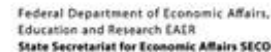
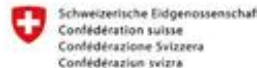




Cities Development Initiative for Asia

Public Transport Projects in Tbilisi



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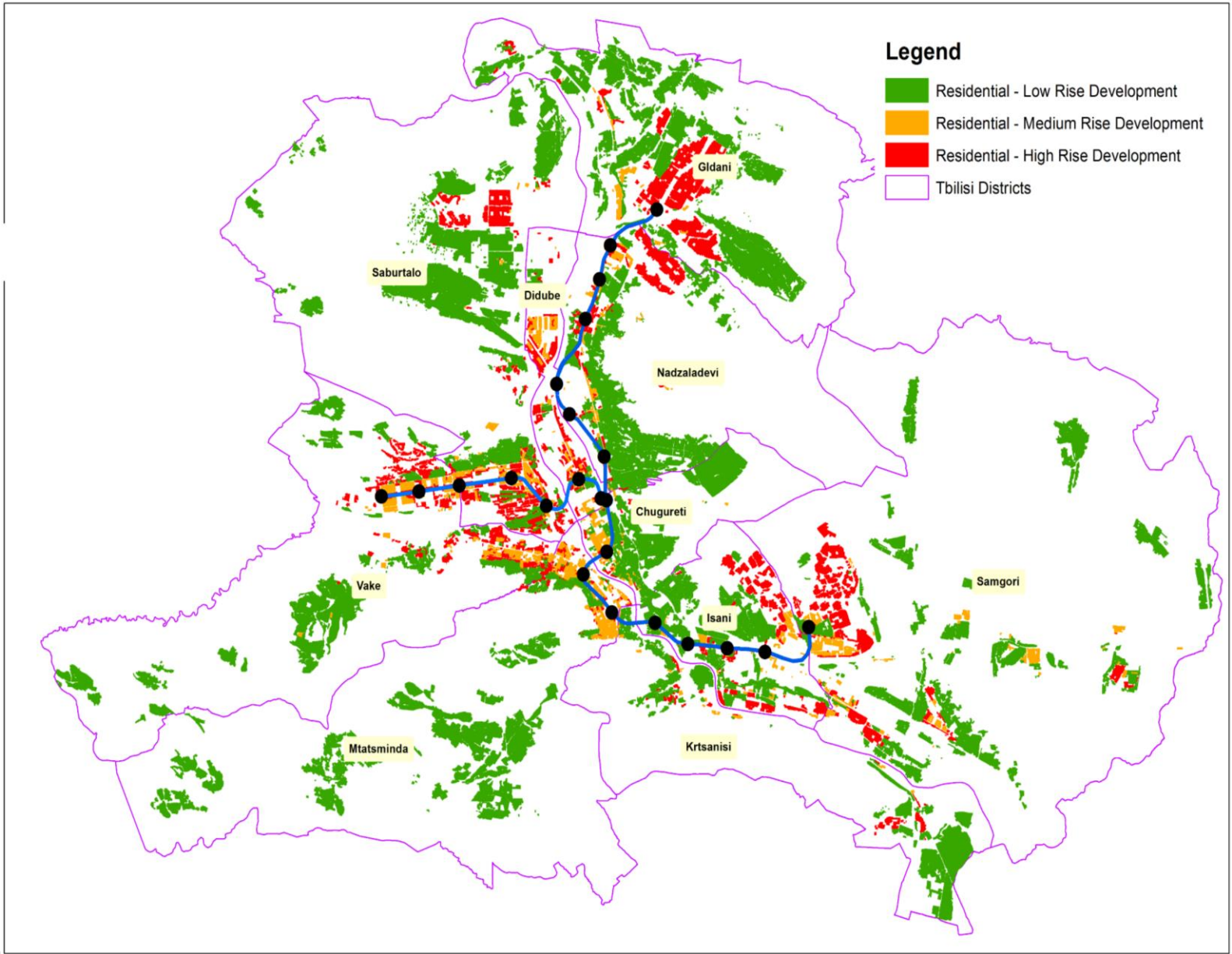


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CDIA Project Preparation Studies

- Born out of the Sustainable Urban Transport Strategy Update 2015 – short and medium term action plans
- Initiated as part of the Future cities Program
- Carried out under the umbrella of the Sustainable Urban Transport Investment Program (SUTIP)
- Two Key Projects:
 - Tbilisi Bus Network Improvement and Pilot Surface Transit System
 - Tbilisi Metro Upgrade
- Common objective: *“to contribute to the shift to sustainable urban mobility in the Tbilisi Urban Area”*
- Working with the City Hall and the Tbilisi Transport Co. (TTC)





The Bus Study

- Final Report was submitted on 10 May 2017
- Key objectives
 - Restructuring and rationalizing the bus network
 - Measures to improve the commercial speed of the bus network
 - Select a pilot rapid transit corridor
 - Conceptual designs for bus rapid transit (BRT) and tram options
 - Comparison between the BRT and tram options
 - Parking strategy



