DEMONSTRATION OF THE REGIONAL PUBLIC TRANSPORT FACILITY FRAMEWORK: A system developed for Ekurhuleni Metropolitan Council to assist decision-making with regard to public transport infrastructure

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What is the regional public transport facility framework?

The Regional Public Transport Facility Framework (RPTFF) is a system that not only contains information on the physical elements of public transport facilities within a region, but also prioritises maintenance and upgrading activities, based on a multi-criteria set of standards. The RPTFF supports these prioritised activities with estimated costs that are based on default unit cost tables. The system is therefore unique in the sense that it acts not only as an information system, but also as a decision-support tool for public transport facilities.

The Ekurhuleni Metropolitan Municipality identified the need for such a framework to assist them with decision-making, and also sponsored the development of the system with co-funding from the CSIR's Division of Transport Technology (Transportek).

1 THE NEED FOR A FACILITY MANAGEMENT TOOL

The Ekurhuleni Metropolitan Municipality needed a tool that could, similar to the Municipality's Pavement Management System and the Storm Water Management System, be used to manage all regional public transport facilities in the Ekurhuleni region. It was envisaged that this tool would need to be updated at least every three years. Together with the two other major strategic components, it would form the backbone of the region's transport infrastructure strategy as contained in the Integrated Transport Plan (ITP). The other two strategies of an ITP are the public transport strategy and the travel demand management strategy.

Subsequently, the requirements of this "tool" were set out as follows:

- It should be *simple* to use and with regard to the methodologies applied in it and the algorisms used in it.
- It should provide the *basic information* needed for prioritising and budgeting public transport facilities, but also be *flexible* regarding user input where required.
- It should be an "*open*" system to accommodate future upgrades to the system and possible interactions with other systems.
- It should be *supported* by the necessary user manual(s) and training courses.
- It should assess the infrastructure with regard to *compatibility* with the taxi recapitalisation requirements.

2 THE RPTFF

2.1 Source

The RPTFF system is based on Microsoft Access (MS Access 2000 mbd format) and was written in Microsoft Visual Basic 6 by researchers at CSIR Transportek.

2.2 Structure

The RPTFF consists of the following five modules:

- Desktop
- Inventory
- Status
- Performance
- Budget.

2.3 Desktop Module

The Desktop Module acts as the “dashboard” of the system and incorporates general tools such as an interactive map indicating the location of facilities, with basic Geographic Information System (GIS) functionalities (Refer to Figure 1). Basic queries can be performed on the data, with the output in the form of either a report or interaction with the map.

The Desktop Module also contains all the default tables required by the system, such as the unit costs, generic facility standards and weighting factors (Refer to Figure 3), as well as stored images of facility lay-out plans and photos (Refer to Figure 2).

2.4 Inventory/Status Module

The Inventory Module contains inventory data on each facility and the Status Module contains the status (requirements for repairs, cost of repairs and urgency of repairs) of the inventory items within each facility (Refer to Figure 4 and 5). These data are usually captured through survey questionnaires and are grouped into eight categories, namely rank location, amenities, support infrastructure, loading area, passenger information and security, surfacing, shelters and accessibility. The typical information that is captured within these categories is as follows:

- Daily and peak hour passenger volumes
- Daily and peak hour vehicle volumes
- Benches
- Demarcated stalls
- Fire extinguishers
- Fire hoses
- Convenience lighting
- Refuse bins
- Telephones
- Toilets
- Vending machines
- Water taps
- Hand railings for disabled passengers
- Parking for disabled passengers
- Pathway ramps for disabled passengers
- Toilets for disabled passengers
- Office

- Vehicle washing bays
- Kiss-and-Ride facilities
- Park-and-Ride facilities
- Bus facility in vicinity
- Rail facility in vicinity
- Holding area in vicinity
- Number of loading bays
- Loading bay size
- Waiting area size
- PA (public announcement) system present
- Destination signs
- Fenced off
- Security lighting
- Waiting area surface
- Loading area surface
- Driveway surface
- Pathway surface
- Holding area surface
- Park-and-Ride surface
- Kiss-and-Ride surface
- Holding area covered
- Rank area covered
- Rank shelter size
- Pedestrian street crossings
- Dedicated pedestrian entrances/exits
- Vehicle entrances in all directions
- Vehicle exits in all directions.

2.5 Performance calculations

2.5.1 Inventory items

A performance score (value between 0 and 100) indicates the relative performance of a facility (Refer to Figure 6). This value is scaled in such a way that a value smaller than 85 means that some of the requirements may not be present, while a value greater than 85 means that the facility is operating above the required minimum standard.

The performance score is calculated by means of the following procedure. Based on the standards set by the user (in the Facility Standards folder in the Desktop Module), each element of a facility is evaluated using either a look-up table or a constant value. Look-up tables consist of a number of ranges, each with a different score extending from 0 to 100. A score of 85 is assigned to the range that represents the standard. The constant values are either 0 or 85, depending on whether the element is present or not.

