Decision Support System for Rural Road Investments
A GIS-based case study in Sri Lanka

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ABSTRACT

Sri Lanka with a population density of 316/km^2 has a rural roads network exceeding 65,000km and more than 70 % of its population still live in rural areas. Even though this implies an overall road density of around 1.5km/sqkm its spatial variability is not uniform, so causing maximum recorded individual walked distances even ranging from 32km to 52km in search of access for basic services.

Like for other developing nations lack of sufficient funds, human capacity & capability restrictions, weak management cultures and scare recourses and corruptions have brought the status of rural road network from bad to worst, severely affecting the socio-economic status of rural communities directly and in general of the whole country.

Local authorities have so far been unable to develop or to formulate effective, yet sustainable mechanisms to facilitate decision making in order to prioritize road development investments. Non availability of technically sound and logical mechanisms have made way for political hierarchies to adopt ad-hoc decisions, eventually leading to waste and corruptions. Making the situation worst the local road network has not yet classified.

In the first place a sustainable rural road classification system was developed for a selected local authority, and based on this classification, a data based approach using available system tools was developed to facilitate investment decisions. Even though systems developed within GIS environments have comparative advantages such system were not sustainable tools, hence a matrix based approach was introduced as an alternative tool.

Key words: Classification, Decision support systems, spatial variation, GIS, investment, corruptions.

1. INTRODUCTION

Reliable access from villages to markets and social services is an essential component of the quality of life for rural population. However, many poor villages in Sri Lanka and in other developing countries do not have all-weather road access and are often cut off for long periods due to impassability caused due to so many factors. The provision of basic, all-weather road access can thus serve as a valuable instrument for rural poverty alleviation & so to improve socio-economic status.

The poor condition of rural roads has much to do with weak assets management practices of local agencies. In developing countries funding for road maintenance in general had been long been inadequate and situation has been much worst particularly for rural roads, leaving out a huge backlog of maintenance and improvement needs unattended. However, underdevelopment of the network, poor assets management practices of agencies and political interferences continued to yield out an ineffective investment decision making culture.

The investment decisions conventionally do not follow clear social and economic criteria and was heavily subjected to political influence. Due to lack of institutional capacities and capabilities, insufficient funds and the influence of political hierarchies, the local authorities, have so far been compelled to take ad hoc decisions over rural road investment decisions. Aggravating the situation further, the local authorities have been left out with very limited sustainable rural road engineering alternatives, for example the only viable surfacing treatment they have is the metaling and taring. Because of the aforesaid engineering administrative culture very important & vital links are left-out unattended for long periods thus creating complete out off of access for rural communities. eventually causing unaffordable socio economic drawbacks.

Despite above facts responsibilities, non-accountability, non quality consciousness of those responsible agencies and of those road users too have been a major contributory factor for today’s pathetic situation of our rural road network.The local authorities, who are responsible for the maintenance of the rural road network, do not have any sort of classification system; instead they just maintain inventories, i.e. only a list of road names. Because of the non-availability of a rural road classification system these local bodies do not have a common scientific base on which they can derive investment priorities for the very limited funds they get. At the first instance this paper presents a simple classification system and based on that a computer based program that will help the local authorities to list out the development priorities.

2. CURRENT STATUS OF PRACTICE

2.1 The institutional arrangements

The overall road network in Sri Lanka is quite developed in extent. Out of a total road network of 111,843kms, nearly 12,000kms are in the category of National Highways – Classed as A & B. Class A roads are basically 2 to 4 lane divided/undivided roads and surfaced with asphalt concrete whereas B class roads are mainly undivided two-way two lane roads with a carriageway width in the range of 7.4mThe provincially administered road network Classed C & D are mainly sealed roads with carriageway widths varying in the range of 3.5m to 5.5 and this network covers a total length of approximately 15,000kms. Out of the class E network that amounts 68,000km a section of approximately 2800kms of urban roads are administrated by urban and municipal authorities, whereas the remaining 66,000kms of sealed/unsealed rural road network is administrated by the rural local authorities called as PS.

There are an estimated 16,000 or more kms of service roads belonging to estates and irrigation sectors that would also fall into this category. Thus the total Class E road length then exceeds 66,000kms while the total network length exceeds 111,800kms. This road network is furthermore supplemented with an extensive network of footpaths. A transport study done in Uva Province indicates that there are over 9,500kms of footpaths in the province compared to the 7,325kms of roads. Thus in all of Sri Lanka, it could estimate that a further 100,000kms of footpaths may be found to exist.

