

Measuring Unemployment by Location and Transport: StepSA's Access Envelope Technologies

Introduction

Increasing emphasis is coming onto spatial planning as government in South Africa moves to address the massive challenge of unemployment. Attention has been turning toward the critical intersection between spatial location, for poverty-level human settlements, and available transport.

Transport fills the gap between where the urbanizing poor can settle, and the places they need to be in order to reach work. Transport therefore is the instrument for knitting the cities together, so that the poor and underclass can overcome exclusion and obtain entry to the urban labour market as participating urban citizens. The recent expansion of Bus Rapid Transit System (BRT) planning is a case in point as new urban planning initiatives move toward opening up economic opportunity to the poor, and planning debates over compaction and the centre/periphery question strongly involve the issue of transport planning for the informal poor in the cities.

To deal with the interaction of unemployment and transport access as they impact poor settlements, new, fully metricated technologies are needed to enable spatial planning to assess what a given location will mean for access to work for the population intended to settle there (see Map 1-2).

Calculating transport envelopes per settlement

From the on-going StepSA Project (Spatial-Temporal Evidence for Planning, South Africa) spatial planning research project, a collaboration of Human Sciences Research Council (HSRC), Council for Scientific and Industrial Research (CSIR) and Department of Science and Technology (DST) with University of Pretoria (UP), the Transport Access Envelopes methodology shows whether the disadvantaged populations in specific informal settlements, backyards and townships are able to access work opportunities at an affordable price. In addition, this technology generates significant policy implications, contributing from a number of angles to the unresolved questions around spatial location of settlement.

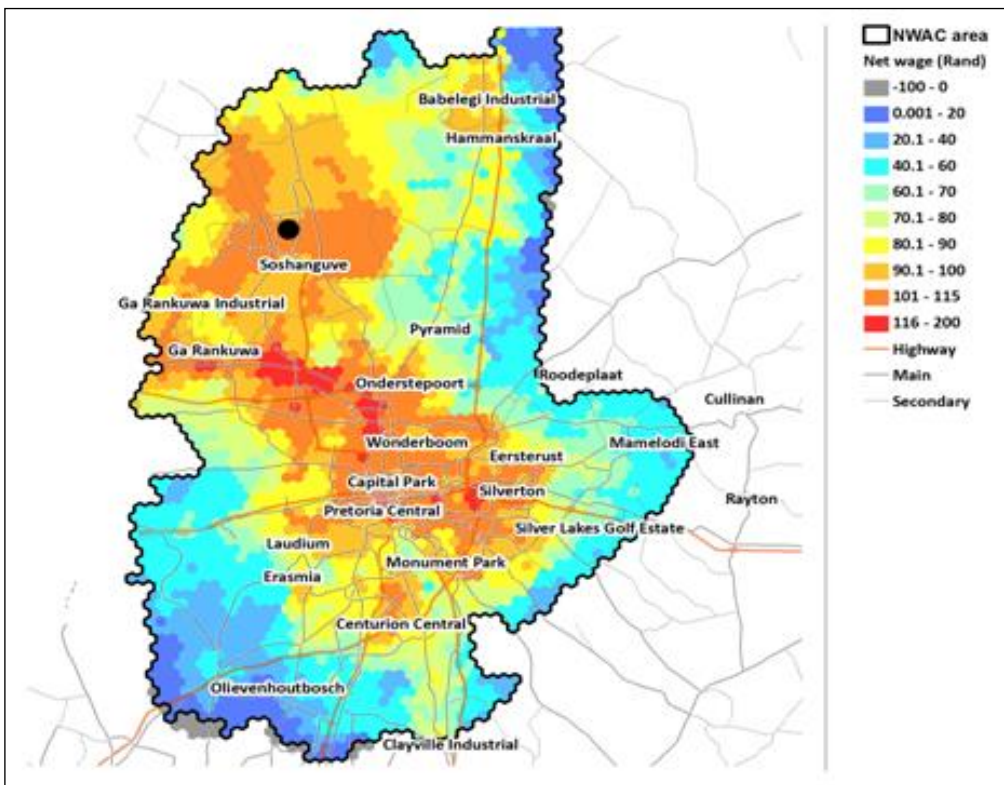
Under StepSA, HSRC commissioned its research partners at the Centre for Transport Development at University of Pretoria to develop the transport access envelope technology and the transport access stress tests, as a new social technology aimed at metricating the question of poor settlements' transport access to the developed economy through access to the urban labour market.

