PUBLIC SERVICE ASSESSMENT OF
PROPOSED ROAD CONSTRUCTION PROJECTS

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A public service based assessment of alternative road construction projects was designed by Bernalillo County, New Mexico, from 2006 to 2008. The purpose of the initiative was to assess and prioritize road projects for capital investment that would independently advise policy decisions. The research phase of the initiative included benchmarking national and international practice. The development phase addressed alternative ways of assessing and prioritizing completed as well as proposed road reconstruction and construction projects. Public service based assessment was successfully deployed in 2008 to advise allocation of bond revenue. Distinguishing characteristics of the public service evaluation are: 1) criteria used to indicate how well a road project would address public needs are measurement based, 2) other non-quantifiable observations are separately noted, and 3) the process involves the public and the results are transparent to the public within and across bond cycles. As of November 2012, the technical evaluation has been successfully deployed in three successive bond cycles. Public service assessment of road projects and other capital improvements is supported by policy makers and is integrated into ongoing operations.
Public Service Assessment of Proposed Road Construction Projects

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INTRODUCTION

A public service based assessment of alternative road construction projects was designed by Bernalillo County, New Mexico, from 2006 to 2008. The purpose of the initiative was to assess and prioritize road projects for capital investment that would independently advise policy decisions. The process developed is the Capital Improvement Program (CIP) Technical Evaluation. Public service based assessment was successfully deployed in the 2008 bond cycle. The CIP Technical Evaluation has been used in three successive two-year bond cycles, and has been extended to all modes of transportation investment as well as other capital improvements including water utilities, parks and recreation. This paper identifies the research, principles, process and practice to prioritize proposed road construction projects.

Redesigning the assessment of proposed road projects was in response to technical evaluations validating policy decisions rather than independently advising policy decisions. Apparent validation was achieved by changing weighting factors to arrive at preselected projects for public investment. The process was not transparent to the public, and weighting factors and technical evaluations varied with changes in elected officials and appointed managers.

There were unintended negative consequences of this practice. The prioritization process was opaque to the public. Technical staff members were discouraged because the effort in preparing data and analyses was irrelevant to the outcome. Policy makers had no resource for unbiased assessment of alternative road construction projects, making it at best difficult to assess projects not associated with political interest.

In response to these unintended consequences, the initiative began. The intent of the initiative was to provide an independent technical evaluation of proposed road construction projects to advise the County Manager and Commission. Policy makers were not bound to the technical evaluations and could rightly consider constituent and other interests in their decisions about how to allocate road construction funds. What policy makers and the public could depend upon was a rigorous assessment of measurement-based public services to help advise fund allocation.

RESEARCH

Bernalillo County staff members contribute to the ongoing search for innovative project prioritization practices. Among transportation projects generally, the persons who research non-motorized transportation and the persons who research reconstructing existing roadways are domain experts with direct responsibility for a type of project. Transportation planners and civil engineers were responsible for researching road construction project prioritization practices.

Benchmark practices are documented and accessible to all Bernalillo County employees and to all interested persons within and external to Bernalillo County. Various city, county, federal and non-governmental organization practices were reviewed within the United States and in other nations.

There are many examples of preselected road projects. Selected examples follow, progressing by level of government.
An international example is experience applying the Highway Development and Management Tool (HDM-4) developed by the World Bank and other organizations. When applied to road project programming, HDM-4 enables life-cycle analysis of proposed road construction projects. In addition to the prioritization process, one practice is to select projects by “user intervention,” as long as preselected projects meet the minimum condition of a positive Net Present Value. User intervention results in projects being, “…excluded from the prioritization process…”(1) Preselected projects are funded before project prioritization begins, reducing available funding for priority projects. Perspectives underlying user intervention might better be part of rather than separate from prioritization.

User intervention in road project selection based on differences in political or policy perspective is not limited to the international community. Within the United States of America, the Montana Department of Transportation (MDT) developed a project selection process that facilitated highway district prioritization of secondary road projects. The change in funding allocation and prioritization process was partially a response to new county commissioners changing priorities, even when funding had already been invested in environmental clearances and preliminary design.(2) Nine selection criteria were identified. MDT coordinated district-level weighting of the criteria. Districts ranked selection criteria differently, based on their secondary road context. The results of the rank were applied to road projects within each District. The problem of changing priorities was addressed by commonly accepted selection criteria and a method to convert the criteria to numeric ratings. The selection criteria and calculations developed by Montana are diverse. Among the selection criteria are “Consideration for County Having Positive Balance,” indicated by positive bank balance in increments of $100,000, and “Reduce Hazards,” indicated by accident number and severity. (2) While the selection criteria are diverse, a method was identified to produce a numeric rating for each criterion.