Once this score has been determined, it is multiplied by a “relevance factor” for each element; this relevance factor is also set by the user in the Facility Standards folder in the Desktop Module. The purpose of the relevance factor is to assign different weights to the different elements of a rank. For example, if the presence of ablution facilities is more important that the presence of security lights, the user can increase the relevance factor for toilets relative to that for security lights. The scores for each element of the facility are

added up and scaled to a value between 0 and 100 by dividing the total performance score by the total of the relevance factors for each facility.

The performance score itself can also be scaled by setting different relevance factors for the respective categories of performance. The system distinguishes between four categories: (1) passenger requirements, (2) disabled passenger requirements, (3) infrastructure requirements and (4) operational requirements. The relevance factors for these categories are also set in the Facility Standards folder in the Desktop Module. If the relevance values for these categories are not all the same, the score is reweighted. The final score represents the overall performance score of the facility.

2.5.2 Status items

The framework allows the user to capture status data on each element. These data typically cover whether an element (such as amenities, constructed surfaces and shelters) requires repairs, the nature of the repairs (minor, moderate or major) and the urgency of the repairs (as soon as possible (ASAP), within three months or within a year).

These data are also converted into a score but, unlike the inventory score, a high score means that the facility requires more urgent repairs than one with a low score. If an element of a facility requires repairs, a score depending on the urgency of the repairs is assigned to the element. Elements requiring repairs as soon as possible get a score of 10, whereas repairs required within three months or a year get a score of 4 or 1, respectively. These scores are multiplied by the same relevance factors used in the inventory performance evaluation and are then added up to give the overall status score of the facility.

2.6 Budget prioritisation

2.6.1 Inventory items

The development of facilities in a region is a continuous process and not all the facilities will need to be developed to the same standard. The system is able to measure the performance of each facility based on a set standard, and then to identify where upgrading is required to bring all the facilities up to this same minimum standard (Refer to Figure 7). It is unlikely that the whole upgrading exercise can be afforded in one budget year and consequently the system allows for a multi-year budget in which upgrading activities are prioritised.

The prioritisation is carried out as follows. If a certain element of a facility does not comply with the minimum standards set for it, the system identifies that element. A “non-compliant score” is assigned to such an element by subtracting the unweighted scores from 85 (85 is assigned to an element if it meets the standard) for each element of a facility. An overall “non-compliance score” is weighted according to the same procedure that is used to weight the performance score.

The total upgrading cost of bringing a specified facility up to standard is also calculated by means of average estimated unit costs for each element. The user can change these estimated unit costs in the Facility Standards folder in the Desktop Module.

The upgrading activities are prioritised using a “priority ratio” calculated by dividing the non-compliance score by the cost. The actual value of the priority ratio has no absolute value but serves to prioritise facilities; the higher the ratio the higher the priority . A higher ratio will mean that more points are scored at lower cost, very much as in an ordinary cost-benefit analysis.

2.6.2 Status items

The system requires two separate budget figures per budget year: one for inventory items (upgrading) and one for status items (repairs). The same priority ratio method as explained for the inventory items is used in determining the priorities for repairs. The score as calculated in the Performance Module for status items is used, but a different calculation is done to determine the estimated cost of repairs.

The Facility Standards folder contains a set of default repair costs for each element. These costs are typically lower than the initial construction costs (based on 85% of the construction cost) of the element, but represent a “major repair cost” for the specific element. If the user indicates that the repair cost is moderate or minor, 50% or 10% respectively of this repair cost is assigned to the element.

The repair activities are prioritised using a priority ratio calculated by dividing the performance score of the status items by the total repair costs. Again, the value of the priority ratio can only be used to rank facilities in order of priority.

The system assigns the upgrading or repair for each facility to a budget year (year 1 to 5), indicating in which year the facility should be upgraded/repaired according to the total budget available and the priority ratio of the facility.

The user has the ability to overwrite both the estimated budget and budget year if required, by indicating alternative values in the Budget Module’s detailed information for each facility.

2.7 Impact of the taxi recapitalisation process

With the introduction of the national taxi recapitalisation initiative, new taxi vehicles will be used as public transport vehicles. Apart from the occupancy figures, the dimensions of these vehicles will differ substantially from those of the current combi-taxi vehicles. These vehicles will gradually replace the current fleet and will subsequently use the current infrastructure such as the taxi-ranking facilities, which were based on guidelines developed for combi-taxis. Such facilities will therefore have to be upgraded.

The preferred bidder for the manufacturing of the new taxi vehicles has not been appointed yet. However, based on the proposals received by the Department of Trade and Industry (DTI), some likely external dimensions for these vehicles were available.

Apart from the new taxi vehicles, the taxi recapitalisation initiative will also introduce electronic management systems to be used for ticketing, vehicle monitoring and vehicle tracking. The extent of the electronic management systems is not yet known. However, based on the various alternatives, the following elements may also play a role in the implementation of the initiative:

- Electricity
- Telephones
- Office buildings.

Although the applicable taxi recapitalisation information was stored within different categories, basic queries within the RPTFF have been used to produce reports on the compatibility of the facilities.