Table 1- Road agencies

Authority	Lengths of roads	Percentage
RDA	12000	10.7
PRDA	15000	13.4
MC/UC	2787	2.5
P/Sabha	66056	59.1
Other	16000	14.3
TOTAL	**111843**	

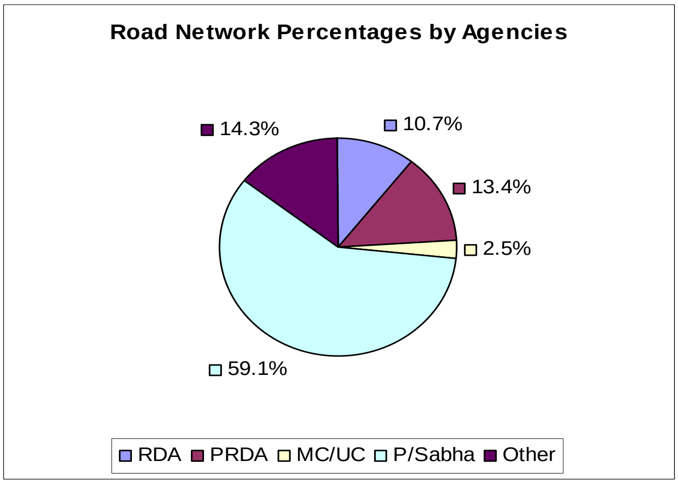

Figure 1- Road network % owned by agencies

The road network in Sri Lanka is administrated by several agencies. the national highways Class A and B are managed by the Road Development Authority (RDA). The secondary roads, Class C and D are managed by Provincial Councils (PRDA), Class E roads are managed at the Pradeshiya Sabha level, with those in urban area being managed by the Local Authorities (By 42 Urban & 18 Municipal Councils). Colombo Municipal Council (CMC) also manages 52kms of national highways running through its city limits on behalf of the RDA.This study and analysis are only limited to E Class road network managed by 270 Pradeshiya Sabhas (Rural Local Authorities) that exceeds of 50% of the total network. Table 2.0 provides lengths of E class roads belong to each province.

Table 2- Lengths of E class roads belong to each province

Provinces	E – Class Road	
	Pradeshiya Sabhas (Rural Local Authority)	Urban Local Authority
Western Province	8,420	1,215
Central Province	8,009	247
Southern Province	5,606	233
North & Eastern Province	12,187	669
North Western Province	11,742	124
North Central Province	9,153	153
Uva Province	4,891	65
Sabaragamuwa Province	6,048	81
TOTAL	**66,056**	**2,787**

2.2 The need for a classification system for E-class road network

These roads serve a wide variety of users with divers needs and in addition geometrics, structural and socio-economic characteristics of these roads too differ considerably. The PSs do not have a road classification hierarchy, so they do not have a common base on which priorities of road improvement works be done effectively. Thus the prevailing management culture has caused to have development proposals based on adhoc political decisions.

Hence it is paramount importance to have a road classification hierarchy based on a set of both engineering and socio-economics criteria and such a classification hierarchy will form the basis to derive out investment priorities in a realistic manner.

3. THE PROPOSED RURAL ROAD CLASSIFICATION SYSTEM

3.2.1 Introduction

Almost 62% of the country’s total road network falls under the category of rural roads and these are not yet classified. These roads in general fall into following categories:

- Sealed roads (sealed using bitumen)
- Concrete roads (Very small quantity)
- Unsealed gravel roads
- Unsealed earth roads
- Foot paths

In addition most of these roads do not have consistent geometric standards and further do not have designed pavement structures. Sri Lanka being a country whereas contribution to GDP from agriculture sector exceeds 23% a systematic approach to develop the rural road sector should have been in place by now.

Because funds availability is always a restriction, improvements and developments need prioritization. The prioritization to be effective it has to be based on a road classification hierarchy. The whole country has a rural road network exceeding 66,000kms and this network is managed by 274 local bodies (PSs). Other than a road inventory these PSs do not have any sort of classification hierarchy. Initially a classification system was modeled and this was discussed with representative PSs officers at two feedback sessions and it was eventually concluded to have only three (3) main categories based on functionality as indicated in figure 3

In order to have an effective classification system initially 7 attributes were selected, which PSs could easily assess quantitatively and these are included in table 3.0.