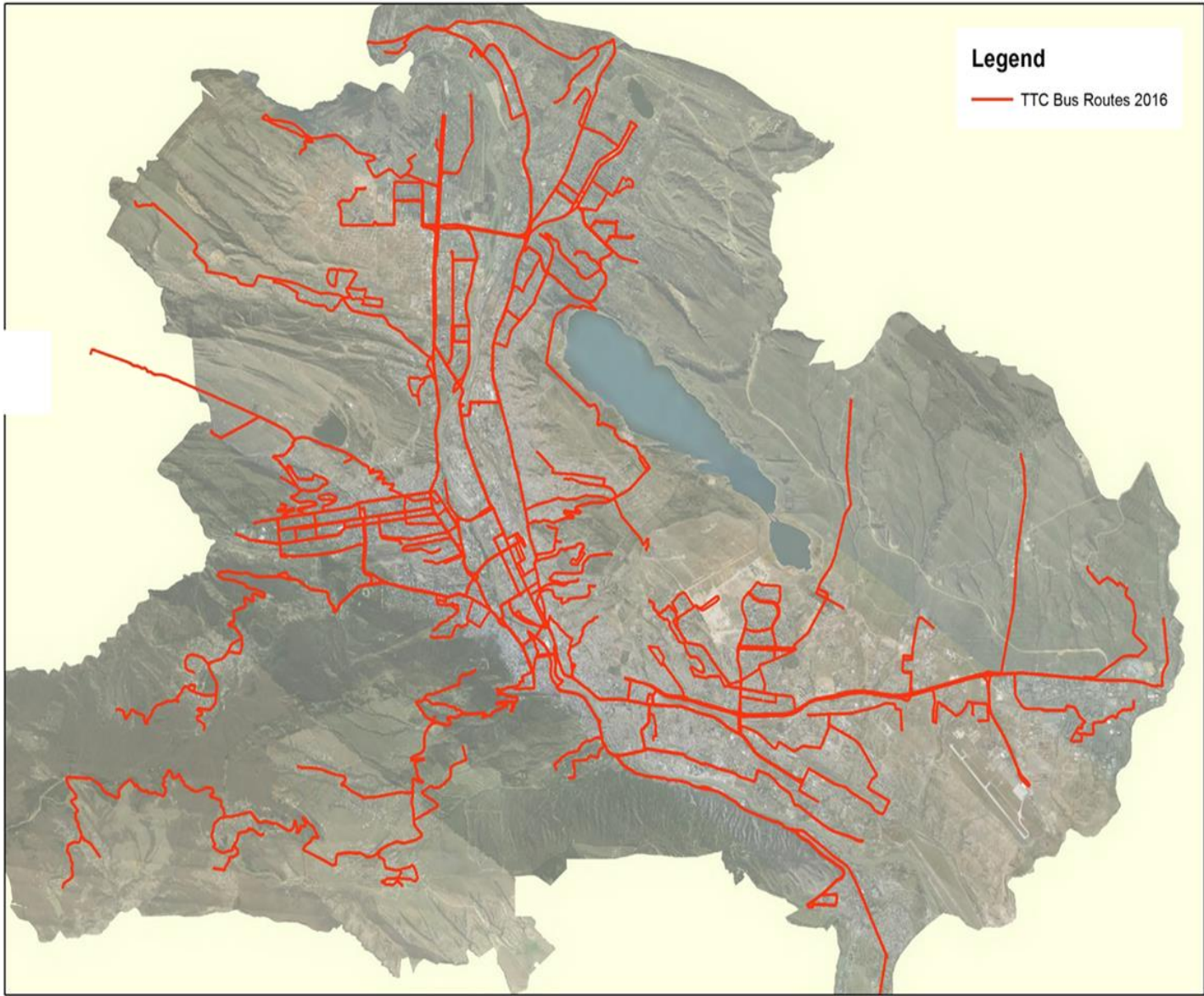
The Current Situation

- Mode share: walk 27%, public transport 39%, taxi 3%, car 30%
- Public transport share: metro 19%, bus 39%, microbus 42%
- Less than 50% of households own a car but rising rapidly
- Average trip time: public transport 39 minutes, car 29 minutes
- The bus fleet (693 buses) is seen as “life expired”
- Of the 97 TTC bus routes, 20 carry 50% of the passengers
- 38 routes carried 10% of the passengers
- The TTC adult full fare is 50 tetri. Microbuses charge is 80 tetri
- Parking is cheap
- Taxis are unregulated