3 RECOMMENDATIONS

1. As with many other management systems, the RPTFF is dependent on data. The RPTFF's inventory data, as contained in the system, may be adequate for some time to come. However, it is recommended that the status data should be collected on a regular basis — not less than once a year — to explore the real potential of the framework.
2. The user has the ability to add photos and drawings to the framework, which can accommodate a number of photos and drawings per facility. It is recommended that more photos and drawings be stored in the framework as they become available.
3. The Ekurhuleni Metropolitan Municipality will only have prioritised their next budget by May 2002. It is recommended that in the meantime they assess the applicability of the standards, relevance factors and unit costs in the framework.
4. The Ekurhuleni RPTFF is the first of its kind in South Africa. It is a useful tool that can be applied by other authorities as well. CSIR Transportek will support the system with regard to continued research and development.
5. The current version of the framework only evaluates the performance of formal taxi ranks. It is recommended that an additional module be included that will be able to evaluate informal taxi ranks in order to prioritise the construction of new facilities as well.

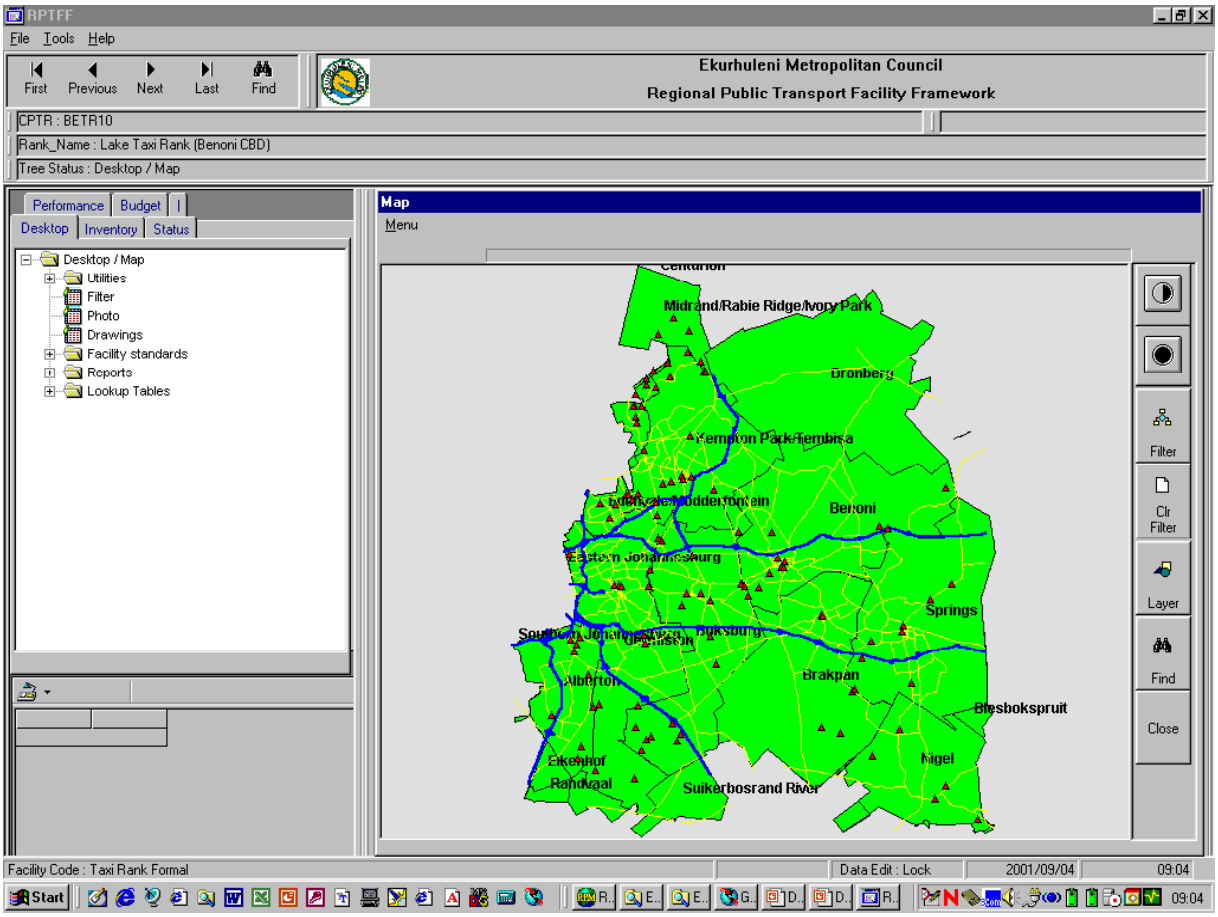


Figure 1: Desktop Module: GIS map of study area

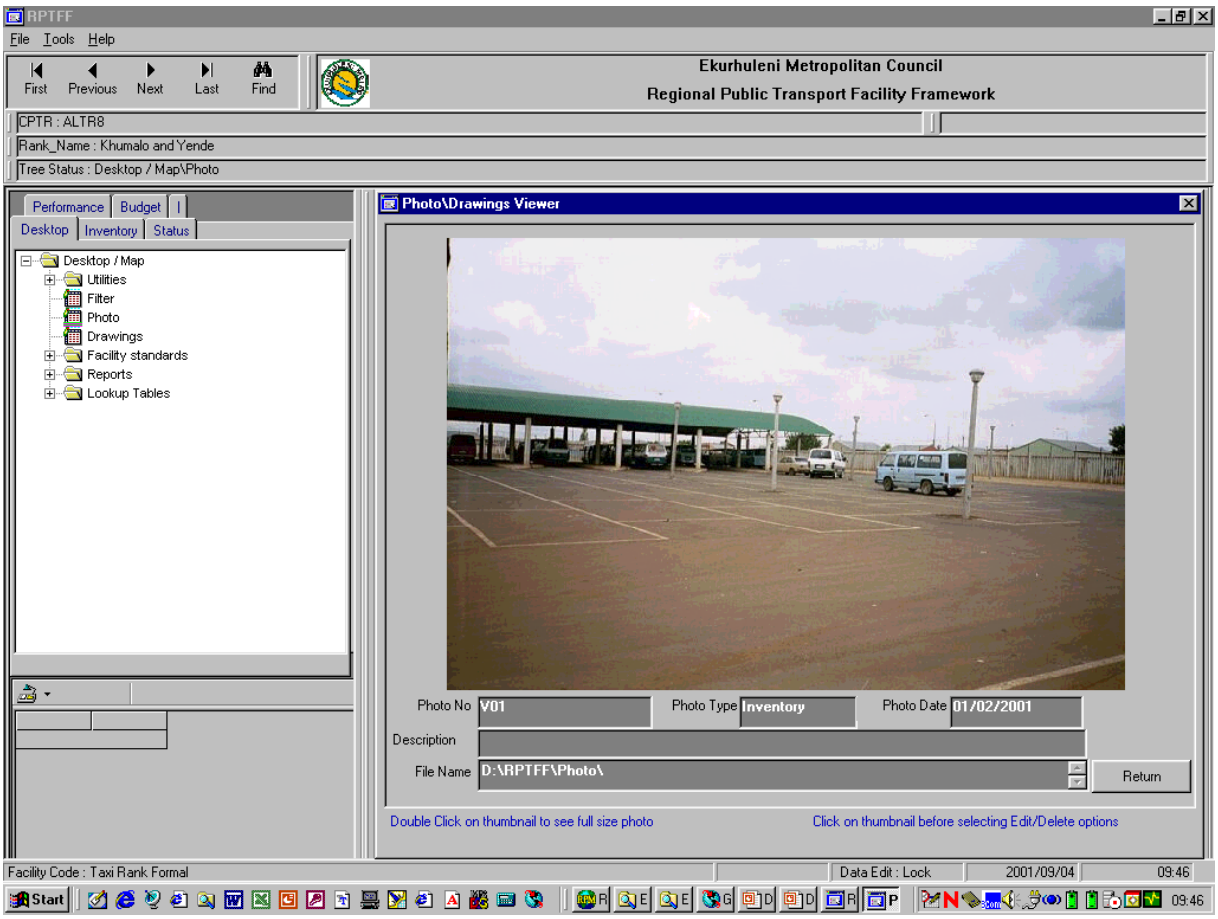