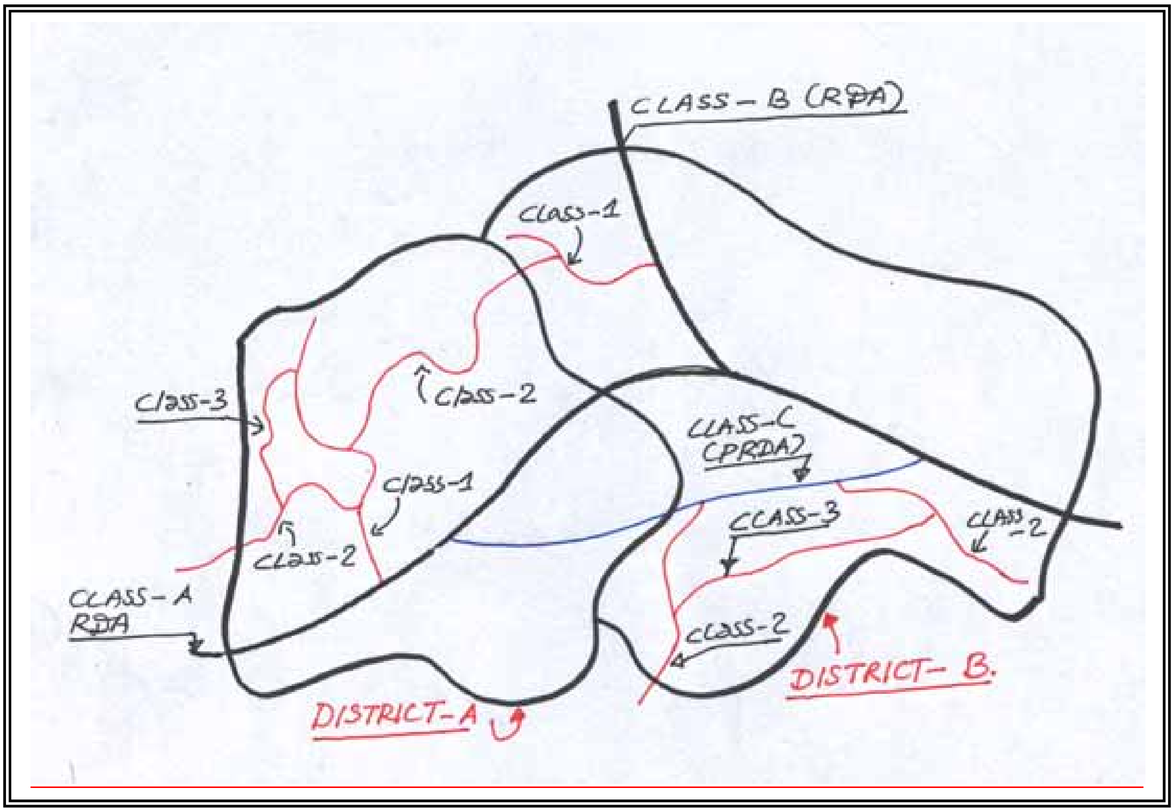

Figure 2-Class-1,, Class-2 & Class-3 roads within two adjoining districts

Table 3.0: Classification model for the rural roads maintained by the PCs.

Classification	Definition	Attributes					
		Vpd(both direction	(L)-Length (m)	Cw (m)	(AxL)-Axle load	Nf	PTS
Class-1	Sealed surface Vpd≥ 300, Nf≥ 500 Cw ≥ 4.6 (15'),PTS-Yes	300 ≥		4.6 (15')≥		500 ≥	Yes
Class-2	Un-Sealed surface or a portion sealed, 300>Vpd≥ 100, Nf≥ 300 4.6>Cw ≥ 3.7 (12'),PTS-No	300 > & ≥ 100		4.6> & ≥ 3.7		300 ≥ & > 500	No
Class-3	Un-Sealed surface 100>Vpd, Nf< 300 Cw < 3.7 (12'),PTS-No	100>		> 3.7		> 300	No
Class-4	Access roads to historic places and places of warship						

Here

Vpd Vehicles per day both side
Cw Carriageway width (m)
Sw Shoulder width (m)
Nf The number of families served (Permanent)
L total length of the road (m)
PTS Public Transport Service
AxL Axle Load ranges

3.1 A coding system

In order to assign attributes to each and every link as separate entities it is required to have a unique identification code for each and every link/path. Hence depending on the number of roads within each class, a further sub division is required so that each road/link can be uniquely identified. Hence a coding system as illustrated below was adopted.

i. Class -1- 00-10.
ii. Class -2– 11-99.
iii. Class -3– 101- 199
iv. All other roads are class– 4 - > 200