The plan was to use geographic information system (GIS) techniques to delimit the area within the city's total job reservoir which could be reached – at an affordable cost – from a specific settlement's spatial location, given existing



transport modes and costs. This access sphere was designated the settlement's *transport access envelope*. From this methodology, the *transport access stress tests have been developed as a planning tool*, which can assess up front the economic viability of any given proposed spatial location for poverty-related human settlements delivery.

Map 1: Soshanguve net wage surface



The method can establish whether or not any proposed settlement's spatial location is viable for the poverty population at given levels of income; or, alternatively, whether transport availability and price for that location will put the settlement's population outside the envelope of effective labour market access.

The same location might be viable for one type of settlement at its characteristic income level, but uneconomic for another settlement-type population at the same place: transport connections which may be easily viable for the population in the township houses are often too expensive for the worse-impooverished households in the backyard dwellings.

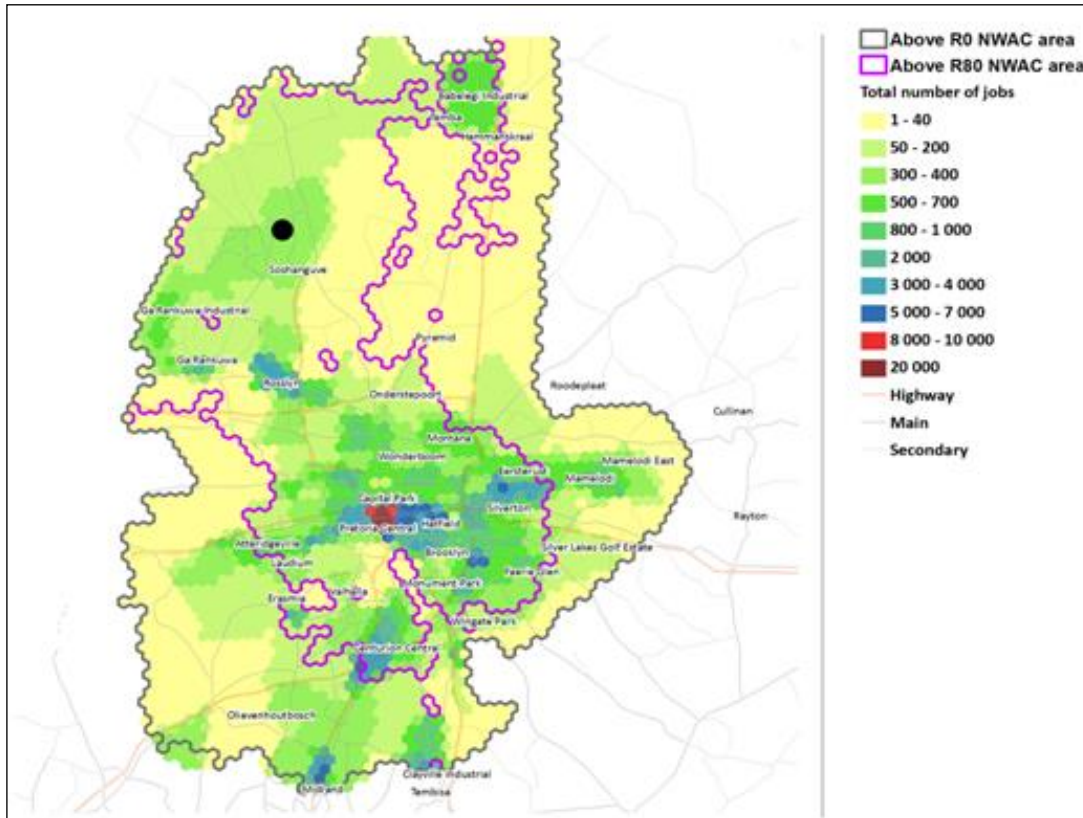
Outputs and measures

The Transport Access Envelopes output is a map easily interpreted and easily related to other spatial data, including job distributions (see Maps 1-2).

Each map is drawn for a specific origin area, to show the access pattern for residents as they work or search for work in the surrounding economy. For each potential destination zone a single measure is calculated as Net Wage After Commute (NWAC). NWAC represents the potential wage earnable at a specific job location, less commutation cost to travel there from home.



Map 2: Soshanguve net wage contours superimposed on total jobs



By subtracting commuting cost and pricing in the travel time used up, the envelope measure approximates real take-home pay earnable at a job location at the end of the day. For overall performance of a location/transport combination, two summary measures are included:

- The total number of accessible job opportunities with an NWAC value above R80, reflecting a retained income of R80 as a minimum daily net wage.
- The average NWAC value for the closest 200,000 jobs.