Prioritization of transportation projects is a regional as well as state concern. The El Paso Metropolitan Planning Organization, in concert with the Texas Transportation Institute, addressed the limitations of decision making with conflicting objectives that were not quantifiable. A method was developed to enable decision makers to rank projects that have a positive cost-benefit ratio based on five common subject areas: mobility; financial feasibility; connectivity; environment; and safety. Subjective judgments were weighted using a pair-wise comparison among competing subjects. The weight derived for each subject is used to combine qualitative and quantitative criteria into a single score. Projects can be automatically ranked without the need for decision makers to assess individual projects. Despite the apparent benefit of an automatic ranking of projects, “The decision-making body, however, can repeat the pair-wise comparison process if decision makers are added or replaced or when criteria are changed”.(3) The process addresses objectives that are not easily quantifiable, but not the concern for technical advisement independent of changes in public officials and appointees.

Local government is involved in road project prioritization, both individually as well as cooperatively with regional, state and federal government. The examples of are San Diego, California, and Puget Sound, Washington, may be helpful in the understanding current project prioritization practice.
The City of San Diego developed a Capital Improvements Program Prioritization Policy. The policy prioritizes projects by type. Projects with restricted funding categories compete only with projects with the same funding category. Projects also compete only with projects with the same asset type or project category, and the same level of completion. This restriction of competition among candidate capital improvement projects permits improvement specific public services and selection criteria to be identified. This is an important advance in improving the technical evaluation of projects by comparing them with projects providing the same public services. The San Diego transportation project prioritization factors include “Health and safety effects;” “Capacity and service;” “Project cost and grant funding opportunity;” “Revitalization, community support and community plan compliance;” “Annual recurring cost or increased longevity of the capital asset;” and, “Project readiness”(4). San Diego combines observations such as community plan compliance with and measurements such as capacity and level of service. Observations are assigned numbers based on judgments without the requirement of a process to qualify the judgment based on professional expertise, and without monitoring over time to determine if the judgment was accurate. The use of judgment is not accountable and not informed and refined over time. In the experience of some organizations including Bernalillo County, judgments not based on professional training and that are not accountable are subject to policy maker change.

A case study in Puget Sound, Washington, was conducted approximately five years after the San Diego policy was adopted. The Puget Sound case study involved two stakeholder groups in weighting goals and measurements associated with planning for highway and other transportation projects. Six desired outcomes of transportation projects were indicated by combing quantitative and qualitative measures. Outcome benefits were weighted by stakeholder assessment. Resulting benefits and output from a travel demand forecasting model were used to score and rank sample transportation projects. The types of projects ranked included arterial widening, a new passenger ferry route, and a vanpool expansion. While transparent, the approach used results in the acknowledgment that project prioritization, “…may change over time as new decision-makers are involved….“(5)

GAPS IN COMMON PROFESSIONAL PRACTICE

Research into other organizational approaches to road construction prioritization identified gaps in common professional practice within Bernalillo County and in other governmental organizations. Two gaps are between the substance and appearance of independent technical evaluation, and between public presentation and public involvement in project identification and selection. The gaps are described below, followed by a resource for closing them in Bernalillo County and elsewhere – commitment to public service improvement.

Independent Technical Evaluation

A common professional practice is modifying road project selection criteria and scores so priorities conform to policy maker expectations. A gap is created between technical evaluation to advise policy maker decisions and technical evaluation to conform to policy maker expectations. This gap in common practice is between the substance and appearance of independent technical evaluation.

In addition to research, personnel transfer into Bernalillo County confirms the gap as common professional practice. Executive leaders are recruited into Bernalillo County. For some, professional experience is outside the County and State of New Mexico and ranges from California to Georgia. Managerial transfers have a consistent initial response, based on their
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experience, that rigorous technical evaluation to advise policy makers is “not realistic,” and that political interests will result in adjustment to technical evaluations. Technical staff persons transferring into Bernalillo County make similar initial comments.

Initial assessments change with experience of the Bernalillo County approach to assessment of proposed road construction projects. Executive transfers see the response of elected officials wanting to see how projects are scored. Disagreements among policy makers about specific projects are often resolved through the independent assessment. One County Commissioner commented, “Too bad these projects did not score higher”. During one presentation to the County Commission of the independent technical assessment of a road project, another Commissioner pumped her fist in the air and said, “Yes!” There is a consistent and positive change in the perception of executive and technical transfers that comes from how elected officials benefit from and use the public service assessment. The gap between substance and appearance can be closed while respecting the interest of elected officials.

