Intermodal Freight Transport	Public-Private Partnerships for Increasing Capacity in Rail Corridors	0.5	0.5	0.5	*1.5*

* These records are included in the second-tier since they do not address all three dimensions of sustainability.

Only one record was determined to address all three dimensions of sustainability in a deeper manner. This record provides a good example of what a research proposal addressing sustainability in a holistic way might look like. The record scoring highest on our sustainability scale was:

Research Program to Develop a Sustainable Decision Making Tool for Transportation Applications Based on Life Cycle Assessment
http://rns.trb.org/dproject.asp?n=27908
Date Posted: 01/31/2011
Sponsoring Committee: AFH30, Emerging Technology for Design and Construction

It makes sense that this record received full points for each sustainability dimension since the purpose of the research is the development of a tool to evaluate the social, environmental, and economic impact of transportation projects. A word cloud (Figure 11) was also created to show the kinds of terms and ideas being discussed in a record with a comprehensive sustainability focus.

Figure 11: Word Cloud for Highest Ranked RNS Record

Conclusion

Overall, it was found that many RNS records address some area of sustainability, whether openly acknowledged or not. It was much less common to find records that propose research that truly addresses sustainability in a comprehensive way, with emphasis on the environmental, social, and economic impacts of the research. Thus, in developing its research portfolio, the Committee on Transportation and Sustainability should proactively support research (and the TRB committees proposing research) that address all three dimensions of sustainability.

Based on the analysis presented in this report, we have developed the following recommendations:

1. Since the Committee on Transportation and Sustainability does not have a portfolio of research statements in the RNS database, it is recommended that a *Research Subcommittee* be established to support the development of the committee's research agenda. To be successful in establishing funded research, the subcommittee will need to recruit federal and state transportation professionals who are active members of the Committee on Transportation and Sustainability to serve on the Research Subcommittee.

2. The Committee on Transportation and Sustainability (or a new Research Subcommittee) should carefully review the top scoring research needs statements (see Tables 4 and 5), with the objective of developing a new series of statements that both advance the ideas being presented and ensure that a more comprehensive/holistic approach to sustainability is promoted. It is recommended that the Research Committee Coordinator reach out to the TRB committees whose research needs statements are included in Tables 4 and 5. There may also be a need to reach out to other committees based on the subject matter. Further, it is recommended that the new/revised research needs statements be developed in a collaborative working environment (such as Google Apps) to ensure a transparent and open process.

3. There is a real need for the Committee on Transportation and Sustainability to develop comprehensive research proposals that address the three main pillars of sustainability. There is also a need to broaden the subjects addressed in proposed research projects, beyond topics such as efficiency and safety (Figure 7).

4. The Committee on Transportation and Sustainability should consider developing and disseminating clear guidance to other TRB committees on how they could develop research proposals that more comprehensively address the main pillars/components of sustainability. For example, the sustainability areas discussed in Table 1 could be included in such guidance to indicate the types of issues that are associated with sustainable transportation. The Committee should also be proactive in helping other committees draft research needs statements that better align their research agendas with the concern for sustainability.

Limitations

Due to resource constraints, it was not possible to extend this analysis to include the more than 10,000 records held within the TRB Research in Progress (RiP) database (http://rip.trb.org/). Thus, the analysis does not take into account any previous or ongoing research related to the concept of sustainable transportation.

Appendix A: Instructions for Replication of Scoring

The assignment of sustainability areas and the scoring of individual records is subjective and based on the perspective of the rater. However, care was taken to ensure objectivity and consistency in rating records. During the course of this study, a few observations were made that may help future researchers replicate or update this analysis.

- Due to the subjective nature of categorizing data, several records need to be examined and rated in the associated spreadsheet before a consistent approach is solidified.
    - In this case, approximately 15-20 records were ranked before the evaluator felt confident that each record was being evaluated in the same way, influenced as little as possible by personal values or preferences.
    - After the evaluator establishes a high level of confidence in his or her consistency in record evaluation, it may be useful to "spot check" some of the earlier records to ensure that they were ranked as objectively and consistently as possible.

- In many cases, RNS records follow a similar format consisting of several sections. In these cases, the problem, research objective, and to a slightly lesser extent, the urgency/payoff sections were evaluated to see if they addressed any of the sustainability areas. Sections discussing prior research were largely ignored, as these discuss previous work only.

- Each record should first be examined for discussion of any of the sustainability areas listed in Table 1. While the same terms do not have to be included verbatim, there should be some explicit discussion of that sustainability area for the record to be considered as addressing that area. In some cases, the evaluator may assume that a record's focus, by its very nature, may indirectly address an area (a record involving public transportation research, for example, will probably have an environmental impact). However, each record should only be given credit for areas that it discusses directly.

- After choosing up to three sustainability areas that the record addresses, records can then be scored either 0, 0.5, or 1 in each of the three sustainability dimensions. These scores should be directly related to the sustainability areas that were attributed to each record.
    - Where the record addressed only one sustainability area (i.e., safety) in an overarching sustainability dimension (i.e., equity) it should generally score only 0.5 points in that dimension.
    - Whether records score a whole point in any dimension is more subjective. In general, a whole point should be awarded if the record addresses more than one sustainability area in that dimension, and if the proposed research addresses that dimension directly and clearly, rather than as an afterthought.

