USING AN AREA-WIDE ANALYSIS OF CONTEXTUAL DATA TO PRIORITIZE NMT INFRASTRUCTURE PROJECTS: CASE-STUDY CAPE TOWN, SOUTH AFRICA

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Abstract

Improving mobility is seen as key to facilitating the economic uplift of the urban poor. In South Africa, the majority of urban poor live in the periphery of cities. They travel long distances at high cost to go to work and school and are dependent on public transport and non-motorized transport (NMT) (walking and cycling) for their travel needs. Prioritizing NMT infrastructure projects, especially in view of the extent of the need and limited budgets, poses a great challenge to local decision makers.

This paper describes the application of a statistical clustering method to the results of a GIS-based Spatial Multiple Criteria Assessment (SMCA) of contextual data in a city or town to identify areas that are most suited for walking and cycling infrastructure. The method allows for a large amount of land use, socio-economic, environmental and transport data to be included into the assessment in a logical manner, and for statistically robust outputs. The method is demonstrated through the use of a case study in the city of Cape Town, South Africa. The results are analysed in relation to the current NMT planning being done in the city. It is able to identify infrastructure that should be prioritized, or may benefit from a possible realignment.

The research demonstrates that contextual information should play a role in infrastructure provision decision-making processes, and shows how the sustainability concerns underlying integrated land use and transport planning can be put into effect within the traditional transport planning environment.

Keywords: Cluster Analysis, Multiple Criteria Analysis, Spatial Analysis, Non-Motorised Transport Planning
1. Introduction and Background

Cape Town is a medium sized city in the Western Cape Province, South Africa, with a population of approximately 3.7 million inhabitants in the broader metropolitan region (Statistics South Africa, 2008). The Western Cape is the second wealthiest area in the country, but it has the highest median income of all 9 provinces in South Africa (Finn et al., 2009). Cape Town, the largest city in the Western Cape is, however, an increasingly unequal city. Smith (2005) notes that the city is experiencing ever widening levels of inequality, due to high levels of migration of unskilled individuals to the city and a disproportionate growth in unemployment between demographic groups. The urban poor tend to settle in the growing informal settlements on the periphery of the city, where access to the resources and services, provided by the city, is poor (City of Cape Town, 2009a).

One of the key strategies that the city government has adopted to address the growing problem of unsustainable informal settlement growth, is to improve the mobility for marginalized peoples, and to provide better access to important centres of employment and social services (City of Cape Town, 2009b). Non-Motorised Transport (NMT) plays a key role in this strategy, and its centrality to the strategy is highlighted in many of the city’s transport policy documents (City of Cape Town, 2005).

Various NMT planning and implementation initiatives have been undertaken in the last few years in Cape Town including corridor plans such as the Klipfontein Road Corridor Project and the Integrated Rapid Transport (IRT) project which included a NMT component. Owing to the various planning initiatives undertaken, the City of Cape Town identified a need for the consolidation of all of the NMT network planning and initiated the development of a city-wide NMT network plan. The scope of work comprised the analyses of various informants and the development of a NMT network. The City of Cape Town identified a need for the consolidation of all of the NMT network planning and initiated the development of a city-wide NMT network plan. The scope of work comprised the analyses of various informants and the development of a NMT network. This paper describes the development of this plan and applies its findings to new research conducted at the University of Cape Town.

Beukes (2011) developed a Context Sensitive Multimodal Assessment method that uses contextual information to develop road infrastructure recommendations for the purpose of improved road design. The method uses a GIS-based Spatial Multiple Criteria Analysis (SMCA) that is combined with statistical clustering techniques to identify contextually similar areas along arterials. The context is defined in terms of a range of land use, socioeconomic, environmental and transportation information, presented spatially, which are used as inputs to the SMCA. The results of this analysis describe the relative suitability of different modes of transport to locations along arterial routes. Clustering the output of this analysis allows for sections of the arterial route with similar contexts to be identified. The cluster attributes are then used to develop proposals for road infrastructure design.

The benefits of the method is that it facilitates a comprehensive view of transport planning that is considerate of the multimodal nature of roads, the variations in local context, and that sits well with existing planning approaches. It helps to bridge the conceptual gap between integrated land use and transport planning and road design by explicitly including, in a formal, methodical process, a much larger range of factors in the planning stages of the design process than what is currently done in practice. The research by Beukes (2011) was subsequently extended by Raynor (2011), to include an area-wide analysis, the findings of which forms the basis for the work presented in this paper.