Change in elected officials by popular vote is fundamental to our Republic. The ability of elected officials to depend upon an independent technical assessment helps them make informed decisions. This is the single, simple, compelling purpose of technical capability at any level of government – providing support to elected officials and their appointees to better serve the public.

Public Involvement

A related gap in common professional practice is between public presentation and public involvement. Public presentation includes general notification of pending actions, invitation to public meetings for presentation and discussion of potential projects. This is common professional practice. Public involvement is less common, but certainly well defined professional practice in many jurisdictions. Public involvement encourages and enables the public to recommend projects. Public involvement makes both available and understandable how projects are evaluated and encourages public comment on the process as well as the result. Public presentation is explanatory. Public involvement is participatory.

Bernalillo County seeks to close this gap in common practice by providing both presentation and involvement. Those who choose to be involved are provided access to the evaluation process as well as the results. This access is not only through public meetings, but also through individual interaction with County staff both in person and using the Bernalillo County CIP Website. The County offers both presentation and involvement and the individuals we serve choose. This gap can be closed.

Public Service Improvement

Gaps in common professional practice can be closed by commitment to the principle of improving public service. The principle of public service is consistent. Tools and techniques change to better implement the principle.

METHODOLOGY

The methodology is presented in three parts. Principles found the process and are presented first. Principles are followed by a description of the process used to identify public services, criteria and measurements. Third, the process is applied in practice to road construction.

Principles

The Bernalillo County technical evaluation of road construction projects began with a set of principles. The principles were defined in 2006 and have been consistently applied as...
grouped and ordered below since their adoption. Language changes have been made, as in 2011 when Internet access was enabled for public involvement. The principles have not changed.

**Public Responsibility**

These three principles are the way in which the CIP is developed and delivered to the people of Bernalillo County.

- Consistency – the technical evaluation is repeatable from one project to the next, so the public can follow project scores and priorities from one CIP planning cycle to the next.
- Transparency – the technical evaluation of projects, not just the results of the technical evaluation, is shared with the public.
- Clarity – the technical evaluation and resulting priority of projects are shared so that the public can understand the Capital Improvement Program.

**Technical Evaluation**

These three principles are the way in which the CIP is developed and delivered to Bernalillo County policy makers.

- Measurement-based – the technical evaluation is measurement-based to ensure objective characterization of the projects and comparison among projects of the same infrastructure type. A measurement is a repeatable empirical observation. Measurement-based evaluation is implemented through defined criteria, measurement scales, measurement intervals and scores. Subjective characterization and final prioritization of the projects is valid in and reserved for subsequent policy-level review.
- Suitable Quantification – the quantification of project public services and attributes is appropriate to the problem and adds information to understand and compare projects.
- Base data retention – all CIP data are retained unmodified. Technical evaluations and adjustments to data, data definitions and procedures will be similarly stored so changes in procedures as well as projects, attributes and public services can be tracked over time.

**Internal Procedures**

These three principles are the way in which the CIP is developed and delivered by and in support of Bernalillo County professional staff.

- Computer-based – all projects, attributes, public service categories are designed for current and ongoing database development and management. Data acquisition techniques are designed to be as automated as possible thus supporting repeatability and maximizing staff output. A web-based front end into the data ensures ease of access and a consistent interface.
- Accountable – all project information is identified by person who entered the data and the date of data entry.
- Ongoing Improvement – changes to improve technical evaluation will be documented and dated so differences in project scores may be tracked. Technical advances by professional staff are encouraged for each criterion, measurement scale, measurement interval and the measurements on which scores are based. (6)

**Process**

Based upon these principles, there is a technical evaluation process. For each type of capital improvement, such as road construction projects, an expert task group implements the
process. Domain experts are assigned to the expert task group by the management team responsible for a type of capital improvement. The expert task group makes recommendations to the management team. The management team in turn recommends practices for final approval to the County Manager and County Commission.

When prioritizing road construction projects, an expert group is appointed by and reports to the Public Works Division management team. The work of the expert task group begins with identification of the public services provided by new road construction projects.

**Identify Preliminary Public Services**

The public services, criteria and measurements associated with road construction are different than those provided by other types of capital improvements such as a fire engine or a community center. The expert task group discusses what public services are associated with road construction. The purpose is to develop a preliminary set of public services provided by road construction projects. The set of public services is preliminary because appropriate criteria and measurements are associated with each potential public service. The expert task group attempts to develop a comprehensive list of public services that are then examined in relation to criteria and measurements.