3.2.1 *Codes to Identify Administrative Districts and PSs*

i. Administrative districts

CO	=	Colombo	BT	=	Baticaloa
GA	=	Gampaha	AA	=	Ampara

KA	=	Kalutara	TR	=	Trincomalee
GE	=	Galle	KU	=	Kurunegala
MA	=	Matara	PM	=	Puttalam
HA	=	Hambantota	AD	=	Anuradhapura
RA	=	Ratnapura	PA	=	Polonnaruwa
KE	=	Kegalle	JA	=	Jaffna
KY	=	Kandy	MR	=	Mannar
ME	=	Matale	VA	=	Vauniya
NE	=	Nuwaraeliya	MU	=	Mulativu
BA	=	Badulla	KI	=	Kilinochchi
MO	=	Monaragala			

ii. Pradeshiya Sabas (PSs)

All together we have a network of 274 PSs and for example Gampaha administrative district has the following categories of local bodies.

Urban Councils	=	05
Municipal Councils	=	02
Pradeshiya Sabas	=	12

Like for administrative districts we have to have codes for each and every local body that comes under each administrative district. For example Gampaha Administrative district can have the following set of codes to represent local administrative bodies.

Gampaha Municipal Council	=**GA-GMC**
Negombo Municipal Council	=**GA-NMC**
Peliyagoda Urban Council	=**GA-PUC**
Minuwangoda Urban Council	=**GA-MUC**
Wattala- Mabole Urban Council	=**GA-WMUC**
Katunayake-Seeduwa Urban Council	=**GA-KSUC**
Wattala Pradeshiya Saba	=**GA-WP**……etc

iii. An Example

For a road that falls in to the class -2 can be coded as described below. Take for example the "Darmapala Mawatha "of Dompe PS that comes under the preview of Gampaha administrative district, can be coded as:

GA-DP-14

This implies a road of Dompe PS that comes under the administrative district of Gampaha is sealed and it has between 500 to 300 vehicles per day. Its carriage-way width is 3.7m and it serves as access to 150 permanent families.

4.0 DEVELOPMENT OF AN INVESTMENT DECISION SUPPORT SYSTEM

4.1 System Sustainability and its Limitations

In depth study of the existing system and outputs of feedback sessions with representative PSs revealed it is difficult to have one uniform and consistent definitions for each class through out the country instead it was compelled to have definitions to suit the particular PS, at least for the initial stage.

The utmost important requirement is to have unique definitions for each class so that the whole country could follow the same and this should be the 2nd phase of this exercise that is to initiate and draft a National Rural Road Development Policy (NRRDP) for the country. Once this policy is established then every PSs can work towards achieving these objectives.

It was further revealed that the development and implementation of a fully automated computer based system to prioritize investment decisions cannot be easily and equally be implemented in all PSs mainly because of following reasons:

a. Most of the PSs do have only one computer and it is mainly used for managing and administration of financial related activities, hence road inventories are maintained, manually using ledger books.
b. Road inventories are managed by respective technical personnel manually and it was understood that each PS has in average a road network of approximately 260kms but PSs have only one or two technical personnel to manage such a network, hence PSs do not have sufficient human resources to maintain an automated system, despite these circumstances all those who attended the feedback sessions vehemently stressed the necessity to have at least a partially auto mated system be implemented.

Accordingly the use of available computer system tools such as excel and access were recognized as the most sustainable means to have at least a partially automated system be implemented as the initial step. Once the partial automation is done and accepted it was agreed to move on to GIS based decision support system.

4.2 The Development of a Partially Automated Decision Support System

4.2.1 An overview of the existing System

First an attempt was taken to model the existing system approach adopted to prioritize rural road investment within a PS and it is depicted in figure 4