Typical Scene





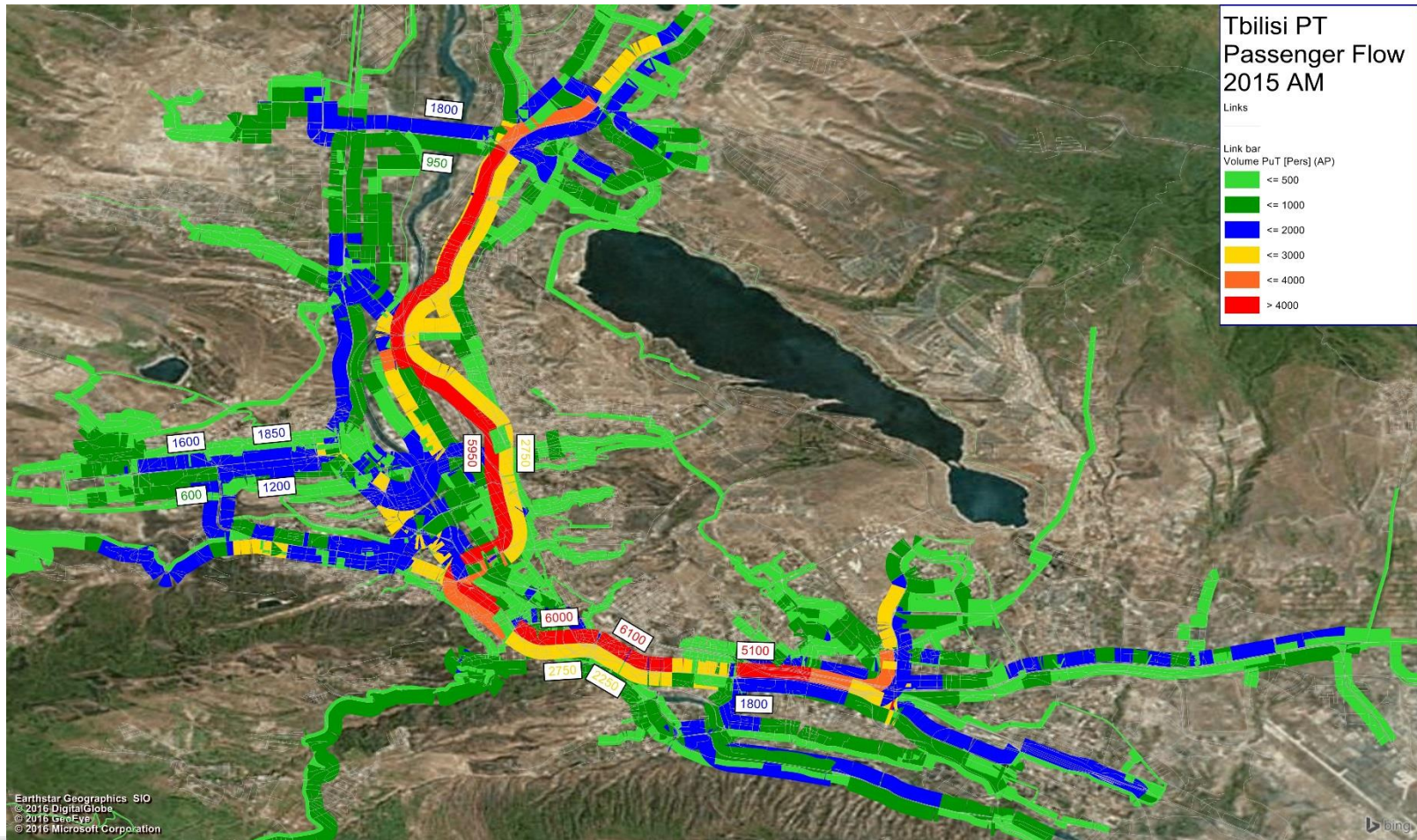
Legend
— TTC Bus Routes 2016

Network Restructuring

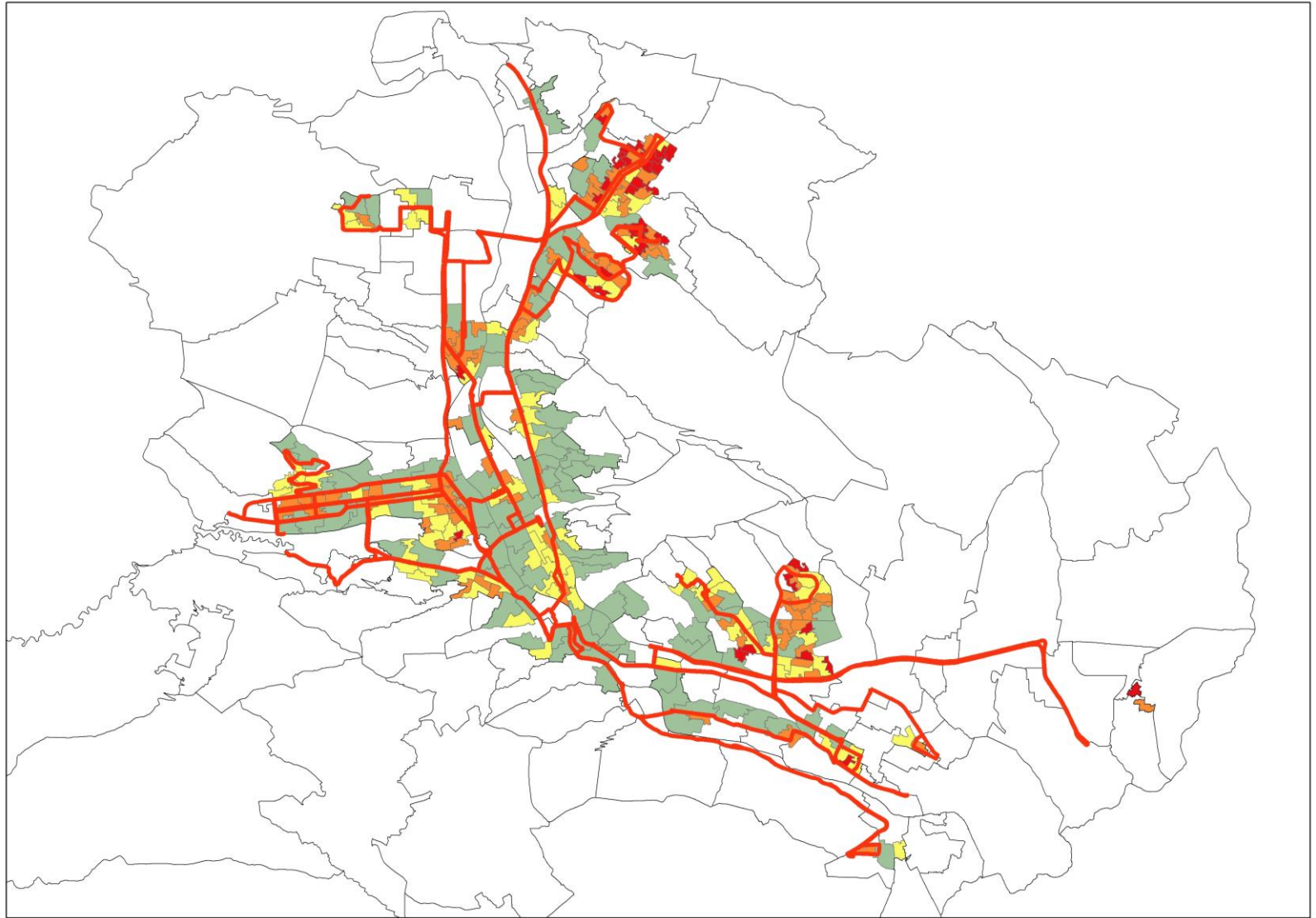
- Smart data collected from TTC and a VISUM model developed
- Analysis of the existing TTC routes using key performance indicators (daily passengers, passengers per peak vehicle etc.)
 - Network comprises many direct point to point routes
 - Operated individually with low frequency
 - Over-complex system
- Developed a strategic core network, a secondary city network and a tertiary village network
- Generally shorter routes of higher frequency with interchange
- The proposed network makes use of the existing fleet size