Specific steps are taken to identify preliminary public services. The first step is review of current professional practice. What emphasis on public service is provided by the common professional discipline or disciplines associated with the capital improvement? The mission statement of professional associations and purpose statement of standard practices of the profession are reviewed. Typically, this effort follows from and contributes to benchmark practices.

The second step is to consult with project providers. Persons who provide the infrastructure – who design, build and maintain roads – are asked why their work benefits the public. This discussion broadens the expert task group to others within and outside of Bernalillo County who are committed to public service.

The third step is to consult with the public. The public is invited to comment on why road projects are important to them. While initially this step was held in conjunction with neighborhood groups, and public meetings remain important for face-to-face communication, the Internet provides an ongoing way to gather insight of persons served.

At this point in the process, preliminary public services are identified. The list is reduced and refined by asking what would indicate how well the public service is being provided.

**Identify Preliminary Criteria**

Criteria are next identified that indicate how well a public service is provided by a project within the population of same type projects. Each identified public service is challenged with the following questions.

What criterion or criteria describe how well the public service is provided by one project compared with another project?

Does a criterion indicate the public service alone, or other public services?

If other public services, does the criterion better indicate how well another public service is needed or would be provided?

Does the criterion describe all aspects of how well the public service is provided, or one aspect?
If the criterion describes one aspect of a public service, what is the relative importance of this criterion compared with criteria that indicate other aspects of the same public service?

The expert task group selects one or more criteria for each public service and reports the selection as a recommendation to the management team. No recommendation is made. The final selection of a criterion, and of a public service, is based on measurements.

**Identify Measurements**

All public services used in project prioritization are measurement based. The public service must have criteria that indicate how well the public service is provided, and measurements directly related to each criterion. There are two steps in identifying appropriate measurements for public service criteria: data review and measurement selection.

**Data Review** Measurement options are identified and questions asked about each alternative. Data review is not measurement selection, but data review provides information used in measurement selection.

**Measurement Appropriateness** Are the data empirical, objective measurements and not estimates? Is there a known error in the measurements? If there is a known error, how does the error compare with differences in measurements among potential projects of the same type? If the measurements are summarized before reporting, what calculations and adjustments are made?

**Measurement Availability** Are the measurements directly related to the criterion? Are measurements currently available for the criterion for existing and proposed projects? If a measurement is not currently available for all proposed projects, can it be taken? If a measurement is needed and can be taken, what resources are required to take the measurement or measurements?

**Measurement Format** Are the measurements in electronic format or readily entered into electronic format? Are the measurements geographically referenced?

Reviewing the data is not a selection. Reviewing the data provides answers to questions that are used the selection of measurements.

**Measurement Selection** The following questions are discussed by the expert task group before recommending public services, criteria and measurements to the management team.

1. Does or would the measurement or measurements for a criterion measure how well the public service is being delivered?

   This is the primary concern in selecting a criterion. It does not matter if measurements associated with a criterion are available and accurate if they do not indicate how well a public service is being provided. Being easy to measure is a secondary consideration, not the primary consideration. Criterion measurement of how well a public service is being provided is the primary consideration.

   At this point, preliminary criteria are removed from further consideration if the answer to this first question is, “no”. If there are no alternative criteria that would measure how well a public service is being delivered, the public service should be removed from the technical evaluation until a criterion is identified that affirmatively answers this question.
2. Are the criteria measurements available, or can the measurements be readily available, for all currently proposed and potentially proposed projects?

A proposed road construction project should not be disadvantaged in scoring because the measurements for a criterion are unavailable or only available with resources that cannot be assigned when the evaluation is taking place. Remove preliminary criteria from further consideration if the answer to this second question is, “no,” measurements will not be available for all proposed projects of the same type. If there are no alternative criteria that would measure how well a public service is being delivered, the public service should be removed from the technical evaluation until a criterion is identified with measurements for all current and potential projects either on record or achieved with available resources.

3. Do the measurements have an acceptable error?

A criterion should have measurements found to have an acceptable error. While this is commonly understood as the error confounds rather than quantifies differences among proposed projects, the expert task group may consider other reasons why a measurement is or is not acceptable. An example is a proposed measurement that is not consistently applied to all candidate projects. For example, if a proposed measurement cannot be taken for road construction across bridges with certain physical characteristics, estimates may be proposed instead of measurements. As a result, in addition to lack of consistency, bias may exist for or against bridges with direct measurements and those with estimates. If potential bias has not been studied, documented and reviewed by the expert task group, the proposed measurement should not be used.

Remove alternative criteria from further consideration if the error in the measurements is not acceptable for comparing among candidate projects. Similarly, if there are no other criteria to indicate the effectiveness of a public service, the public service is not included.