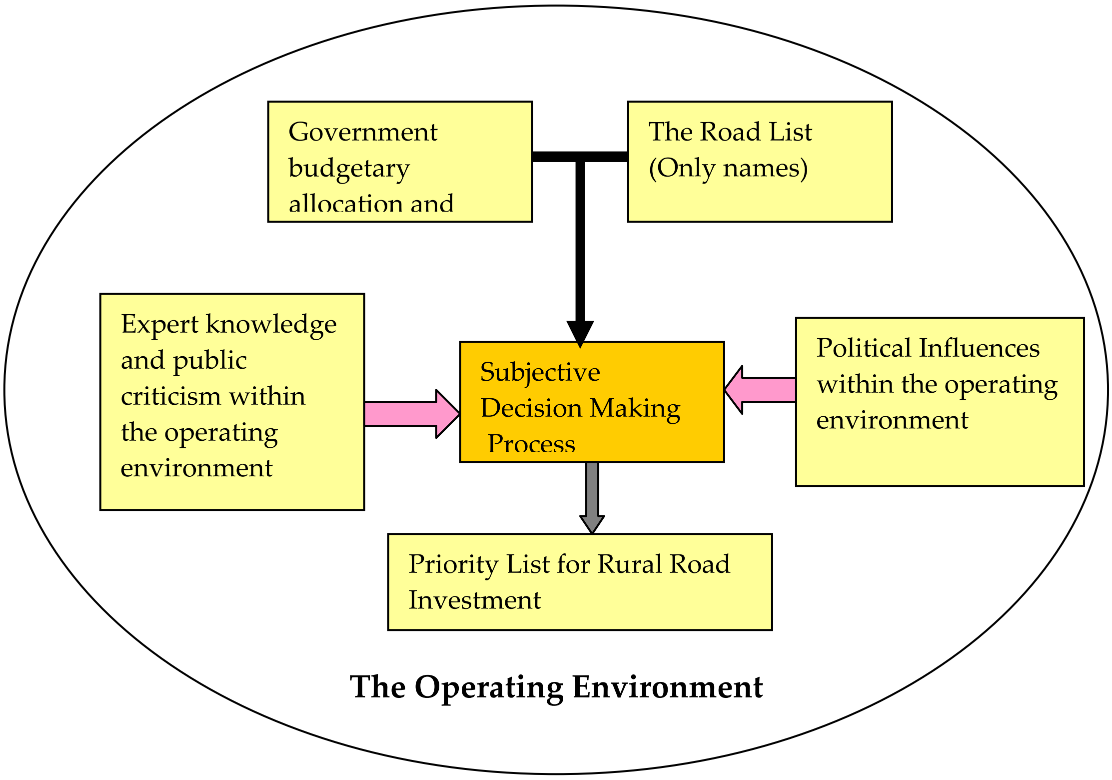

Figure 4-The existing system approach

4.2.2 .The Proposed system

Taking into consideration the factors/issues identified above as an initial step it was decided to develop a semi-automated system make using of the available computer based tools such as access or excel. Accordingly a rural road data base development and investment prioritizing attempts were done using Microsoft Access program.

4.1 The Case Study

It was decided only to select a section of the rural road network administrated by Gampaha Pradeshiya Saba. This particular section comes under its one sub-division Wrefereed as “Henaratgoda”. The Henartahgoda section itself has a total of 416 links, total length summing up to 187kms. The existing format of the inventory, together with attributes is indicated in table 4.0.
Here, PTS = Public Transport System and Nf= Number of Families (Permanent)

4.3.1 Development of the Rural Road Data Base

Prior to develop the road database using the existing system, an attempt was made to update it by adding two vital attributes recognized during feedback sessions, as more important and influential attributes in investment decision making. These two attributes were vehicle per day (both directions) and axel load limitations for each class of road.

Only vehicles per day of roads of class-1, 2 and 3 were readily available to collect but limited human resources and equipments together with time restrictions prevented to have a full scale survey arranged to assess axle load limitations covering the whole "Henarathgoda Section" in time before finalizing this study, hence the database was developed only using the available information.

Table 4.0: the existing inventory format – Gampaha PraDeshiya Saba (PS)-Henarathgoda unit

Serial Number	Road Name (Description)	Length (m)	Carriageway Width (m)	PTS (Yes/No)	Nf	Last year an Improvement has Been done
47	The gravel road to right, at a distance 5.783km from Balum-Mahara Junction on New Kandy road	668	4.6	No	500	2004
48-12	Kolagasma Road	698	4.6	No	400	2004
48-17	Singha Mawatha	1192	Varying 5.0 to 8.5	No	1000	2005
48-33	The gravel road ,to left at a distance 3.290km along Nadungahahena temple road on New Kandy road.	173	Varying 3.1 to 3.7	No	180	2004
48-11	The gravel road, to right at a distance 834 m along Nadungahahena temple road on New Kandy road.	85	3.1	No	60	Not known

Next the network was classified into four classes and then each road link was assigned with an unique code as described earlier. Table 5.0 illustrates the classification system developed. Subsequently identification codes and the corresponding attributes were entered into an access database.