The NWAC measure is intuitive and easily interpretable. The concept builds on previous and current practice in accessibility measurement, but provides a new approach towards measuring spatial access in the context of job access. Its new and innovative method of combining job income, travel time and travel cost into a single measure is sensitive to both land use and transport delivery patterns.

The case study findings

Several local-area case studies were undertaken in informal settlements and in townships to test the Transport Envelopes product and methodology. Actual data on taxi, bus and rail services was used for the pilot, including metro routes, fares and travel times drawn from the Gauteng transport model and StepSA's survey database, and potentially important results have emerged (Table 1).



Table 1: Case studies: summary statistics of transport access envelope calculations
Public transport defined as longer-distance bus, rail and taxi routes

Origin area and scenario	Total job opportunities in NWAC higher than R80	Average NWAC value for closest 200 000 jobs
Soshanguve formal township: existing employment + existing transport access conditions	657348	R 96
Mamelodi central formal township: initial trip stage to public transport by walking	710530	R 108
Mamelodi east informal settlement: initial trip stage to public transport by walking	596805	R 91
Mamelodi east informal settlement: initial trip stage to public transport by local taxi	660268	R 103
Mamelodi east informal settlement: scenario of initial trip stage to BRT trunk route by subsidized feeder line	663939	R 106
Soshanguve formal township: scenario of serial temporary work as semi-employment + existing transport access conditions	0	R 56
Lotus Gardens formal residential area: existing employment + existing transport access conditions	677752	R 111

Case studies were conducted in the Mamelodi shacks areas and townships, in Soshanguve, a relatively new township, and in other areas. The comparative case in Table 1 illustrate the use of the NWAC methodology for measuring

- Comparative access between two or more housing areas to determine the relative access advantage
- Impacts of possible transport interventions on employment and earning.

Results summarized in Maps 1 and 2 and in Table 1 cover pilot exercises in Soshanguve, Mamelodi central township and Mamelodi peripheral informal settlement, and a formal residential area at Lotus Gardens. Maps 1 and 2 above show NWAC calculated with Soshanguve as origin. Soshanguve is conventionally thought of as a relatively poorly located formal township area on the metro periphery to the north of Pretoria. The NWAC surface indicates that work destinations around Rosslyn, Pretoria North, Pretoria Central, and as far as the Silverton industrial areas and even Centurion are all accessible from Soshanguve within a relatively high NWAC value of R80 or more.

It looks clear that localities on the city periphery are not necessarily disadvantaged in access to the labour market, if transport access is available and appropriately priced for the poor household. Large parts of the Pretoria economic core are accessible from the periphery with very low travel time or travel cost penalties.



Results shown in Table 1 also indicate the following:

1. Job opportunities within key metro employment clusters can be accessible to low-skilled workers in informal areas. Less-skilled workers from Soshanguve's shacks can access jobs both on the metro periphery and in the central city zone, and take home at least R100 in earnings per day after paying for commutation.
2. Not all similar types of settlements are the same in average NWAC returns. For townships, Mamelodi was a superior jobs access location compared to Soshanguve: more jobs above the NWAC cutoff level of R80/ day could be accessed from Mamelodi than from Soshanguve.
3. Formal areas do not necessarily show significantly higher NWAC earning returns than the informal settlements, depending on location and travel distance. NWAC value for the Mamelodi township and for Lotus Gardens was only slightly higher than in the Mamelodi shack areas.
4. The initial, informal stage of the trip prior to taking public transport makes a significant difference to the location's potential NWAC returns. To reach the formal public transport system, distances from informal areas to public transport required either time-consuming walking trips, or a local taxi trip which raised the total commute cost. The unrecognized cost of a feeder taxi trip could *reduce the number of accessible job opportunities returning R80 per day by up to 50,000*.
5. Continuing job search by workers living on serial temporary jobs can severely affect NWAC earning levels. Piece-work earning combined with two days a week of door to door job search can reduce average daily wage by 40% without reducing commutation costs, creating an *incentive for workers living on temporary jobs not to continue looking for permanent employment*.
6. Proposed BRT routings do not necessarily enhance employment access for poor settlements. Hypothetical NWAC testing of City of Tshwane's initial BRT proposals for Mamelodi indicated that *planned BRT routes would not significantly affect access to the main employment areas* in the CBD and its industrial zones: proposed BRT routes duplicated the existing rail service routes to the city core, and have subsequently been under review.

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