4. Are there other differences among measurements?

The critical concerns are the first three questions. The remaining alternative measurements, criteria and public services meet the minimum qualitative threshold for selection. Other differences in measurements can be referenced in making the final recommendation.

As an example from considering Measurement Format during Data Review, data may be currently incapable of being entered into a consolidated database or a GIS environment. This comparison may help answer the question of which of two measurements should be used for a criterion, and may answer which of two or more criteria should be selected for a public service.

At this point in the process, the expert task group recommends public services, criteria, and measurements to the management team. While the management team considers the recommendation, the expert task group reviews other project attributes.

Review Project Attributes

Attributes are characteristic of all types of capital improvements. An expert task group associated with a specific type of capital improvement reviews the attributes to confirm whether or not the attributes apply to the type of capital improvement for which they are responsible. Confirmation, or a recommendation for change, is made to the management team for consideration.

Score and Rank Projects
**Score Projects**  After the process has been approved, it is applied to all proposed projects of the same type. A numeric 4-scale is used for both public services and attributes. The public service scoring scale is numeric. The number “4” is the highest score a project can receive for a public service criterion, and the number “1” is the low. A zero is assigned if a project measurement does not fall within the intervals of the scoring range. The scores are summed and the result is the total public service score for a proposed project.

The attribute scoring scale is alphabetic. The letter “A” is high and the letter “D” is low. A null is assigned if a project observation does not fall within the intervals of the scoring range. The letter scores are averaged and the result is the total attribute score for a proposed project.

**Rank Projects**

Public service and project attribute scores are reported together to rank projects. The public service score is presented first followed by the attribute score. An example set of road construction project scores is as follows.

<table>
<thead>
<tr>
<th>Project Number</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project 1</td>
<td>19 A</td>
</tr>
<tr>
<td>Project 2</td>
<td>19 D</td>
</tr>
<tr>
<td>Project 3</td>
<td>16 C</td>
</tr>
<tr>
<td>Project 4</td>
<td>9 B</td>
</tr>
</tbody>
</table>

A project with a combined public service and attribute score of 19A would be considered higher than a project with a combined score of 19B, C or D. The order of reporting scores reinforces that capital improvement project prioritization is based on measurements of public services and then clarified by observations of other important project attributes.

**Report Project Priorities**

For each type of capital improvement, a list of proposed projects by priority and with scores is provided to policy makers. For each proposed project, a one-page summary of project public service and attribute scores is also provided to policy makers. It is helpful to provide project-specific disaggregate scores for policy-level review in addition to the list by technical priority. The technical evaluation is constant. Policy makers then assess the technical evaluation and make their decision. Each step in the process, including reporting project scores and ranking, is public.

**Process Summary**

The process described above was first used for road construction projects and has been used for other types of transportation and other capital improvements. Additional steps are taken. The most common is documentation of alternatives that could not be implemented because of data limitations. Practice considered and not adopted is documented as well as practice considered and adopted. This permits reassessment of public services over time as improvements are made to data and related data tools, and helps implement the principle of ongoing improvement. The result of applying the process to road construction project prioritization follows.

**Practice**

Practice describes how the above practice informed prioritization of road construction projects in Bernalillo County. Final public services, criteria and measurements are presented. Included is one public service and criterion subsequently not scored for road construction.
projects because of measurement errors. The practice includes the public attributes used to score
other important observations about proposed projects. Public services provided by road
construction projects are presented first.

Public Service Introduction

Three public services of proposed road projects were selected by the expert task
group: Mobility, Environment, and Safety. Eight criteria were identified for these public
services. After approval, while scoring the projects a measurement error was found in
relation to one criterion. While alternative measurements are being considered, the
measurement, criterion and public service are noted to describe how the process was put
into practice.

In some criteria described below, professional judgment is accepted when
measurements are unavailable. Requirements are defined for professional judgment.
Requirements include documentation of the basis for the judgment and tracking results.
These requirements are referred to by Bernalillo County as “accountable professional
judgment”. A technical brief on Accountable Professional Judgment was prepared by
Bernalillo County to ensure consistency of practice. As all CIP documentation, this
technical brief is available to all interested persons and organizations.

Public Service: Mobility

Criterion - New Construction Level of Service This is the first of two criteria based on
Level of Service (LOS) as an indicator of the public service of improved Mobility: the
first criterion applies to new road construction, and the second applies to reconstruction
of an existing roadway.