Table 5.0: Classification system developed for Gampaha PS-Heneratgoda unit

Classification	Definition	Attributes					
		Vpd(both direction	(L)-Length (m)	Cw (m)	(AxL)-Axle load	Nf	PTS
Class-1 (**GM-GP-01-25**)	Sealed surface Vpd≥ 300, Nf≥ 500 Cw ≥ 4.6 (15'),PTS-Yes	300 ≥	≥ 1000	4.6 (15')≥		≥500	Yes
Class-2 (**GM-GP-26-45**)	Un-Sealed surface or a portion sealed, 300>Vpd≥ 200, 500>Nf≥ 300 4.6≥Cw > 3.7 (12'),PTS-No	300 > & ≥ 200	> 1000 & ≥ 500	4.6> & ≥ 3.7		500 > & ≥ 300	No
Class-3 (**GM-GP-46-126**)	Un-Sealed surface 100>Vpd, 300>Nf≥ 200 3.7 >Cw ≥2.5 (12'),PTS-No	200> & ≥ 100	> 500 & ≥ 200	> 3.7 & ≥ 2.5		> 300 & ≥ 200	No
Class-4 (**GM-GP-127-264**)	Un-Sealed surface 100≥Vpd, Nf< 200 Cw <2.5 (12'),PTS-No	≥100	> 200	> 2.5		> 200	No

4.2.1 Development of the Prioritizing Mechanism

The figure 5 shows a section of the improved inventory with added attributes.

Rural-Road-GampahaPS : Table

ID	Code	Vpd	Length of r	Carriagewa	Axle load	Number of	Public-tran	Last year i
1	GM-GP-01	511	1844	5.5		1400	No	2005
2	GM-GP-02	498	1640	4.6		1400	No	2004
3	GM-GP-03	481	1459	6		1200	No	2004
4	GM-GP-04	480	1253	4.5		1200	No	2004
5	GM-GP-05	470	1290	5.5		1000	No	2004
6	GM-GP-06	470	1028	4.6		950	No	2004
7	GM-GP-07	466	1492	4.6		900	No	2005
8	GM-GP-08	454	1150	4.6		900	Yes	2005
9	GM-GP-09	472	1129	5		900	No	2004
10	GM-GP-10	451	921	5.3		850	No	2005
11	GM-GP-11	450	1006	4.6		800	No	2004
12	GM-GP-12	444	913	5.5		800	No	2005
13	GM-GP-13	431	820	4.5		800	No	2005
14	GM-GP-14	421	648	4.5		800	No	2005
15	GM-GP-15	420	970	6		700	No	2005
16	GM-GP-16	416	914	6		700	No	2004
17	GM-GP-17	417	840	4.6		700	No	2005
18	GM-GP-18	401	1323	6		650	No	2002
19	GM-GP-19	389	678	9.1		650	No	2005
20	GM-GP-20	331	1058	4.6		600	No	2003
21	GM-GP-21	314	821	4.6		600	No	2005
22	GM-GP-22							
23	GM-GP-23	149	771	3.6		550	No	2004
24	GM-GP-24	300	613	5.5		500	No	2003
25	GM-GP-25	300	596	5.5		500	No	2005
26	GM-GP-26	291	750	6.1		450	No	2005
27	GM-GP-27	281	736	6.1		450	No	2003
28	GM-GP-28	270	725	3.7		450	No	2003
29	GM-GP-29	261	708	3.7		450	No	2005

Record: 1 of 269

Figure 5- A section of the improved inventory

Example 1.0:

Derivation of a priority list to satisfy following criteria

- ✓ Road length been ≥ 500m
- ✓ Road with VPD been ≥ 300
- ✓ Road with 300>Nf ≥200

The resulted road list that satisfy the above set of criteria is shown in figure 6

Lenth>=1000_VPD>=300_NF>=200 : Select Query

ID	Code	Vpd	Length of road	Carriageway width	Axle load	Number of families	Public-transport	Last year improvement done
1	GM-GP-01	511	1844	5.5		1400	No	2005
2	GM-GP-02	498	1640	4.6		1400	No	2004
3	GM-GP-03	481	1459	6		1200	No	2004
4	GM-GP-04	480	1253	4.5		1200	No	2004
5	GM-GP-05	470	1290	5.5		1000	No	2004
6	GM-GP-06	470	1028	4.6		950	No	2004
7	GM-GP-07	466	1492	4.6		900	No	2005
8	GM-GP-08	454	1150	4.6		900	Yes	2005
9	GM-GP-09	472	1129	5		900	No	2004
11	GM-GP-11	450	1006	4.6		800	No	2004
18	GM-GP-18	401	1323	6		650	No	2002
20	GM-GP-20	331	1058	4.6		600	No	2003
mber)		0						

Record: 1 of 12

Figure 6-Investment Priority list

5. Conceptual Approach to the investment Prioritization using GIS

5.1 Introduction

The above described Microsoft Access based partially automated system yielded outputs in table format, it doen't provide us a graphical display, but despite this presentation deficiency this approach was more sustainable, economical and was acceptable by most of the PSs. Still some PSs were unable to accept the system mainly because of non-availability of IT related infrastructure especially the computers.