2. Regional NMT plans for Cape Town

In developing the NMT plans, the city was divided into quadrants: north, south, east and central. The
planning for each quadrant was awarded separately to different consulting teams who worked largely independently from each other. This resulted in four rather different documents being produced, each providing different levels of detail and explanation, and with the emphasis not consistently placed on the same issues amongst the teams. Differences in the approach taken to planning and project identification are also very evident. In retrospect, the reasoning behind managing the planning process in this way could, therefore, be called into question, since it is the end product, the NMT plan for the city, that was negatively affected.

The project brief given to each team was to provide the professional services for the planning, assessment, design and implementation of NMT projects for their particular region of Cape Town (KV3 Engineers, 2010).

The scope of work included:

- Reviewing and updating the previous NMT Master Plan.
- Providing an overview and inventory of existing NMT facilities.
- Identifying, auditing and assessing and costing of potential NMT projects.
- Prioritising between the identified projects

3. Regional Planning Approaches

There were significant differences in the approach adopted to identifying the projects in each region. The approach taken in each region is outlined below:

3.1 Central Region

The consulting team generated an inventory of the existing infrastructure, classifying each in terms of the classification system recommended in the Pedestrian and Bicycle Facility guidelines; Manual to plan, design and maintain safe pedestrian and bicycle facilities (NDoT, 2003). Planned infrastructure or infrastructure projects under construction were also included in the overview.

The document (Kayad Knight Piesold Consulting, 2010) does not indicate whether existing infrastructure was evaluated in terms of its suitability or functionality. Typically, this would involve an assessment of service levels and a condition assessment. Accident information was collected, but is unclear as to how this information was used to make planning decisions.

In fact, the methodology used to identify the NMT requirements along each route is not detailed in any way other than a brief note stating that possible priority projects were identified during the overview of existing NMT infrastructure, from information for planned projects and from information and requests made by regional authorities and the public.

The NMT inventory is presented in a table describing the existing infrastructure and road reserve constraints, with commentary on the facilities provided, any observed safety issues and the recommended classification.

The report also includes numerous drawings showing planned routes and the recommended classification and type of infrastructure along these routes, but does not indicate what method was used to assess the suitability of these recommendations.
3.2 Northern Region

The approach taken by this consulting team included providing a tabular assessment of the existing infrastructure along each route in their area (Daveng Consulting Engineers, 2010). This “motivational matrix” also included qualitative information on usage (high, medium or low), a description of the topography, some general comments on the adjacent land uses and a qualitative description of the accident frequencies (high, medium or low). A classification for the proposed NMT infrastructure upgrades on each route is also included.

The drawings include detailed network diagrams of the proposed NMT network, showing the location of attractors, such as schools and police stations, and the land uses in each area. This indicates that some cognisance was taken of trip destinations when the planning was done.

3.3 Southern Region

The Southern Region planning document (Pendulum Consulting, 2010) provides a comprehensive overview of the issues involved in planning for NMT, with a significant emphasis on the spatial planning aspects of NMT infrastructure. Projects were identified by considering the following motivating factors:

- NMT connections between higher public transport services (rail to MBT/ bus);
- NMT provision around public transport precincts;
- NMT connections between strategic facilities (hospitals, clinics, courts, educational, etc.) and public transport;
- Improvements to neighbourhood blocks;
- Pedestrianisation of public spaces or very active blocks;
- Connection of existing cycle networks;
- Training routes;
- Commuter routes;
- Road safety;
- Safer routes to schools;
- Pedestrian bridges across major barriers such as expressways and rail tracks; and
- Recreational paths;

The projects identified are presented in a table that lists the project location and scope, and which of the motivating factors it satisfies. The projects, routes and proposed classification were also assessed in terms of the following:

- Roadway width and length;
- Road reserve width; and
- Cross-section available;

This information, taken in combination, was used to define the infrastructure type provided for each project.

3.4 Eastern Region

The eastern region planning document (KV3 Engineers, 2010) provides a comprehensive treatment of the issues involved in NMT planning, with a distinct emphasis on the guideline recommendations and
design standards typically applied to NMT infrastructure. Large sections of the document are devoted to information on signage, markings and the geometric considerations related to NMT infrastructure.