- Principles for the reorganisation of the microbus network



Transport Modelling/Data



Strategic Core Network



Secondary City Network

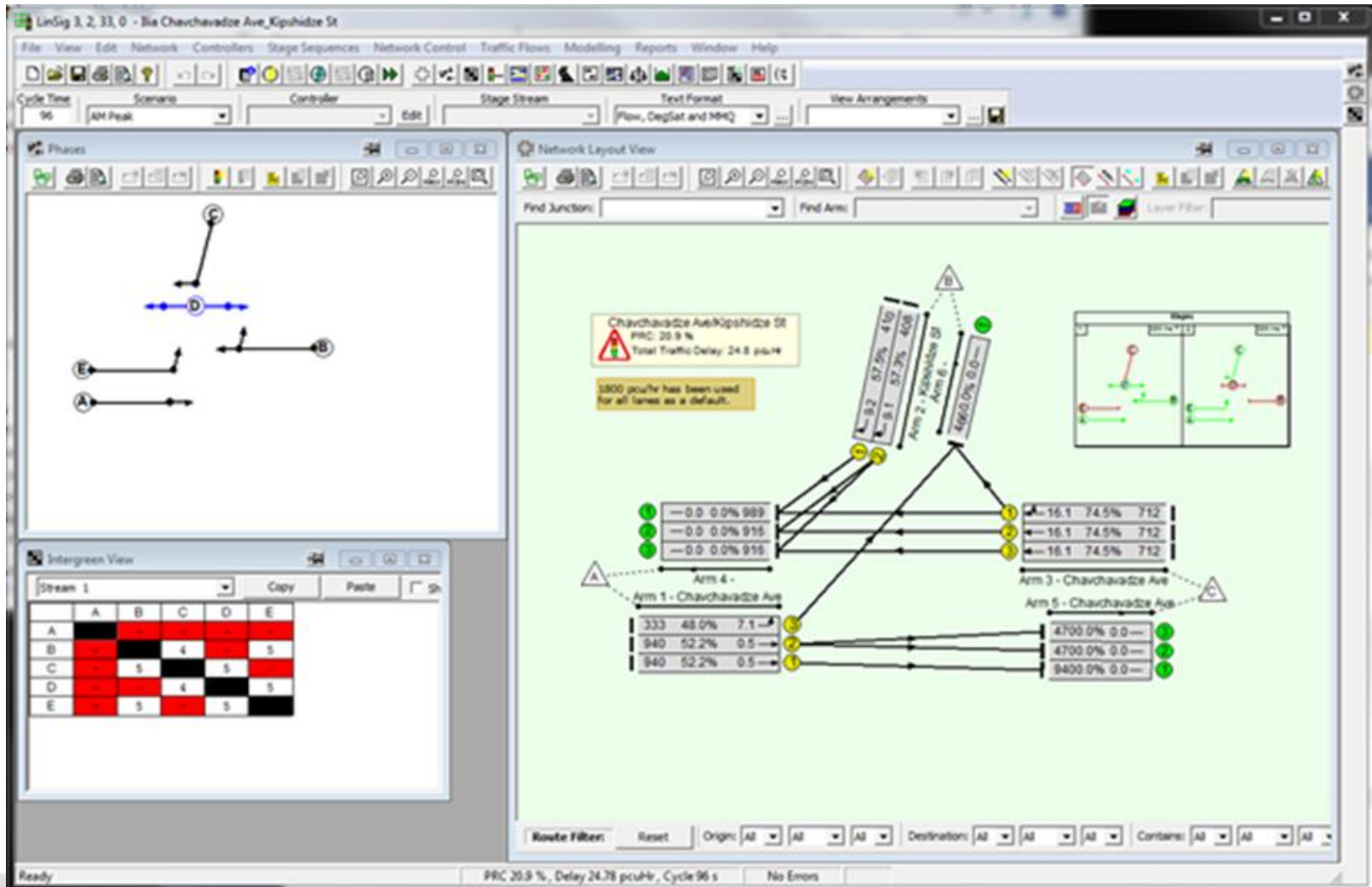


Commercial Speed of Buses

- Worked closely with City Hall Transport Department and the TTC:
 - Optimised 11 junctions along an agreed corridor that is used by the new Man buses
 - Priority to buses at traffic signals using the existing GPS
 - Identified roads where bus priority can be introduced
 - Preliminary design of a contraflow bus lane on Petre Melikishvili Street (about 600m)



Junction Optimization



Bus Lane Priority Options



Side Lanes

- No parking
- No cycles
- Problems with side roads
- Slower buses
- Abuse of lanes