Figure 2: Desktop Module: Photo

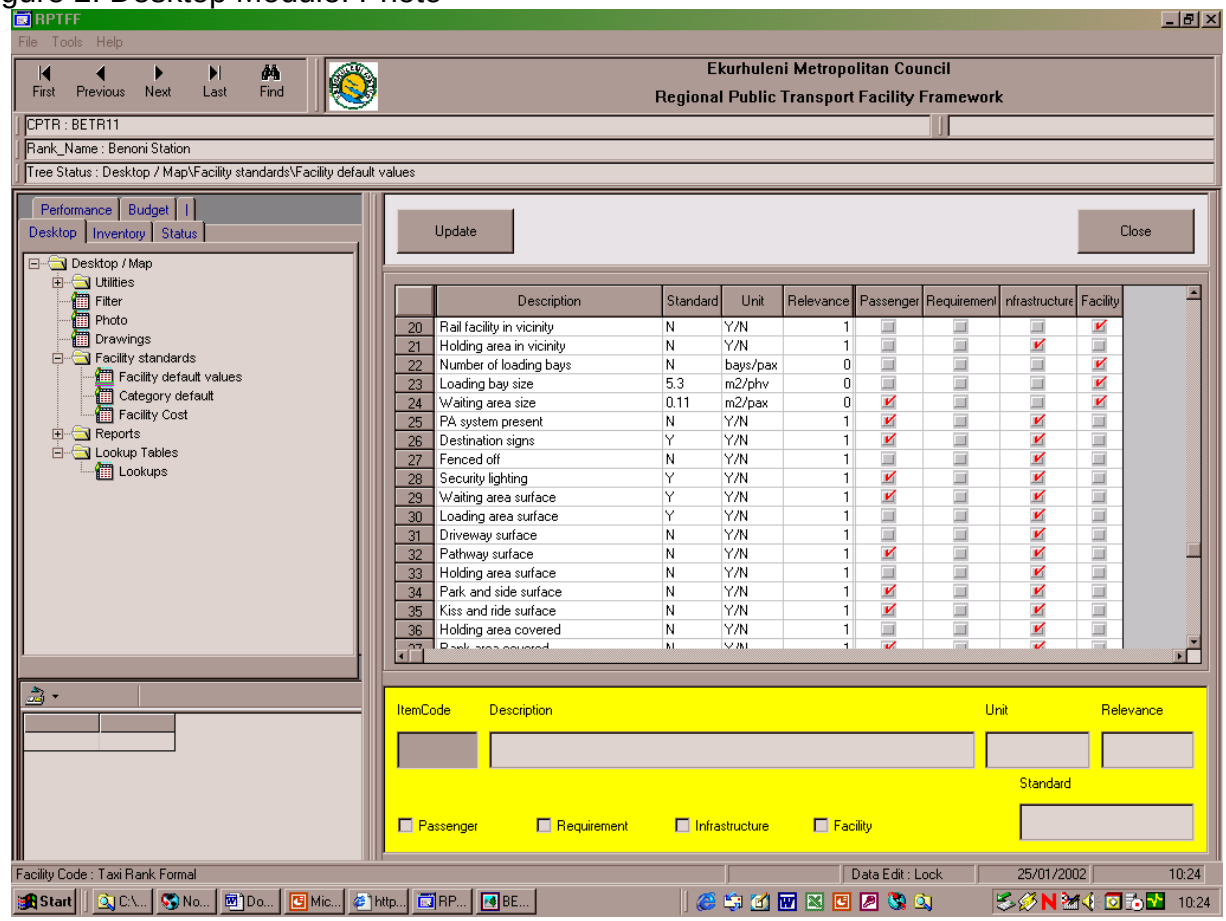


Figure 3: Desktop Module: Multi-criteria standards and weighting factors

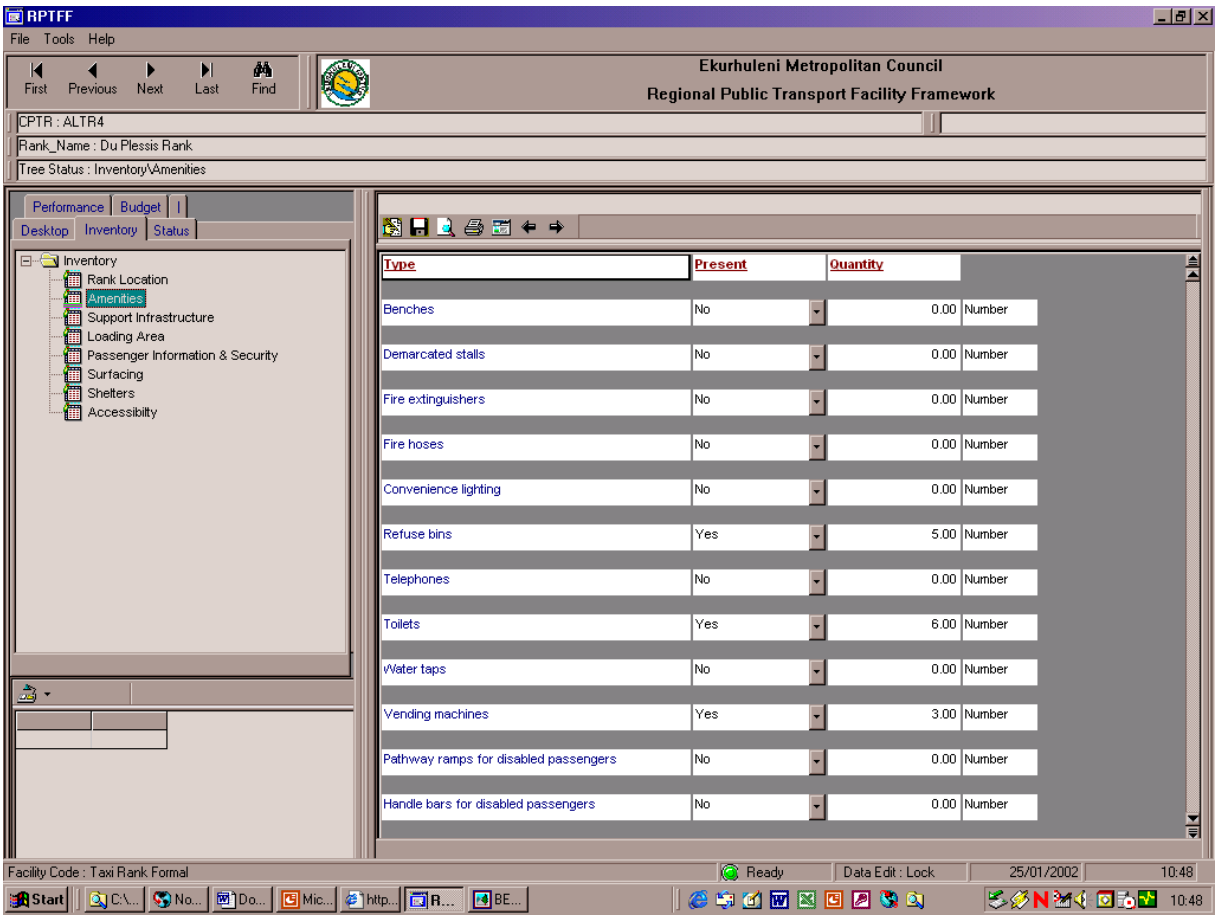


Figure 4: Inventory Module: Amenities

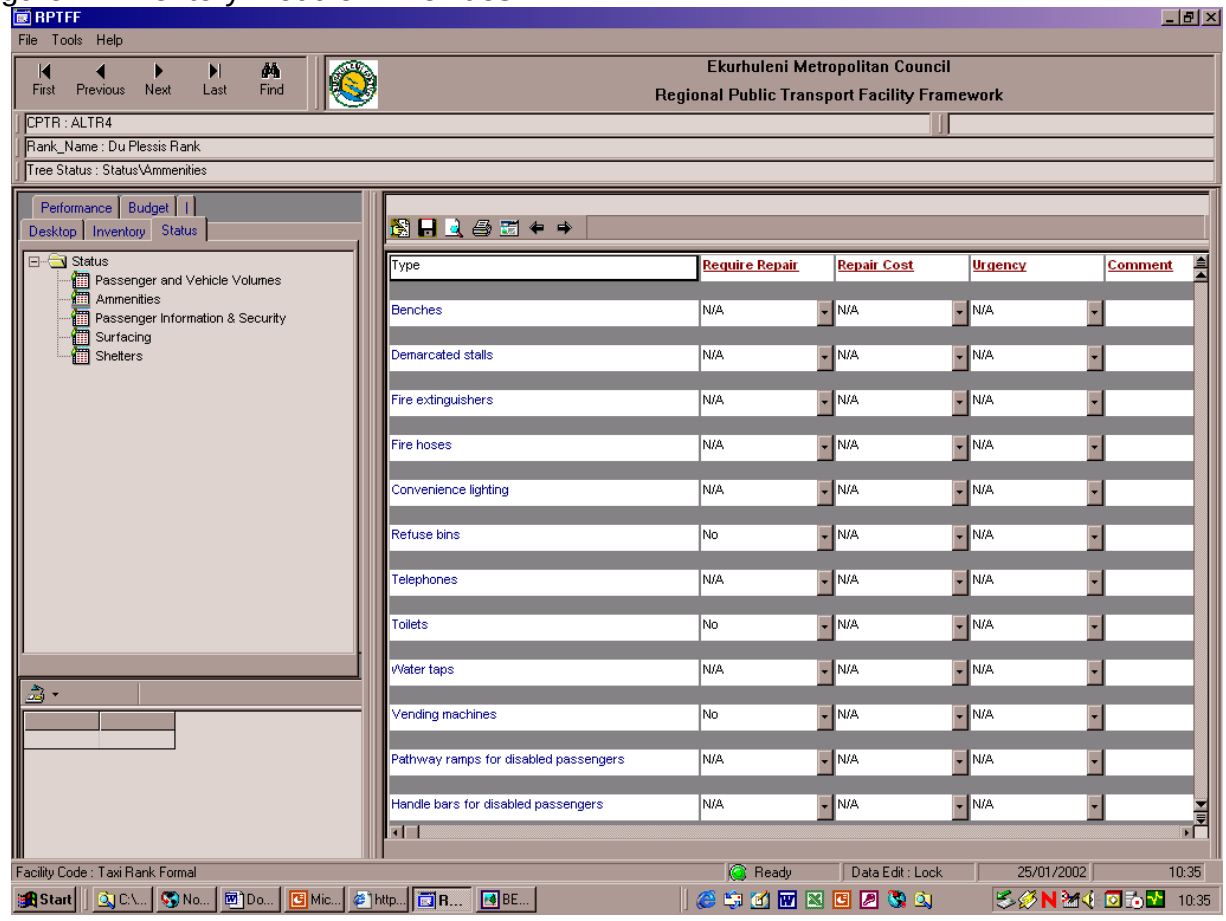
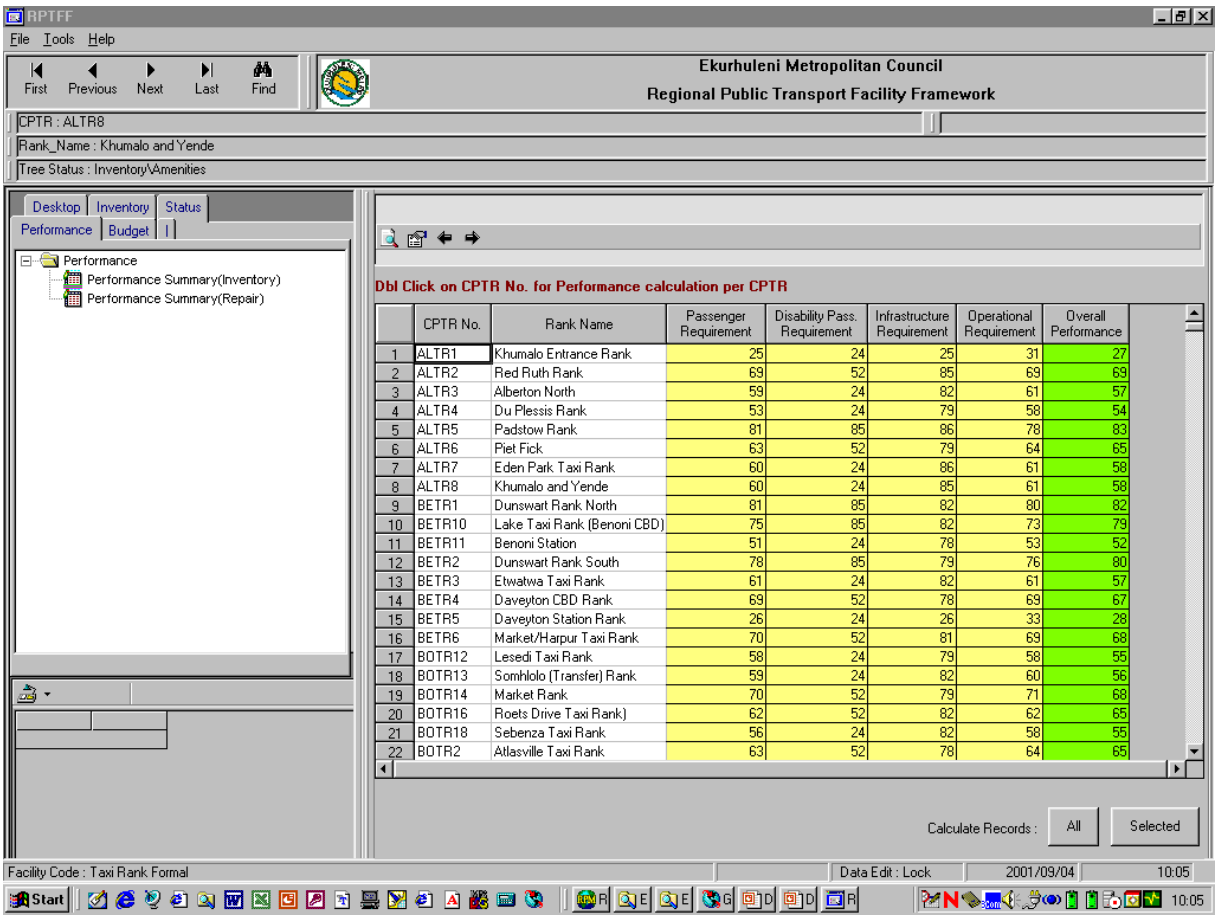
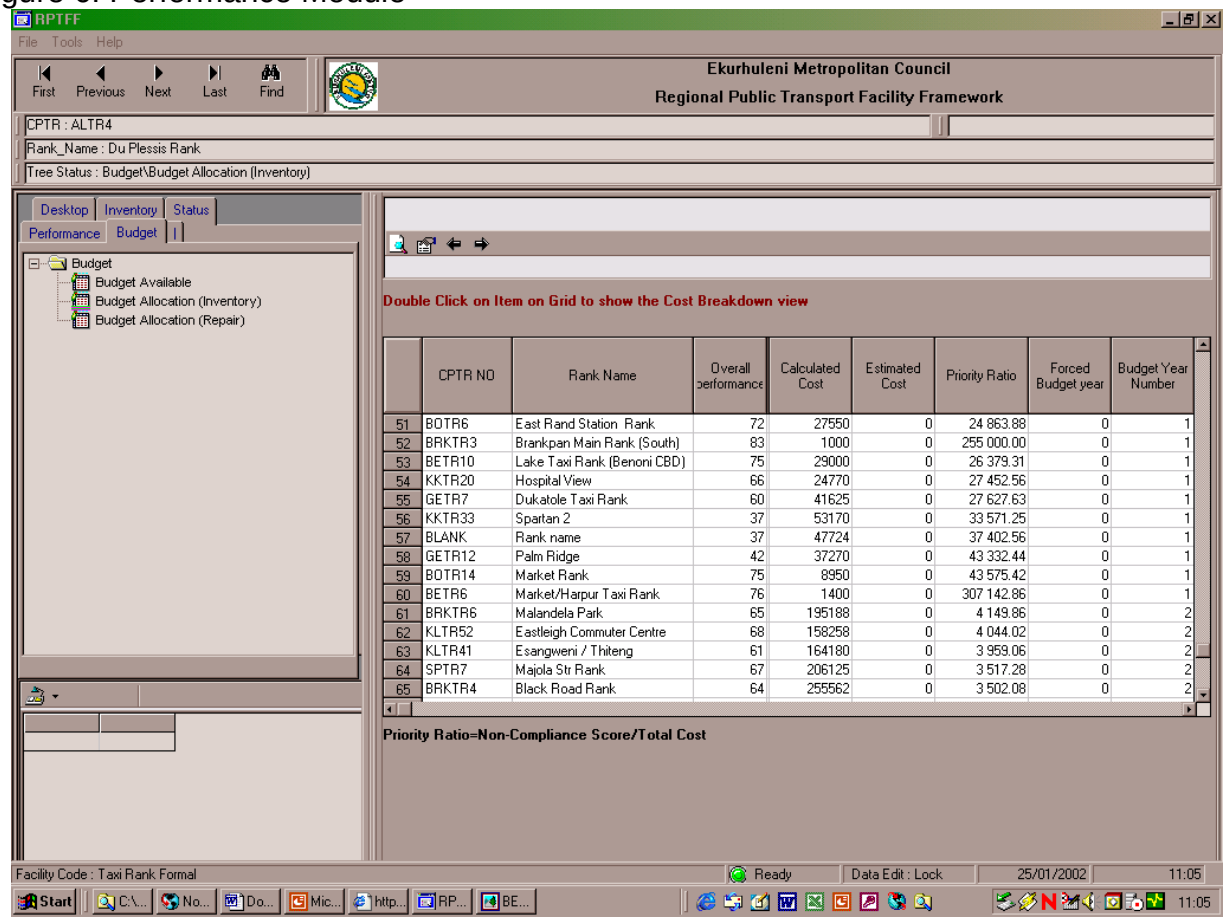