This is the only regional document that includes any significant count information; something that is distinctly absent from the other documents. The document also comprehensively identifies potential trip generators in the region, including shopping centres, schools, clinics and public transport facilities, amongst others. Accident information and hazardous locations are dealt with as best as possible, given the paucity of the data available. The document devotes a lot of attention to planned and under construction projects and covers public transport services in the area in both quantitative and qualitative detail.

Despite this comprehensive treatment, the document does not identify how any of this information is used to identify projects. There is no motivational or logical methodological framework for identifying NMT interventions. The proposed projects are listed in tabular form, with brief descriptions of the area and road reserve characteristics, followed by a recommendation for the category of infrastructure to be provided.

4. Summary

The range and extent of variation between the four regional documents, and the BMP document that draws upon the recommendations made in each of them, illustrates the fact that, although the issues affecting NMT planning are now quite widely appreciated in the engineering industry, knowledge of how to actually use this information to systematically plan NMT facilities is lacking.

Each consulting team took roughly the same approach, but focused on different aspects of the issues, and dealt with different issues in vastly different levels of detail. Granted, there may be merit in obtaining such a range of perspectives, but given that these were all different contracts focusing on different regions of the city, it is impossible to say whether one team would have reached the same or similar conclusions as another would have for any given stretch of road.

These issues are, generally, not a problem in vehicular road design, where the methodological processes involved in planning a road are clearly outlined and well understood and applied across the industry. In fact, the rigidity of these processes has, actually, become somewhat problematic (Jones, 2004). This lack of consistency highlights the need for a more systematic and uniform approach to planning NMT facilities that goes beyond the quantitative, LOS based approach codified in the Highway Capacity Manual (Transportation Research Board, 2000), to include the qualitative, urban planning, social and environmental issues without losing direction.

5. Context Sensitive Multimodal Planning

Since the 1990s, the integration of GIS and Multi-Criteria Decision Analysis (MCDA) has attracted significant interest as GIS gained in popularity (Power, 2003). GIS is well suited to analysing large and disparate sources of information, and spatial decision problems often involve a large set of feasible alternatives and multiple, sometimes conflicting, evaluation criteria. Accordingly, GIS and MCDA are particularly well suited to each other. GIS techniques and procedures have an important role to play in analysing decision problems, whereas MCDA provides an established set of methodologies for structuring decision problems, and designing, evaluating and prioritising alternative decisions.

The spatial application of MCDA techniques, SMCA, is being applied to an increasing number of different spatial decision problems, and increasingly, transportation problems too. Typical applications include site selection problems (Carver, 1991; Openshaw et al., 1989) and routing problems (Bailey et
Whereas, with other SMCA applications, the alternatives assessed were either different sites or routes, Beukes et al. (2011) demonstrated the use of SMCA where the route was predetermined, and instead, the alternatives assessed were the modes of transport using the route. This has important implications for the results. Previous applications generated a single accumulated map from the combination of the standardised criterion maps of the various spatial indicators and derived routings using a least-cost algorithm. Beukes (2011) generates an accumulated map to describe the contextual suitability for each mode of transport. This results in numerous accumulative maps (one for each mode of transport). In this instance, each map shows the relative suitability of a particular mode of transport to a particular location. Since five modes of transport were used in the analysis, five suitability maps are generated.

The criteria used in the assessment are shown in Table 1.