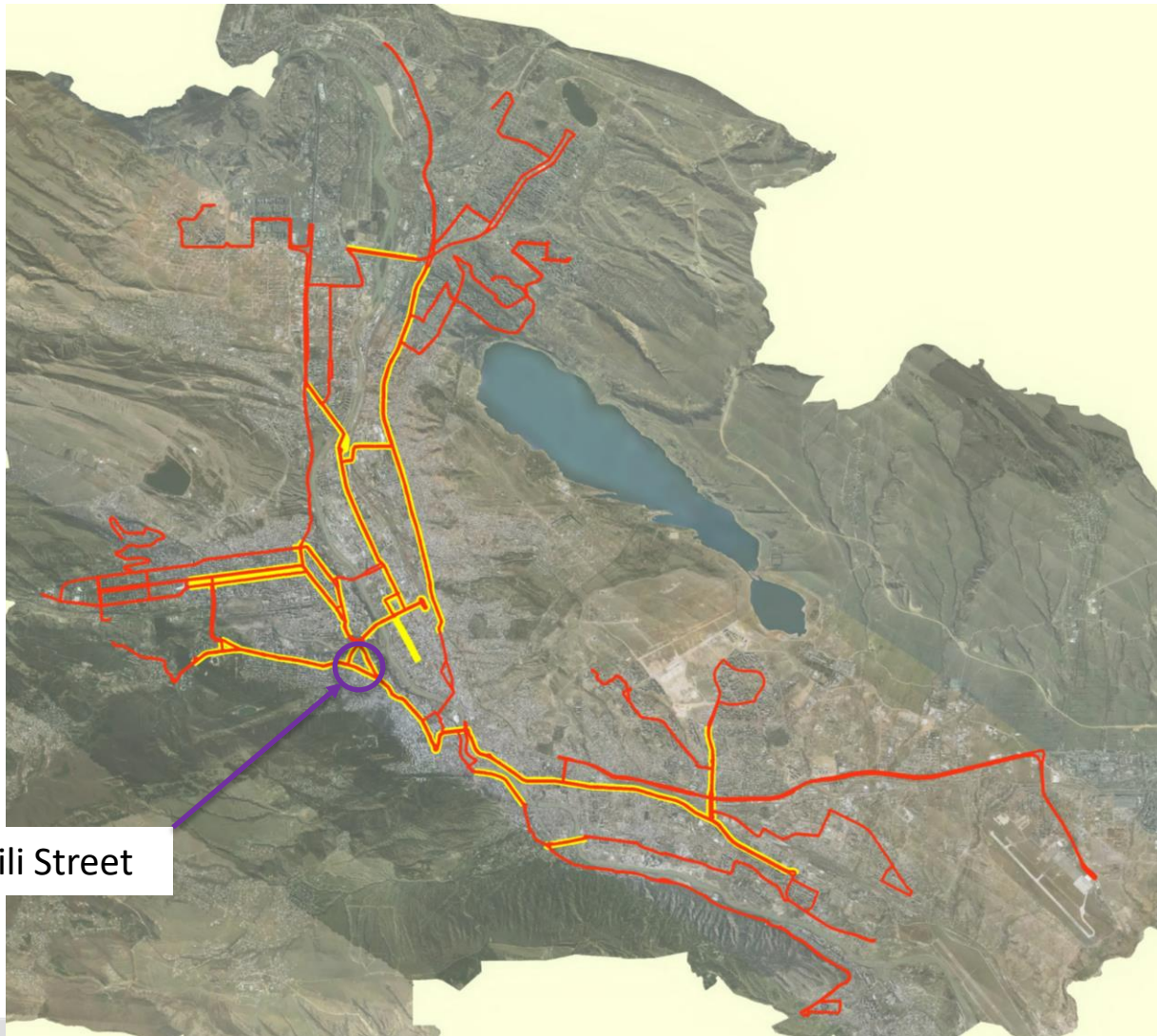


Median Busway

- Allows parking
- Safer road crossings
- Faster for buses



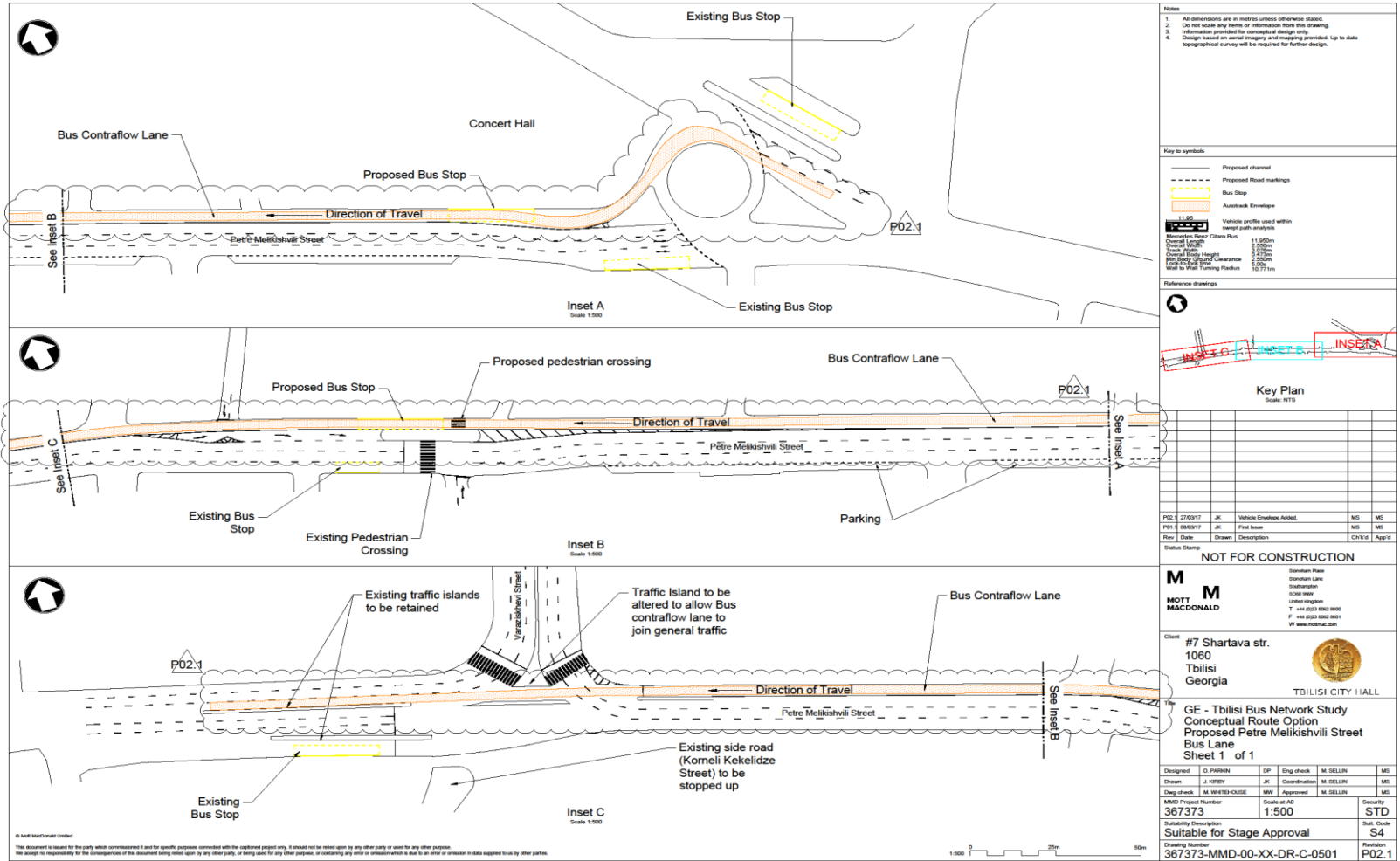
Extent of Potential Bus Priority



Petre Melikishvili Street



Petre Melikishvili Street Bus Lane

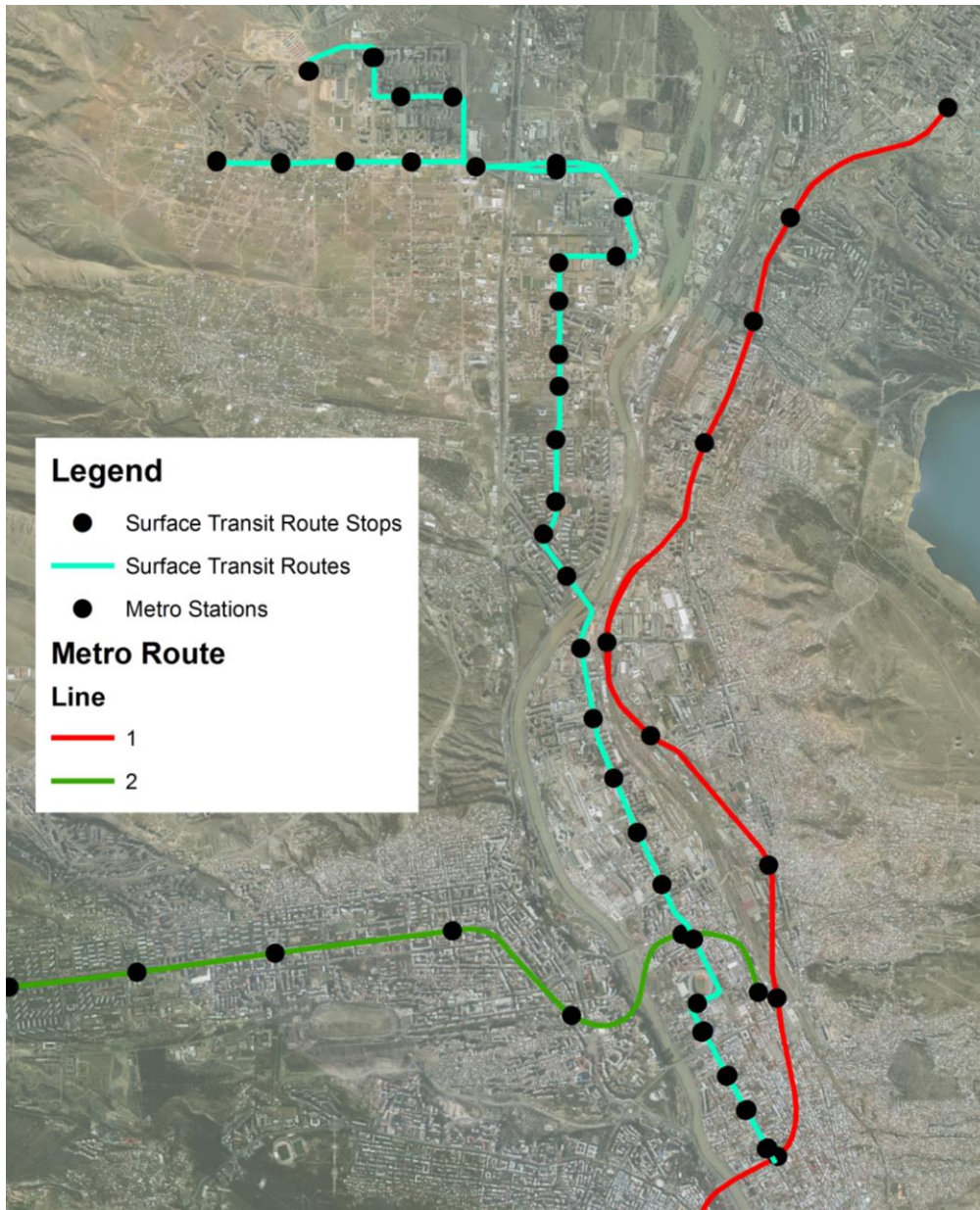


Rapid Transit Corridor

- A workshop was held to develop the criteria for route selection (areas served, ridership, journey time improvements, modal shift from car, development opps etc.)
- 5 corridor options were developed
- A multi-criteria analysis of the routes was conducted
- This resulted in ranking the 5 options
- Meetings with the head of the Transport Department, the Deputy Mayor and the Mayor resulted in a recommendation for Option 3 being agreed by all parties
- Option 3 was then taken forward by the design team for both BRT and tram conceptual design