Figure 5: Status Module: Amenities



	CPTR No.	Rank Name	Passenger Requirement	Disability Pass. Requirement	Infrastructure Requirement	Operational Requirement	Overall Performance
1	ALTR1	Khumalo Entrance Rank	25	24	25	31	27
2	ALTR2	Red Ruth Rank	69	52	85	69	69
3	ALTR3	Alberton North	59	24	82	61	57
4	ALTR4	Du Plessis Rank	53	24	79	58	54
5	ALTR5	Padstow Rank	81	85	86	78	83
6	ALTR6	Piet Fick	63	52	79	64	65
7	ALTR7	Eden Park Taxi Rank	60	24	86	61	58
8	ALTR8	Khumalo and Yende	60	24	85	61	58
9	BETR1	Dunswart Rank North	81	85	82	80	82
10	BETR10	Lake Taxi Rank (Benoni CBD)	75	85	82	73	79
11	BETR11	Benoni Station	51	24	78	53	52
12	BETR2	Dunswart Rank South	78	85	79	76	80
13	BETR3	Etwatwa Taxi Rank	61	24	82	61	57
14	BETR4	Daveyton CBD Rank	69	52	78	69	67
15	BETR5	Daveyton Station Rank	26	24	26	33	28
16	BETR6	Market/Harpur Taxi Rank	70	52	81	69	68
17	BOTR12	Lesedi Taxi Rank	58	24	79	58	55
18	BOTR13	Somhlolo (Transfer) Rank	59	24	82	60	56
19	BOTR14	Market Rank	70	52	79	71	68
20	BOTR16	Roets Drive Taxi Rank)	62	52	82	62	65
21	BOTR18	Sebenza Taxi Rank	56	24	82	58	55
22	BOTR2	Atlasville Taxi Rank	63	52	78	64	65

Figure 6: Performance Module



	CPTR NO	Rank Name	Overall performance	Calculated Cost	Estimated Cost	Priority Ratio	Forced Budget year	Budget Year Number
51	BOTR6	East Rand Station Rank	72	27550	0	24 863.88	0	1
52	BRKTR3	Brankpan Main Rank (South)	83	1000	0	255 000.00	0	1
53	BETR10	Lake Taxi Rank (Benoni CBD)	75	29000	0	26 379.31	0	1
54	KKTR20	Hospital View	66	24770	0	27 452.56	0	1
55	GETR7	Dukatole Taxi Rank	60	41625	0	27 627.63	0	1
56	KKTR33	Spartan 2	37	53170	0	33 571.25	0	1
57	BLANK	Rank name	37	47724	0	37 402.56	0	1
58	GETR12	Palm Ridge	42	37270	0	43 332.44	0	1
59	BOTR14	Market Rank	75	8950	0	43 575.42	0	1
60	BETR6	Market/Harpur Taxi Rank	76	1400	0	307 142.86	0	1
61	BRKTR6	Malandela Park	65	195188	0	4 149.86	0	2
62	KLTR52	Eastleigh Commuter Centre	68	158258	0	4 044.02	0	2
63	KLTR41	Esangweni / Thiteng	61	164180	0	3 959.06	0	2
64	SPTR7	Majola Str Rank	67	206125	0	3 517.28	0	2
65	BRKTR4	Black Road Rank	64	255562	0	3 502.08	0	2

Figure 7: Budget Module

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Short CV of Mr TJ Lamprecht

Mr Lamprecht has completed a B.Ing (Civil) degree at RAU in 1993 and a B.Ing Hons (Transportation) degree in 1995 at University of Pretoria. Mr Lamprecht has started his career in transportation engineering at BKS in 1994 after which he has joined the CSIR's Division Transportek in 1998 to further his career in a transportation research environment. He has more than eight years experience in transportation planning and engineering, and he is registered as a professional engineer with the Engineering Council of South Africa.