LOS describes operational conditions within a traffic stream, based on service
measures such as speed and travel time, freedom to maneuver, comfort and convenience.
LOS ranges from the best operating conditions at LOS A to the least desirable operating
conditions at LOS F. LOS is of particular interest because it conforms well to public
experience, which can help with public communication. The minimum acceptable
serviceability adopted by Bernalillo County is LOS D. It should be noted that one
proposed interchange was projected after completion of construction to operate below the
adopted serviceability design standard.

If the design for a new road construction project is analyzed as operating at LOS
D or better (C, B, or A), the facility receives a “4”. If a project is analyzed at operating
below LOS D (E or F), it receives a score of zero.

Points New Construction LOS

<table>
<thead>
<tr>
<th></th>
<th>Meets or Exceeds LOS Design Standard</th>
<th>Below LOS Design Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Criterion - Reconstruction Level of Service Improvement**  When assessing reconstruction or replacement LOS Improvement, the emphasis is on the change in established LOS rather than design to the County minimum acceptable standard of LOS D. The measurement intervals emphasize the priority in improving LOS – addressing first roads that currently fail. After improvements to LOS F, the logical progression of LOS improvement follows. The improvement must be to the minimum design standard for a current serviceability of F and E, and a minimum increase of one level of service for road with a current serviceability of D and C. No improvement past LOS C is awarded a point in the measurement interval. Improving a road operating at LOS C when other roads were operating at or below the minimum acceptable level of service would not improve the public service of mobility.

<table>
<thead>
<tr>
<th>Points</th>
<th>Improvement to Existing Roadway LOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>F Improved</td>
</tr>
<tr>
<td>3</td>
<td>E Improved</td>
</tr>
<tr>
<td>2</td>
<td>D Improved</td>
</tr>
<tr>
<td>1</td>
<td>C Improved</td>
</tr>
</tbody>
</table>

**Criterion - County Households Served**  Roads, intersections and multi-use trails may be compared on the basis of the number of households served. This criterion emphasizes the importance of serving the mobility needs of our current population.

The TRansportation Accessibility Model (TRAM) is used with Census data and the local as well as regional street and trail network to define the service or market area for the proposed transportation infrastructure. A contour map is drawn from the road proposed for improvement and incorporated into the GIS. Using the GIS, households inside the contour are summed. The basis of the map for each project is the 5-minute travel time using the proposed infrastructure improvements. To ensure the motorized vehicle theoretical access corresponds to the link use, the 5-minute travel by motorized vehicle is constrained by a select link analysis using the Mid Region Council of Governments (MRCOG) regional transportation model that identifies road network connectivity and use.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Current Households Served</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>10,000 +</td>
</tr>
<tr>
<td>3</td>
<td>5,000-9,999</td>
</tr>
<tr>
<td>2</td>
<td>1,000-4,999</td>
</tr>
<tr>
<td>1</td>
<td>1-999</td>
</tr>
</tbody>
</table>

**Criterion – Projected Households Served (10-Year Growth)**  Road construction projects are compared on the basis of the number of households that will be served in ten years. This criterion emphasizes the importance of serving the mobility needs of population growth areas.

The Transportation Accessibility Model (TRAM) is used with Census data and the local as well as regional street network to define the service or market area for the roadway. A GIS contour map is drawn from the road proposed for improvement, and the projected number of households summed within the defined boundary.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Projected Households Served (10 Year Projection)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>10,000 +</td>
</tr>
<tr>
<td>3</td>
<td>5,000-9,999</td>
</tr>
<tr>
<td>2</td>
<td>1,000-4,999</td>
</tr>
<tr>
<td>1</td>
<td>1-999</td>
</tr>
</tbody>
</table>
**Criterion – Households Without Other Access**  This criterion considers the mobility needs of households with limited street access. The criterion measurement is the number of households that have access to the road network through the road project and only through the road project. This acknowledges that some roads of lower functional classification are most important to those who access directly and solely onto those roads. While the criterion was initially suggested as a way of acknowledging the public service of some rural roads, the criterion has found helpful application throughout Bernalillo County.

Once the parcels are identified within the Geographic Information System, aerial photos are overlaid and a manual count is made of the households. The household records by parcels are maintained for other uses, including validation of future proposed methods to automate household access estimates based on parcel data.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Households Without Other Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>100+</td>
</tr>
<tr>
<td>3</td>
<td>50-99</td>
</tr>
<tr>
<td>2</td>
<td>25-49</td>
</tr>
<tr>
<td>1</td>
<td>1-24</td>
</tr>
</tbody>
</table>

**Public Service – Environment**

**Criterion – Air Quality Improvement**  Mobile source air pollution is in a part a result of length of and time required to take a trip. If trip length – or Vehicle Miles Travelled (VMT) – is reduced, and if the travel time – or delay – is reduced, air pollution will decrease. Some road construction projects are intended to reduce trip length and travel time, and therefore may benefit the public by improving air quality.