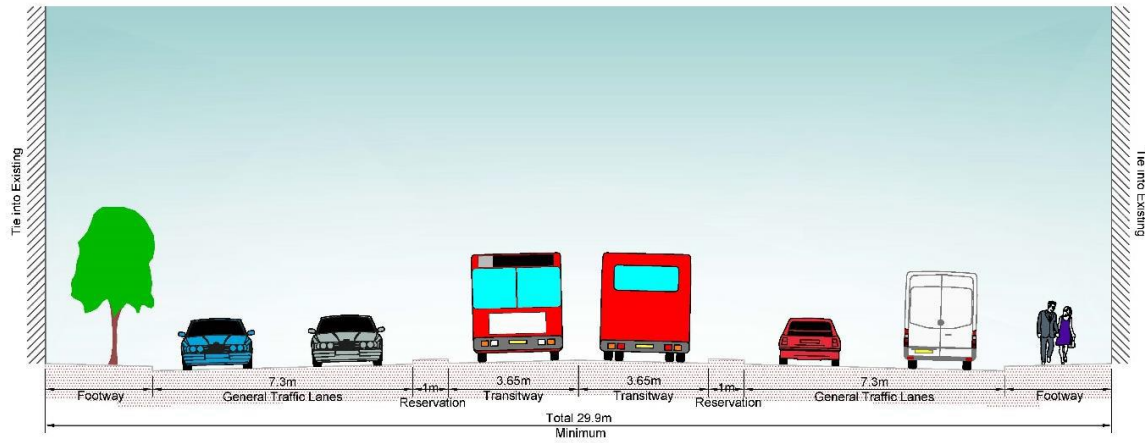


Route Design

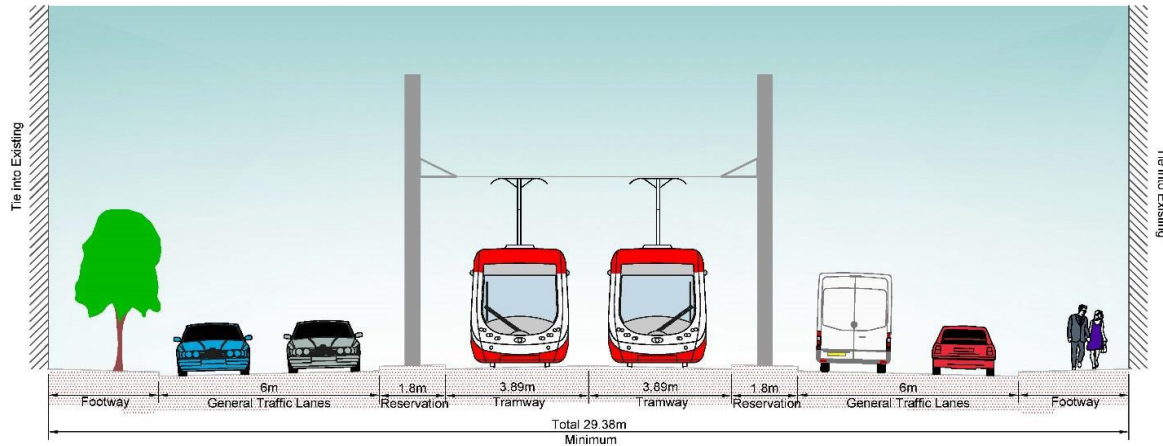
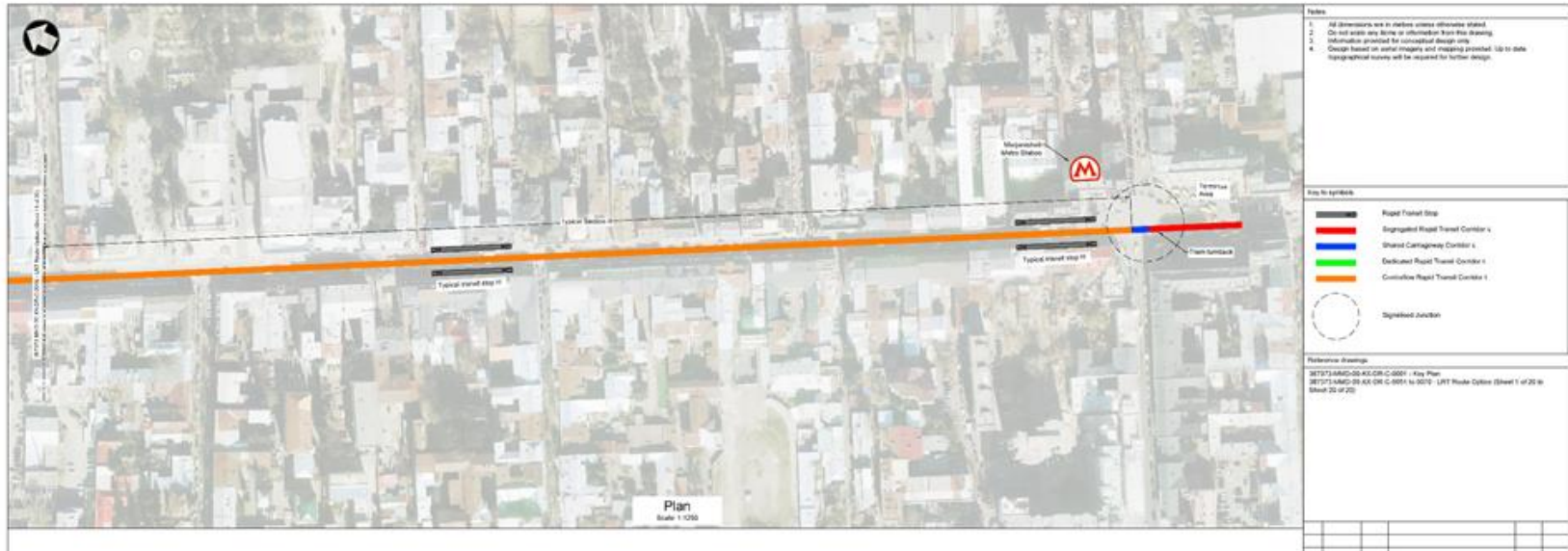


- Population within 400m = 184,000
- Distance: 11.4 km + 2.3 km (N) or 1.9 km (S)
- Peak boardings per hour = 4,330
- Serves:
 - Didi Digomi
 - Hospitals
 - Didube metro
 - Expo Georgia
 - Tsereteli metro
 - Dinamo stadium
 - Marjanishvili metro

Conceptual BRT Plan



Conceptual Tram Plan



Cost Estimates

| Item | BRT | Tram |
|----------------|------------|-------------|
| Infrastructure | 58,110,000 | 251,190,000 |
| Fleet | 11,400,000 | 66,470,000 |
| Depot | 1,500,000 | 25,000,000 |
| Total | 71,010,000 | 342,660,000 |

BRT and Tram Operations

- Frequent operation – every 5 minutes for BRT and every 6 minutes for the tram
- Fleet required: 30 BRT buses or 23 trams
- Estimated daily patronage 52,888 journeys
- Estimated annual revenue (Fare GEL 0.5) GEL 8.8 million
- Least annual costs for CNG fuelled BRT
- Annual subsidy of GEL 2.6 million
- Operational surplus if fare revised to GEL 0.80 like minibuses

BRT and Tram Video



Comparison Between Modes

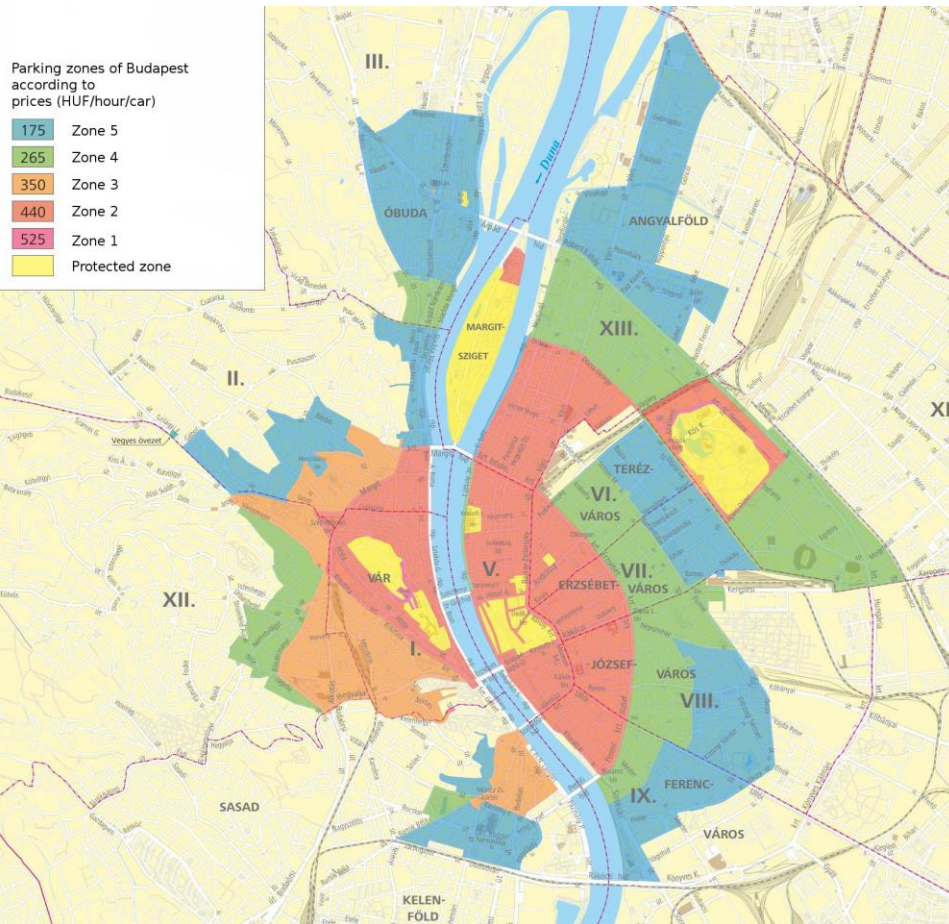
- More land needed for turning BRT buses
- Trams are more expensive to construct than BRT – tracks, power, overhead
- Capacity of BRT vehicle 120 – tram 200+
- Tram must be built in stages from depot. BRT can be built in multiple stages
- Construction time is about 2 years for BRT and up to 4 years for tram
- New skills will need to be learned for both modes