### Table 1: Assessment Criteria

<table>
<thead>
<tr>
<th>Category</th>
<th>Criteria</th>
<th>Interpretation for NMT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Use</td>
<td>Land Use</td>
<td>Certain Land Uses are better suited to NMT.</td>
</tr>
<tr>
<td></td>
<td>Household Density</td>
<td>Higher density areas are more suited to NMT.</td>
</tr>
<tr>
<td>Socio-Economic</td>
<td>Employment</td>
<td>Areas with high levels of employment are better suited to NMT.</td>
</tr>
<tr>
<td></td>
<td>Income</td>
<td>In terms of NMT policy, NMT should be encouraged across the city, with specific focus on provision in low income areas.</td>
</tr>
<tr>
<td></td>
<td>Proportion of vulnerable road users</td>
<td>Higher levels of children and elderly increases the need for NMT facilities.</td>
</tr>
<tr>
<td>Environmental</td>
<td>Proximity to heritage sites</td>
<td>Heritage sites should be made more accessible to NMT modes.</td>
</tr>
<tr>
<td></td>
<td>Proximity to wetlands</td>
<td>Environmentally important areas should be made accessible to NMT modes.</td>
</tr>
<tr>
<td></td>
<td>Proximity to ecologically significant areas</td>
<td>Environmentally significant areas should be made accessible to NMT modes.</td>
</tr>
<tr>
<td>Transportation</td>
<td>Public Transport demand</td>
<td>NMT access to PT facilities should be improved.</td>
</tr>
<tr>
<td></td>
<td>Private Car demand</td>
<td>High volumes of vehicular traffic are dangerous for NMT.</td>
</tr>
<tr>
<td></td>
<td>Proximity to PT stops</td>
<td>NMT access to PT facilities should be improved.</td>
</tr>
</tbody>
</table>

Each criteria included in the assessment is represented spatially, as a map, and assessed in terms of its impact upon the operations of the five modes of transport. For every mode of transport, the aggregate performance, or suitability, score is then generated and also represented spatially.

Figure 1 maps the aggregated suitability scores for bicycles in Cape Town, with bluer areas being more suitable for bicycles.

Beukes (2011) applied the methodology to assessing the suitability of modes of transport along arterials (as shown in Figure 2). The next step in the method involved extracting the suitability scores along the centreline of the arterials and clustering them to identify regions of contextual similarity.
In theory, contextually similar areas along the route could receive the same design treatment, simplifying the road planning process. The data that was clustered consisted of 5-dimensional points with each dimension being the suitability score of a mode of transport at a particular point. The clusters produced, therefore, represented context types, each described by a particular mix of modal suitabilities. However, since the suitability maps were generated for the city as a whole, this presented the opportunity to conduct an area-wide assessment as well.

Raynor (2011) undertook the exercise of clustering the entire city. He used, as input data, the suitability maps generated by Beukes (2011). The hypothesis assumed was that there is an underlying contextual structure across the city, and that this can be used to establish the priorities that should be afforded to each mode of transport, in each area of the city. Although each section of the city will be unique, it is likely that there will be locations that are spatially separate, but also contextually similar, and that these should, therefore, be treated similarly.

Both Beukes and Raynor used the well-known K-means algorithm to cluster the data. Since the exercise undertaken by Raynor involved applying significant computational resources (some 16 million 5-dimensional data points were to be clustered), a pre-clustering step using a 10% sample was done to identify suitable seed cluster centroids. The procedure is outlined in Figure 3.

Clusters were generated for a 3, 4, 5 and 6-cluster scenario, and an analysis was done to determine which scenario best represents the underlying contextual structure of the city. Although each cluster scenario revealed interesting insights into the city structure, the 5-cluster scenario was concluded to be
the most appropriate, since adding additional clusters (6-cluster scenario) started to produce more arbitrary distinctions between areas (Raynor, 2011).

**Figure 2: K-Means Clustering Process**

The cluster statistics are shown in Table 2.

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Area (ha)</th>
<th>Area %</th>
<th>Sum-d</th>
<th>Sum-d %</th>
<th>Centroid Suitability Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Car</td>
</tr>
<tr>
<td>A1</td>
<td>3775</td>
<td>23%</td>
<td>15963</td>
<td>23%</td>
<td>0.3059</td>
</tr>
<tr>
<td>A2</td>
<td>2541</td>
<td>15%</td>
<td>8990</td>
<td>13%</td>
<td>0.4011</td>
</tr>
<tr>
<td>B1</td>
<td>2753</td>
<td>17%</td>
<td>15095</td>
<td>22%</td>
<td>0.3479</td>
</tr>
<tr>
<td>BC2</td>
<td>4480</td>
<td>27%</td>
<td>14440</td>
<td>21%</td>
<td>0.4234</td>
</tr>
<tr>
<td>C1</td>
<td>3060</td>
<td>18%</td>
<td>13898</td>
<td>20%</td>
<td>0.4853</td>
</tr>
</tbody>
</table>