Intersection delay was integrated into the project design. Professional judgment of a domain expert, typically the domain expert who would design the proposed project if funded, was used to assess whether or not there would be a reduction in delay.

Accountability was built into the process.

Expert task group discussion of lowering VMT was reduction in trip length through development of the arterial road network. The initial approach to road segment impact on VMT was use of the regional travel model. For this application, errors in the current regional travel model output were not acceptable. Professional judgment was used to assess whether or not a proposed road would reduce VMT.

In both aspects of air quality improvement, professional judgment was whether or not VMT and/or delay would be reduced by a proposed project. Accountability is in place for before and after studies of delay. VMT accountability requires improvement to the analytical model, which is pending. The analytical model for accountability for non-motorized transportation projects has been completed, based on an approach developed cooperatively with URS Corporation.(7)

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<thead>
<tr>
<th>Scale</th>
<th>Reduction in Mobile Sources of Air Pollution</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Reduction in Vehicle Miles Traveled (VMT) and delay</td>
</tr>
<tr>
<td>3</td>
<td>Reduction in VMT or delay</td>
</tr>
<tr>
<td>0</td>
<td>No reduction in VMT or delay</td>
</tr>
</tbody>
</table>

**Public Service – Safety**

**Criterion – Crash Rate Reduction**  Improvements to existing roadways can result in the reduction of accidents. Two approaches were considered for this criterion. The first was the potential reduction of accidents by a specific type of improvement to a specific type of roadway; or, an Accident Modification Factor (AMF). An AMF would be estimated
based on the Highway Safety Manual. The AMF for an improvement would be noted and the appropriate score assigned to the project. The more a design reduced the potential for accidents based on national experience, the higher the score. All projects scored using this approach require a project design as well as a before-and-after study. The AMF-based scoring would be based on professional judgment about the road design. For existing roads it would involve a before and after study.

The second approach is measurement-based, using Crash Rates published by the regional government. Use of crash rates reduced professional judgment and accountability requirements, and was adopted for this criterion. Roads higher than the average regional crash rate are a priority for reconstruction. Scores are based on how much more a proposed road crash rate is above the regional average. For proposed new roads, a domain expert identifies a parallel facility, and the crash rate was used for the current, parallel facility. Accountability for new road crash rate is in comparison of crash rates between the new road and the identified parallel facility.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Proposed Project Crash Compared with Regional Average Crash Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>4 times higher than the regional average</td>
</tr>
<tr>
<td>3</td>
<td>3 times higher than the regional average</td>
</tr>
<tr>
<td>2</td>
<td>2 times higher than the regional average</td>
</tr>
<tr>
<td>1</td>
<td>Between 1 and 2 times higher than the regional average</td>
</tr>
</tbody>
</table>

Criterion: Speed Dispersion (in mph) Crash-involved vehicles are generally over-represented in the high and low-speeds, and vehicles travelling just above the average speed are least likely to be involved in a crash. The standard deviation of speeds is one way in which speed dispersion is expressed. Speed is monitored at the site of each CIP road reconstruction project that is proposed in part to address the public service of safety and the criterion of reducing speed dispersion. The measure of dispersion confirms whether or not and the extent to which there is a speed dispersion problem at the current site.

A requirement for applying a score for this criterion is that the project is or will be designed at least in part to reduce the speed dispersion. If this is the design intent, the score is applied only when there is also a commitment to an after study to assess whether or not and the extent to which the design resulted in a reduction in speed dispersion. If there is not a commitment to a before-and-after study for a specific project, this criterion is scored as uncalculated.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Standard Deviation of Vehicle Speed (mph)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>25+</td>
</tr>
<tr>
<td>3</td>
<td>20-24</td>
</tr>
<tr>
<td>2</td>
<td>15-19</td>
</tr>
<tr>
<td>1</td>
<td>10-14</td>
</tr>
</tbody>
</table>

Attribute Introduction

In practice, while changes have been considered since project attributes were first identified, attributes and criteria have not changed. Changes have been made to scoring scales and observations. There are four attributes common to all types of capital improvements and applied to evaluate proposed projects: Leveraged Funds, Recurring Costs, Project Impact, and Expressed Need. There are eight criteria for these attributes.