Parking Strategy - Current Situation



- Obstructive parking
- Impacts on efficient bus operation
- Parking effectively free (50¢/year)
- Parking places are often full
- Enforcement is ineffective and no deterrent
- No effective control on parking

International Comparisons



- Key lessons:

- Effective enforcement required:
 - Camera enforcement
 - Punitive fines
 - Owner liability
- Zoned residents' parking
 - Zones sized to avoid intra-zone commuting
- Visitor parking charges set to:
 - Discourage or prevent commuting
 - Ensure reasonable availability of spaces
 - Reflect local demand
- Parking controlled to respect historic and tourist areas

Parking Strategy Objectives

1

Prevent obstruction to buses, pedestrians and cyclists

2

Control parking to reduce traffic levels

3

Control parking so drivers can find a space when and where they need one

4

Parking should respect the urban realm

5

Use parking controls to improve vehicle standards

6

Parking controls should be clear and fairly enforced

7

Consult on kerbside controls with those directly affected

8

Parking control should be commercial, with surplus used transparently

9

Develop park-and-ride services

10

Introduce controls in a way acceptable to the population of the City

The Metro Study

- Described by Deputy Mayor Irakli Lekvinadze as “Tbilisi’s project of the century”
- The Interim Report is due this week
- Key objectives
 - To enable a coherent and optimal vision and plan for upgrading the Tbilisi Metro System operations to a modern standards level
 - Improve passenger safety
 - Improve accessibility and inter-modal connectivity
 - Introduce energy saving solutions
 - Optimize operations through re-equipping, training and the introduction of new operational standards and procedures

Tbilisi Metro System

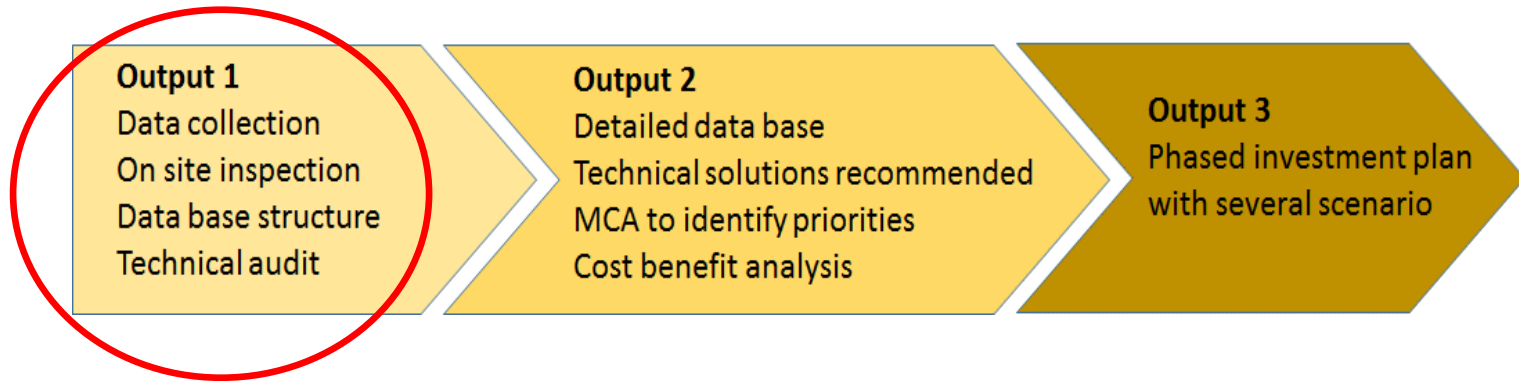
თბილისის სატრანსპორტო კომპანია
TBILISI TRANSPORT COMPANY
 WWW.TTC.COM.GE

თბილისის მეტრო
TBILISI METRO



Outputs

- 3 main outputs



- Interim Report (Output 1): Received 30 May 2017
- Final Report (Outputs 2 & 3): end August 2017

Rolling Stock

- The rolling stock fleet comprises 149 cars (29 trainsets of 4 cars and 11 trainsets of 3 cars)
- Stock housed in two depots
- Most of the cars are in reasonable condition, with an acceptable appearance, are clean and modernized
- Comfort quality is low compared to European standards in terms of noise, ride, passenger information etc.



Escalators

- A very strategic component of the metro system (access, safety, evacuation) and most are out of date
- All underground stations are equipped with 3 escalators
- More than 24 escalators need urgent replacement
- Very expensive > \$5 million per station



Electromechanical Equipment

- Drainage pumps are to prevent flooding of the tunnel (24,000 m³/day) – reaches danger level with 45 minutes
- Most pumps are out of date (> 30 need urgent replacement)
- Numerous ventilators are missing or out of service
 - Clean air cannot be maintained
 - Smoke cannot be removed in case of a fire



Civil Works - Tunnel

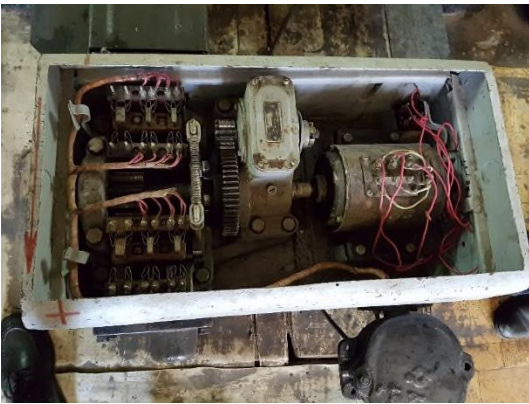


Civil Works

- Not actually covered in the consultant's TOR but.....
- Needs a geotechnical investigation (approx. \$ 1.5 million)
- The consultant is preparing the TOR as a VO to the contract
- Significant issues with the track
 - Poor alignment causing both vertical and lateral oscillation of the rolling stock
 - Grinding of the rail profile



Other Issues



Output 1

- 11 components

| OUTPUT | DELIVERABLE |
|--|---|
| <p>Output 1 – Audit, Inventory and Assessment of the Tbilisi Metro System</p> | <p>Interim report, Dataset and Narrative Report of the Audit of the Tbilisi Metro System including:</p> <ul style="list-style-type: none">● Output 1.1 -Inventory Database structure filled.● Output 1.2 -Outline of the current operation plan.● Output 1.3 -Financial and economic models of before-modernization metro operation.● Output 1.4- Energy efficiency assessment.● Output 1.5 -Safety assessment report (annex of Interim report)*.● Output 1.6 -Assessment of accessibility.● Output 1.7 - Assessment of multimodality by station.● Output 1.8 - Assessment of the current ticketing system.● Output 1.9 - Assessment of the current turnover.● Output 1.10 - Interior servicing area of stations.● Output 1.11 - Assessment of Key social and gender issues. |