For each cluster, the values for Sum-d (the summation of all the Euclidean distances to the mean centroid for every object), the Sum-d percentage (of the total Sum-d), and the area percentages (of the total sample area) are included to provide more information on the quality of the clusters. The smaller the Sum-d value, the ‘tighter’ the cluster is, and the better the cluster quality. Although a smaller Sum-d value indicates a higher quality cluster, the Sum-d can be expected to decrease with increasing numbers of clusters, because the number of points in each cluster gets smaller. As a result, the sum of
distances gets smaller (since there are fewer distances to sum), and the distances themselves get smaller, since supposedly, the clusters themselves are smaller overall. This is why the Sum-$d$ percentage is also included. If the Sum-$d$ percentage is less than or equal to the area percentage for a particular cluster, the cluster is of good quality. The centroid suitability score represents the “mean” suitability for that cluster and can, therefore, be said to be the representative score for a particular cluster.

6. Cluster Descriptions

The work conducted by Raynor also involved analyzing how clusters form with each additional increment in the number of clusters that was searched for. This gives useful information about the robustness of clusters and, hence, also the relative contextual difference of the areas in those clusters. A cluster that remains stable irrespective of the number of clusters chosen in the analysis consists of areas that are very distinct from others outside of its cluster.

The lowest cluster number selected was 3, producing clusters labeled A, B and C. Cluster A consisted of largely undeveloped areas, B consisted of developed areas with a higher suitability for public transport and NMT, and C consisted of developed with a higher suitability for private vehicles and freight modes. As the cluster numbers were increased, Raynor analysed how each of the clusters broke up and tried to ascertain the reasons for the instability and the implications for modal suitability. Child clusters were labeled according to their cluster ancestry, and given numeric suffixes to differentiate them from each other. The cluster split pattern included in Figure 3 shows how clusters split as additional clusters were added to the analysis.
The clusters produced in the 5-cluster scenario are described in more detail below.

Cluster A1 is a child cluster of the original Cluster A. The suitability characteristics of cluster A1 are very similar to that of the original cluster A. The only features of this cluster which stand out are the kurtosis statistics, which are very high for all modes, except for the pedestrian mode. This indicates...
that a large amount the point scores in these modes lie far away from the mean. The rural and mountainous areas in this cluster explain the low suitability scores, as well as the poor suitability of all modes except pedestrian transport. Cluster A1 areas are essentially undeveloped rural land, and this is the primary factor leading to these points becoming grouped together in a cluster. The cluster is made up of those points within environmentally sensitive areas such as nature reserves and wetlands.

Cluster A2 is also formed from elements that were originally in Cluster A. The elements which moved into this cluster were those with higher suitability for the car and freight modes of transport. This cluster is primarily composed of agricultural land, which explains the importance of freight vehicles in these areas.

Cluster B1 is a child cluster which formed from the original Cluster B. The areas in this cluster have a high suitability for NMT and public transport modes, and a low suitability for the car and freight modes. Figure 4 shows how the split from Cluster B occurs using the freight mode as an example. Two peaks are present in the original suitability histogram for the freight mode. These peaks correspond to the peaks of the split suitability histograms of the clusters B1 and BC2, which are formed from Cluster B.

**Figure 4: Cluster split demonstration – Cluster B to clusters B1 and BC2 – freight**

Satellite imagery of sample points in Cluster B1 areas reveals interesting information about the cluster. The sample points are all in close proximity to PT facilities or near a relatively major route, which has the potential to accommodate PT services. This seems to be the main factor which has influenced the formation of this cluster.

Cluster BC2 is formed from those elements of cluster B which did not split to form cluster B1 and some points in the original Cluster C. The result is that the modal suitability is high for all modes, but the cluster slightly favours PT and NMT in terms of suitability scores.

Although cluster C splits to form Clusters BC2 and C1, only a small proportion of the objects in Cluster C shifts to Cluster BC2. As a result, there is little change in the suitability of the various modes in Cluster C1 from the original Cluster C. The cluster is made up of urban areas including very low
density residential areas, urban agricultural areas, urban open spaces and road or rail reserves. The car mode is the most suitable, followed closely by freight. PT and NMT still show fairly high suitability but are markedly less suitable than the private motorised modes. This is explained by the context and land use of areas in the cluster. The land use accounts for the high car and freight suitability, and the low density peri-agricultural areas, which are surrounded by built up urban areas, account for the relatively high PT and NMT suitability. Figure 5 maps the clusters in the five cluster scenario.