Hence for such PSs manually prepared ledger type, speared sheet was introduced, but such a system is unable to integrate multiple criteria, instead maximum of 2 were possible at a time. Advantage of using GIS supported database approach is its capability to integrate multiple attributes and as well as the ability to produce graphical out comes.

5.2 Modeling Road Engineering & Socio-Economic parameters in a GIS environment

Today's decision making environment of all most all developing countries is to give more weight age to social parameters compared to engineering parameters especially when prioritizing rural infrastructure investments.
Hence the conceptual model presented here, intend to integrate both engineering and as well as socio-economic parameters. Accordingly taking into consideration the capabilities,

capacities and facilities available at PSs to carryout survey works, only following engineering and socio-economic parameters were selected for integration.

5.2.1 Road Engineering Related Parameters

a. Length of road section.-RE1
b. Carriageway width.-RE2
c. Number of lanes.-RE3
d. Type of Surfacing.-RE4
e. Shoulder width.-RE5
f. Number of vehicles per day both sides.-RE6
g. Percentage of heavy vehicles.RE7
h. Last surface treatment done on –RE8
i. Road side drainage system.-RE9
j. Cross drainage system.-RE10

5.2.2 Socio-Economic related parameters.

a. Public transport system is in operation.-SE-1
b. Number of families (permanent).-SE-2
c. Telecommunication system is in operation.SE-3
d. Electricity supply system is in operation.SE-4
e. Water supply system is in operation-SE-5
f. Schools located along the link.-SE-6
g. Medical centre is located along the link.-SE-7
h. Weekly fair is located along the link.-SE-8

The next step is to digitize the rural road map of the selected PS and this will be the main input map. Each link is made associated with an attribute table loaded with above stated engineering and socio-economic parameters, desirably assessed quantitatively. Principally two types of amylases are possible:

a. Reclassification of base map to yield out maps by integrating multiple decision making criteria, this approach is depicted in figure 7.

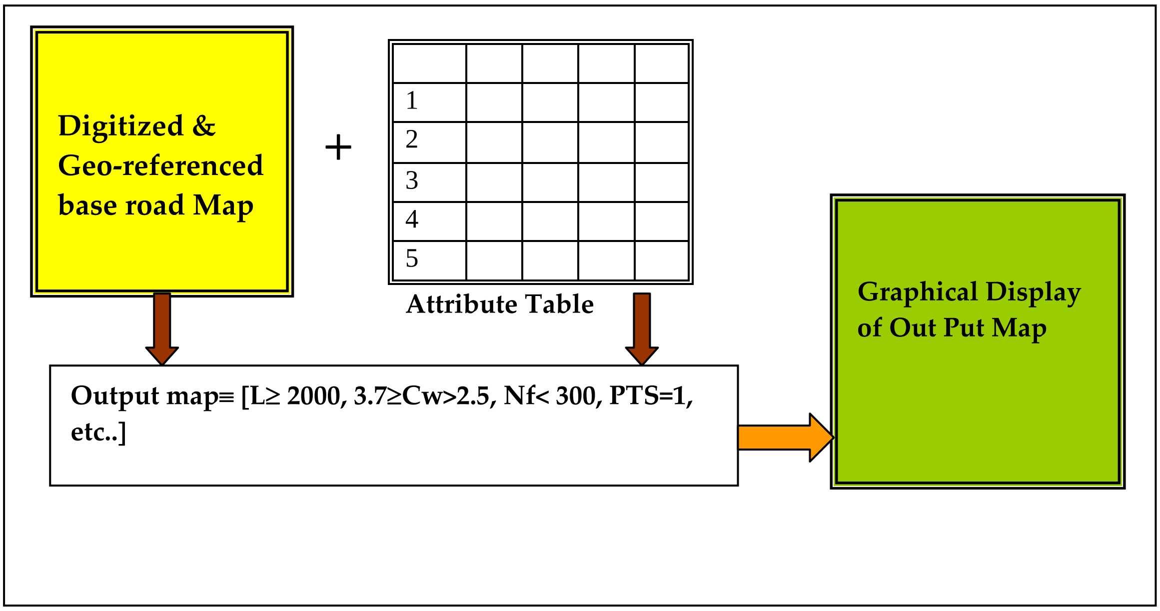

Figure 7-Integration of multiple criteria in a GIS environment

Table 6 - Weights for length of road

	E1-Length of Road (km)	Weight
1	0.5 – 1.5	2
2	1.6 – 2.5	4
3	2.6 – 5.5	6
4	5.6 – 10.0	8
5	>10.0	9