Output 1.1 Inventory Database

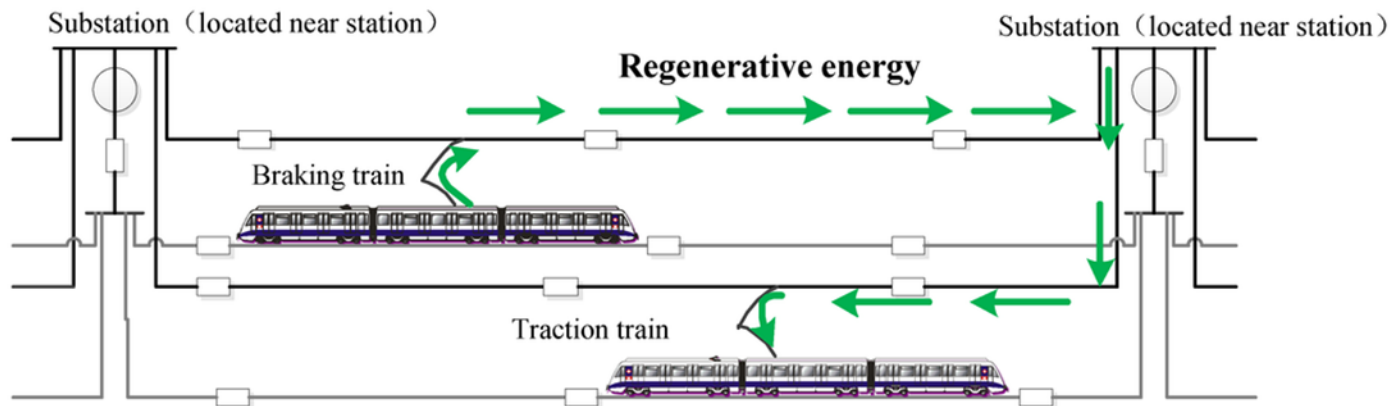
- Progressing through close cooperation with the TTC
- By mid-May approximately 1200 components had been identified of which 800 had been added to the database
- Will be handed over to TTC on project completion
- Database training will be provided

The screenshot shows an Excel spreadsheet titled "DATA BASE_V23 - Excel" with the following columns: A (ID), B (Quantity), C (Code), D (Code), E (Code), F (Code), G (Code), H (Code), I (Code), J (COMPONENTS / ITEMS), K (MANUFACTURER), L (TYPE / IDENTIFICATION), M (FIL), N (FOT), O (QUANTI), P (UN), Q (UN), R (LOCATION). The data is organized into sections for different drainage systems (N8, N9, N10) and various components like pumps, pipes, and detectors.

| A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R |
|-----|---|---|---|---|---|---|---|---|--------------------------|----------------|--------------|-----|------|----|---|---|-----------------------------------|
| 742 | 1 | 1 | 6 | 1 | 7 | 5 | | | Detector | | float system | | | | | | Metro Station "Varketili" |
| 743 | 1 | 1 | 6 | 1 | 7 | 6 | | | Alarm | | "Iisna" | | | | | | Metro Station "Varketili" |
| 744 | 1 | 1 | 6 | 1 | 7 | 7 | | | Valve | | | | | | | | Metro Station "Varketili" |
| 745 | 0 | 0 | 6 | 1 | 8 | | | | main drainage system N8 | | | | | | | | |
| 746 | 1 | 1 | 6 | 1 | 8 | 1 | | | Pumps Type D-320/70 | "Livgidromash" | 4A422552y | 1 | unit | 90 | | | Metro Station "Sarajashvili" |
| 747 | 1 | 1 | 6 | 1 | 8 | 2 | | | Pumps Type D-320/50 | "Sakhidromash" | 4A4250M4y3 | 2 | unit | 75 | | | Metro Station "Sarajashvili" |
| 748 | 1 | 1 | 6 | 1 | 8 | 3 | | | Pumps Type D-320/50 | "Sakhidromash" | 4A250M4Y3 | 1 | unit | 75 | | | Metro Station "Sarajashvili" |
| 749 | 1 | 1 | 6 | 1 | 8 | 4 | | | Control system | | | 1 | unit | | | | Metro Station "Sarajashvili" |
| 750 | 1 | 1 | 6 | 1 | 8 | 5 | | | Piping | | steel pipes | 170 | m | | | | Metro Station "Sarajashvili" |
| 751 | 1 | 1 | 6 | 1 | 8 | 6 | | | Detector | | float system | | | | | | Metro Station "Sarajashvili" |
| 752 | 1 | 1 | 6 | 1 | 8 | 7 | | | Alarm | | "Iisna" | | | | | | Metro Station "Sarajashvili" |
| 753 | 1 | 1 | 6 | 1 | 8 | 8 | | | Valve | | | | | | | | Metro Station "Sarajashvili" |
| 754 | 0 | 0 | 6 | 1 | 9 | | | | main drainage system N9 | | | | | | | | |
| 755 | 1 | 1 | 6 | 1 | 9 | 1 | | | Pumps Type D-320/70 | "Livgidromash" | 4A422552y | 2 | unit | 90 | | | Metro Station "Akhmeteli Theatre" |
| 756 | 1 | 1 | 6 | 1 | 9 | 2 | | | Control system | | | 1 | unit | | | | Metro Station "Akhmeteli Theatre" |
| 757 | 1 | 1 | 6 | 1 | 9 | 3 | | | Piping | | steel pipes | 165 | m | | | | Metro Station "Akhmeteli Theatre" |
| 758 | 1 | 1 | 6 | 1 | 9 | 4 | | | Detector | | float system | | | | | | Metro Station "Akhmeteli Theatre" |
| 759 | 1 | 1 | 6 | 1 | 9 | 5 | | | Alarm | | "Iisna" | | | | | | Metro Station "Akhmeteli Theatre" |
| 760 | 1 | 1 | 6 | 1 | 9 | 6 | | | Valve | | | | | | | | Metro Station "Akhmeteli Theatre" |
| 761 | 0 | 0 | 6 | 1 | 9 | | | | main drainage system N10 | | | | | | | | |
| 762 | 1 | 1 | 6 | 1 | 9 | 1 | | | Pumps Type D-200/36 | "Sakhidromash" | 4A200M4Y3 | 3 | unit | 45 | | | Metro Station "Delisi" |
| 763 | 1 | 1 | 6 | 1 | 9 | 2 | | | Control system | | | 1 | unit | | | | Metro Station "Delisi" |
| 764 | 1 | 1 | 6 | 1 | 9 | 3 | | | Piping | | steel pipes | 78 | m | | | | Metro Station "Delisi" |
| 765 | 1 | 1 | 6 | 1 | 9 | 4 | | | Detector | | float system | | | | | | Metro Station "Delisi" |

Output 1.4 Energy Efficiency Assessment

- Regenerative braking would be a big saving but is it worth it?
 - Need new rolling stock
 - Need new sub-stations
- The metro system uses 65 million kWh/year
- 60% is used by the rolling stock
- Equates to 18% of the metro expenses
- Regenerative braking will give 30% energy saving



Output 1.5 Safety Assessment

- CDIA view is that safety is the top priority
- City Hall and TTC agree!
- Key concerns:
 - Cabling in a poor condition with high fire risk
 - Escalator failure: it is the only way out!
 - Lack of ventilation equipment
 - Inappropriate materials in use



Output 1.6 Accessibility

- How to provide wheelchair access to 65 m deep platforms?
- Escalator speed for impaired and old people
- The interface between station and rolling stock is a problem
- Metro signage is very poor



Output 2 Multi-criteria Analysis

- Looking for City Hall and TTC to confirm criteria weighting by end of May 2017

| CRITERIA GROUP | TOTAL WEIGHT FOR CRITERIA GROUP |
|----------------|---------------------------------|
| SAFETY | 30 % |
| TECHNICAL | 20 % |
| SOCIAL | 18 % |
| ECONOMIC | 18 % |
| OPERATIONAL | 10 % |
| ENVIRONMENTAL | 4 % |
| TOTAL | 100% |

“Our struggle for global sustainability
will be won or lost in cities.”

- Ban Ki Moon, UN Secretary General



SHANGHAI MUNICIPAL
GOVERNMENT
上海市人民政府



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Federal Department of Economic Affairs,
Education and Research EAER
State Secretariat for Economic Affairs SECO

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