Attribute: Leveraged Funds
**Criterion: Committed Funds**  This criterion recognizes the importance of the status of committed funds for a project. The progression from planning, programming, and signed agreements is the basis for the evaluation.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Signed Agreement</td>
</tr>
<tr>
<td>B</td>
<td>In Program</td>
</tr>
<tr>
<td>C</td>
<td>In Plan</td>
</tr>
<tr>
<td>D</td>
<td>Not Planned</td>
</tr>
</tbody>
</table>

**Criterion: Non-Local Funds**  This criterion recognizes the importance of attracting external funds to supplement local funds. As in the first criterion for this characteristic, the status of external funds is the basis for scoring.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Signed Agreement</td>
</tr>
<tr>
<td>B</td>
<td>In Program</td>
</tr>
<tr>
<td>C</td>
<td>In Plan</td>
</tr>
<tr>
<td>D</td>
<td>Not Planned</td>
</tr>
</tbody>
</table>

**Criterion: Expended Funds**  The final criterion for evaluating the attribute of leveraged funds is whether or not non-local funds have been expended on the project. A minimum threshold of 2% of the projected cost of the project must be expended to meet a response of “Yes” in the following scale. If this threshold is not met, there is no score assigned, indicated by a “-“.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>-</td>
<td>No</td>
</tr>
</tbody>
</table>

**Attribute: Recurring Costs**

**Criterion: Recurring Cost Reduction**  This criterion indicates lower maintenance cost resulting from a capital improvement. No score is given, and a flag is shown by the project final score transmitted to policy makers if a project is projected to increase recurring costs. Increased costs are estimates based on professional judgment. Projected costs are retained for ongoing evaluation and refinement of professional judgment. This is an example of accountable professional judgment.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>$5,000 and over</td>
</tr>
<tr>
<td>B</td>
<td>$1,000-$4,999</td>
</tr>
</tbody>
</table>

**Attribute: Project Impact**

**Criterion: Geographic Area**  This criterion recognizes the importance of valuing the geographic area of the County served by a project. The area of the County impacted by a project is based on Commission Districts. If all Commission Districts are impacted, the County as a whole is impacted. If not all but more than one District is impacted, then the Districts (plural) score is applied. If an area within a District but not the entire District is impacted, then the Neighborhood score is applied.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>County</td>
</tr>
<tr>
<td>B</td>
<td>Districts</td>
</tr>
<tr>
<td>C</td>
<td>District</td>
</tr>
<tr>
<td>D</td>
<td>Neighborhood</td>
</tr>
</tbody>
</table>
**Criterion: Service Continuity**  This criterion recognizes the relative importance of maintaining current public services. Some capital improvements replace existing infrastructure, and receive the corresponding score. Some capital improvements extend existing infrastructure, and receive the new infrastructure score.

- **Attribute: Expressed Need**

**Criterion: Community Request**  This criterion concerns whether or not Bernalillo County has received a request from someone in the community to proceed with a project. The request may be in public meetings, telephone, Internet or mail, from residents in support of a project.

- **Criterion: Request History**  This criterion concerns the number of years that a project has been proposed for CIP funding. The years are counted from initial request to most recent request for the same project. The highest score is for projects proposed over three successive CIP cycles. The community request database is the basis for the request history.

**RESULTS**

Distinguishing characteristics of the public service evaluation are: 1) criteria used to indicate how well a road project would provide public services are measurements or based on accountable professional judgment, 2) attribute observations are separate but included in the project score provided policy makers, and 3) the process involves the public and the results are transparent to the public within and across bond cycles.

As of November 2012, the technical evaluation has been successfully deployed in three successive bond cycles. Public service assessment of road projects has been integrated into ongoing operations, and retains its technical integrity.

Ongoing improvement is being made in several ways beyond the specific examples noted in the paper. There is ongoing improvement of data collection practices. There is ongoing benchmarking of other related practices. Documentation is of increasing interest.

Documentation beyond current practice, proposed practice, and rejected practice includes guidance to expert task groups and domain experts. Consistent with the principles on which this initiative was founded, documentation is open and available to all who are interested. Responses to the documentation, along with benchmarking and specific technical improvements, further strengthen project prioritization principles, process and practice.

**ACKNOWLEDGEMENTS**

The Capital Improvement Program Technical Evaluation could not have been implemented without the hard work and ongoing support of many persons. Jon Phillips, Paul Davidson and David Albright made noteworthy technical contributions to road construction project prioritization.
REFERENCES


(5) Outwater, Maren L.; Adler, Thomas; Dumont, Jeffrey; Kitchen, Matthew; and Bassok, Alon. Quantitative Approaches for Project Prioritization: A Puget Sound Case Study, presentation to the Transportation Research Board 2012 Annual Meeting, Paper Submitted August 1, 2011, revised November 14, 2011, p. 16.