b. Using the base map and attribute table we can generate 18 attribute maps and then to facilitate spatial calculations all a maps have to be rasterized. Accordingly we now have 18 raster maps each representing either road engineering or the socio-economic properties assed quantitatively.
c. Next step is to re-classify these 18 raster maps so that weights can be assigned to each class depending on the nature of the decision problem. For example the raster map called “Length of Roads” can be classified in to 5 class map each class been assigned a weight as per the table 6.0

Similarly we could calculate altogether 18 raster maps and we can now calculate a single map only to yield out pixels that have a weights ≥ 9.0. In other words, to calculate a map as describe by the formula number 1 below.

Final-Map≡IFF[[(RE1map)≥9,(RE2Map)≥9,(RE3Map)≥9,(RE4Map)≥9,(RE5Map)≥9,(RE6Map)≥9,(RE7Map)≥9,(RE8Map)≥9,(RE9Map)≥9,(RE10Map)≥9,(SE1Map≥9,(SE2Map≥9,(SE3Map)≥9,(SE4Map)≥9,(SE5Map)≥9,(SE6Map)≥9,(SE7Map)≥9,(SE8Map)≥9] Base Map,0]……………………………………………………………………………………….01

Here we have assigned one unique weight for each sub-class of a parameter, but in reality the performance or the characteristics of a road varies spatially along a road.
For example, take the parameter "Number of vehicles per day" (Vpd), for all roads where Vpd > 200 a weight equal to 9.0 has been assigned, but in reality Vpd varies spatially along the road. The proposed model doesn't take this scenario into effect. But this situation can be improved to a greater extend by using the local expert judgment in assigning weights. In addition weight assigning criteria likely to differ among local authorities.

6. ALTERNATIVE APPROACH FOR INVESTMENT RANKING USING AVAIABLE TOOLS

Taking into consideration the facts, that most of the PSs do have financial restrictions in acquiring IT infrastructure and lack of soft skills, it was decided to develop a matrix based approach. This approach encouraged most of the PSs to at least to get on board to have a systematic approach for rural road investment decisions.
Here road will have a series of 18 weights, assigned with respect to the 18 parameters and as indicated in table 7.0 it is possible to use "Access" program to rank out the priorities depending on the total weight. For simplicity only four parameters of road engineering and four parameters of socio-economic have been presented here, but the total has calculated taking in to all parameters.

Table 7: The Matrix Approach

Road Code	Engineering Parameters				Socio Economic Parameters				Total weight	Rank
	RE1	RE2	RE3	RE4	SE1	SE2	SE3	SE4		
GM-GP-01	5.0	8.0	8.0	6.0	5.0	6.0	6.0	7.0	147	2
GM-GP-02	5.0	6.0	6.0	6.0	7.0	5.0	5.0	7.0	120	6
GM-GP-03	6.0	5.0	4.0	7.0	5.0	6.0	6.0	5.0	139	4
GM-GP-04	5.0	5.0	3.0	4.0	5.0	4.0	5.0	4.0	091	7
GM-GP-05	4.0	5.0	6.0	5.0	4.0	5.0	4.0	4.0	061	8
GM-GP-06	6.0	5.0	4.0	7.0	6.0	5.0	4.0	6.0	133	5
GM-GP-07	8.0	9.0	7.0	9.0	8.0	6.0	7.0	9.0	151	1
GM-GP-08	5.0	5.0	6.0	6.0	8.0	7.0	6.0	8.0	142	3

7. MODEL VALIDATION

Model validation is a very important aspect. The priority list derived for a local authority is required to be communicated and its external validity should be assessed, against a list conventionally derived priority list by the same local authority.

This process will help to validate the model. The matrix based approach has been implemented within the Gampaha PS and the validation process is yet to be implemented.

8. CONCLUSION

The system developed using Microsoft access tool is now been implemented in Gampaha PS and depending on its practicality system is to be implemented within a selected representative PS network. It is very important to validate the priority list generated form this model against a conventional list of the PS concerned. Even though a single weight is assigned the performance of most of the parameters varies spatially and this aspect has not successfully integrated yet. Quantitative approaches to reduce the degree of subjective ness too are yet to be addressed.

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BIBLIOGRAPHY

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