Appendix B: Crosstab of Sustainability Topic vs. TRB Subject

TRB Subject	Access	Affordability	Efficiency	Emissions and Waste	Employment	Energy	Health/Environmental Damage	Intergenerational Equity	Intragenerational Equity	Land Use	Noise	Non-renewable Resources	Recycling	Renewable Resources	Safety	Social Cost	Standards	Total
Administration and Management	5	4	16	2	1	1	8	0	5	1	0	1	0	0	3	4	2	53
Aviation	1	0	5	7	1	0	4	0	1	0	4	1	0	1	6	0	1	32
Bridges and other structures	0	1	11	2	0	0	0	0	0	0	0	0	0	0	8	0	0	22
Construction	1	1	15	7	0	0	8	0	2	1	1	1	2	0	13	3	1	56
Data and Information Technology	10	0	10	3	0	1	4	0	3	0	0	0	0	0	7	1	0	39
Design	10	2	23	9	0	0	9	0	8	2	0	1	1	0	39	1	0	105
Economics	8	5	34	1	5	2	4	0	12	3	0	0	1	1	5	7	1	89
Education and Training	3	0	2	1	1	0	1	0	2	0	0	0	0	0	8	0	0	18
Energy	2	1	11	20	0	15	4	1	1	0	0	3	0	2	3	3	2	68
Environment	2	0	7	14	0	4	13	1	1	1	2	2	0	1	2	2	5	57
Finance	2	3	25	2	0	1	5	0	7	1	0	0	0	0	7	12	0	65
Freight Transportation	1	0	14	5	0	1	2	0	1	1	0	0	0	1	7	2	0	35
Geotechnology	0	0	5	3	0	0	3	0	0	0	0	0	1	0	4	0	0	16
Highways	23	6	71	21	4	11	22	1	24	8	1	4	2	0	65	12	2	277
History	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	3
Hydraulics and Hydrology	0	0	1	1	0	0	3	0	0	1	0	0	0	0	0	0	1	7
Law	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	2
Maintenance and Preservation	2	0	7	1	0	1	3	0	0	0	0	1	0	0	12	0	1	28
Marine Transportation	0	0	4	2	0	0	3	0	0	0	0	0	0	0	0	0	0	9
Materials	0	0	8	4	0	0	0	0	0	0	0	1	0	0	3	0	0	16
Motor Carriers	0	1	2	0	0	1	0	0	0	0	0	0	0	0	5	1	0	10
Operations and Traffic Management	16	1	21	5	1	0	9	0	2	3	0	0	0	0	31	5	1	95
Passenger Transportation	6	0	6	1	0	0	0	0	2	0	0	0	0	0	4	0	0	19
Pavements	0	0	8	0	0	1	1	0	0	0	1	0	1	0	7	0	0	19
Pedestrians and Bicyclists	24	0	9	1	0	0	3	0	8	2	0	0	0	0	29	0	0	76
Pipelines	0	0	2	1	0	0	0	0	0	0	0	0	0	0	3	0	0	6
Planning and Forecasting	29	3	41	7	2	4	14	0	19	6	1	1	0	0	24	7	3	161
Policy	7	2	18	3	0	0	7	0	4	2	0	0	0	0	3	5	0	51
Public Transportation	29	4	32	6	1	4	11	0	23	5	1	0	0	0	11	5	4	136
Railroads	3	0	5	3	0	0	0	0	2	0	0	0	0	1	5	1	0	20
Research	3	1	5	3	1	1	0	0	2	0	0	0	1	0	6	0	0	23
Safety and Human Factors	12	2	6	1	1	0	4	0	6	2	2	0	0	0	48	1	0	85
Security and Emergencies	0	0	4	0	0	0	2	0	3	0	0	0	0	0	9	0	0	18
Society	3	1	10	1	1	1	6	0	13	2	1	0	0	0	3	3	1	46
Terminals and Facilities	7	0	14	3	0	0	6	0	1	1	1	0	0	0	9	1	0	43
Transportation (General)	2	1	9	3	0	3	2	0	2	1	0	1	0	0	2	3	1	30
Vehicles and Equipment	2	2	3	2	0	5	1	0	0	1	0	0	0	0	1	2	0	19
Total	213	41	465	146	19	57	162	3	155	44	15	17	9	8	393	81	26	-

Appendix C: Highest Scoring Records with Word Clouds

Research Program to Develop a Sustainable Decision Making Tool for Transportation Applications Based on Life Cycle Assessment
Sustainability Score: 3

Analysis of Synergies between Transit, Land Use, and Pricing Strategies to Reduce Greenhouse Gas Emissions

Sustainability Score: 2.5

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Analysis of Social Costs and Benefits of Advanced Biofuels and Other Low Carbon Fuels
Sustainability Score: 2.5

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Performance Measures for Societal Goals
Sustainability Score: 2.5

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