**Figure 5: The five-cluster scenario**

The five-cluster scenario sees the formation of two rural clusters, A1 and A2, and three urban clusters: B1, which is made up only of areas with high PT and NMT suitability and low private vehicle and
freight vehicle suitability; BC2, which has high suitability scores for all modes, slightly favouring NMT and PT over private and freight vehicles; and C1, which is the polar opposite of BC2, with high suitability for private and freight vehicles.

7. Combining NMT Planning and Cluster Analysis

Given the information from the cluster analysis, it is possible to identify those areas in the city where additional scarce resources could be best applied to improving NMT facilities. In the 5-cluster scenario, clusters A1 and A2 represent rural or undeveloped areas, and of the three urban clusters: Cluster B1, is made up of areas with high PT and NMT suitability and low PMT suitability; cluster BC2, has high suitability scores for all modes, slightly favoring NMT and PT over PMT; and cluster C1 has high suitability for private and freight vehicles.

In terms of the overarching hypothesis, in general, the transport infrastructure provided should, in any cluster, reflect its contextual character. Thus, NMT facilities should be especially important in clusters B1 and BC2. Overlaying the routes identified in the NMT planning process undertaken by the city municipality with the areas in Clusters B1 and BC2 enables routes to be highlighted for priority attention in the network, as shown in Figure 6.

The proposed NMT plan was overlaid onto the cluster map for Cape Town, and those sections of the NMT network that fall within these clusters were extracted. A total of 48.19% (or 927km) of the routes falls within these areas, of which 16.66% (320.5km) are in B1-cluster areas, and 31.52% (606.5km) are in BC2-cluster areas.

Given that there are differences between these clusters in terms of the relative suitability of NMT modes, further distinction can be made on which routes to focus on in particular. In Cluster B1 areas, NMT and public transport modes are much better suited than car and freight modes, whereas in BC2 areas all modes are more or less equally important. Policy or project objectives could, therefore, dictate which of these areas to focus on, since they both include a substantial length of NMT routes.

In addition, within each of these cluster areas there are differences in the overall suitability of one or another mode, the cluster mean being only a representative value of the score range in that cluster. Specific projects can, therefore, be identified by focusing on a given mode of transport and looking at where that mode is most suited within a given cluster. The method produces data that can be used to extract areas using suitability thresholds, and routes can be prioritized according to whether they lie within a certain suitability threshold.

In Figure 7, a suitability threshold of 75% of the maximum suitability in the Cluster B1 areas was extracted and the sections of the NMT network in the Cluster B1 areas that lie within this threshold identified. Of the 320.5km of NMT routes in Cluster B1 areas, approximately 160km lies within areas where the suitability score for bicycle exceeds 75% of the maximum score for bicycles in Cluster B1. Similar techniques can be used to identify areas with high suitability for pedestrians or public transport, and these can be combined to show those routes with high suitability for more than one mode of transport. The example shows the power of using SMCA and cluster analysis to identify project priorities.
Figure 6: NMT priority routes
Figure 7: Project prioritization approach
8. Conclusions

For more than a decade, policy documents in South Africa have emphasized that providing for the needs of public transport and NMT is a more important strategic priority than providing for private motorized transport. It has taken a number of years for infrastructure planning practice in South Africa to begin to change in response to these policy objectives. The fact that the City of Cape Town commissioned four NMT studies is encouraging evidence to support the conclusion that practice is
changing, albeit slowly.

Although the issues around NMT planning have been taken on-board by the transport practitioners, there does not seem to be a consensus around planning methods or approaches. The four NMT studies all had different focuses despite being based on the same terms of reference. There is, thus, a definite need for a more methodologically uniform and technically sound approach to NMT planning that can be employed by practitioners.

The NMT plan produced by the process undertaken by the City of Cape Town planning authorities identifies important NMT routes, and makes recommendations as to project priorities. However, the approach taken to selecting projects for implementation is subjective, with variation in the approach used by each consultant.

This study has shown that the use of spatial decision making techniques can facilitate the identification of planning priorities, using a range of criteria that can be derived from policy priorities – thereby better aligning transport planning with transport policy. It is hoped that this methodology can provide planners with a more objective way of defining project priorities.

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