GPS SOLUTIONS FOR ROADS:
DIFFERENT GPS OPERATION TYPES AND APPLICATIONS

SOLUTII GPS PENTRU DRUMURI: DIFERITE TIPURI DE OPERATII GPS SI APLICATII

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Abstract: *All GPS Surveying is carried out using differential techniques. That is to say a baseline is measured from a fixed point, (a reference station) to an unknown point (a rover station). This is undertaken using one of two methods: - Post Processing - The raw GPS data from the satellites is recorded and processed in the office using software; Real Time - The processing of the data is carried out as you work, giving an instantaneous and accurate position*

Rezumat: *Toate GPS-urile utilizează diferite tehnici de măsurare. Aceasta este să spunem o bază măsurată de la un punct fix, (stație de referinta) către un punct necunoscut(rover mobil). De aceea putem discuta de două metode: - Post procesare - Datele brute de la sateliții sunt inregistrate şi procesate la birou cu softul specific; Real time - Procesarea datelor de face direct pe teren obţinând direct acurateţea de cm.*

Key word: Stop and go/kinematics methods, real time, post processing
Cuvinte cheie: metodele stop and go/cinematica, timp real,post preocesare

INTRODUCTION
- Using GPS for Surveying
- Static
- Rapid Static
- Stop and Go/Kinematic
- Real Time
- Accuracy and Observation Time

MATHERIAL AND METHOD
Static Survey (STS)
- The classical method for long lines and the highest accuracy 3mm + 1ppm baseline rms
- Classical GPS baseline measurement, where each line is observed for at least two hours
- The observation time is proportional to the length of the line
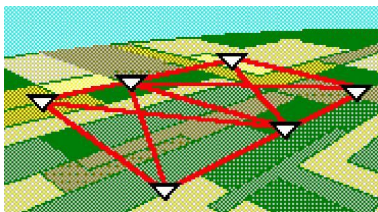- Standard method for lines over 20 Km

Figure 1: Static Survey (STS)

Applications:
- Geodetic control over large areas
- National and continental networks
- Monitoring tectonic movement
- Network adjustments for highest accuracy
Rapid Static Survey (STS) - 1/2
- Short observation time for baselines up to 20 km. Accuracy is 5-10 mm + 1 p
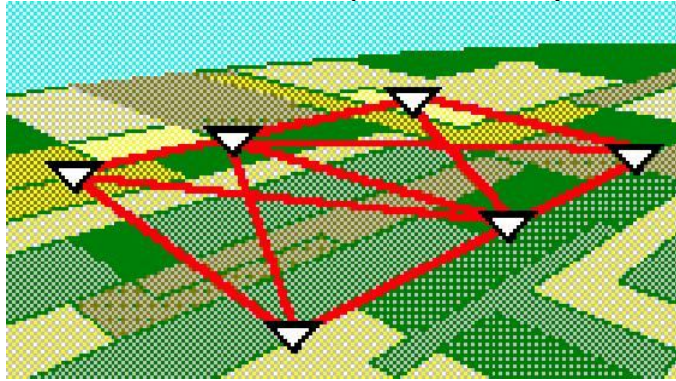

Figure 2. Rapid Static Survey (STS) - 1/2

Applications:
- Control Surveys, GIS city inventories, detail surveys. Replace traversing and local triangulation. Any job where many points have to be surveyed
Advantages
- Easy, quick, efficient
- Ideal for short range survey
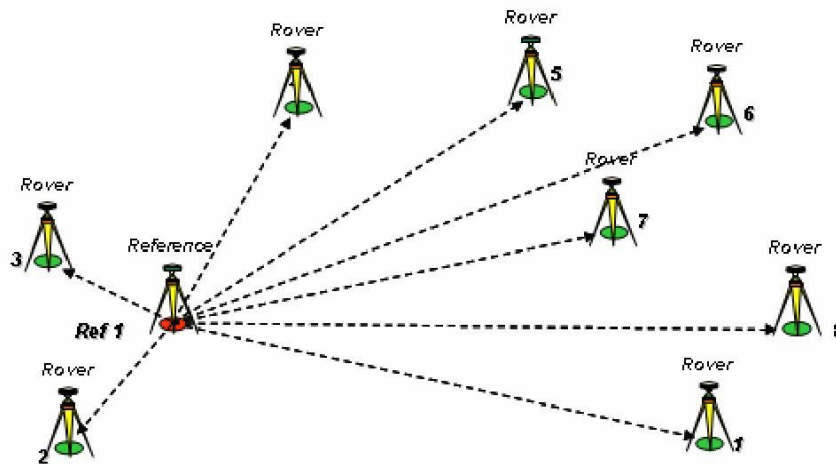**Rapid Static Survey (STS) - 2/2**
• 1 Reference and 1 Rover

Figure 3. Rapid Static Survey (STS) - 2/2 (1 Reference and 1 Rover)
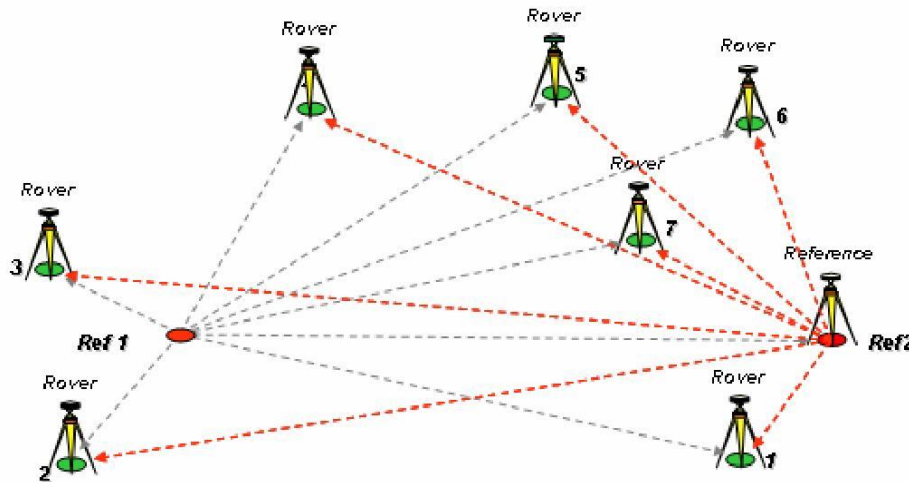
2 References and 1 Rover

Figure 4. Rapid Static Survey (STS) - 2/2 (2 References and 1 Rover)
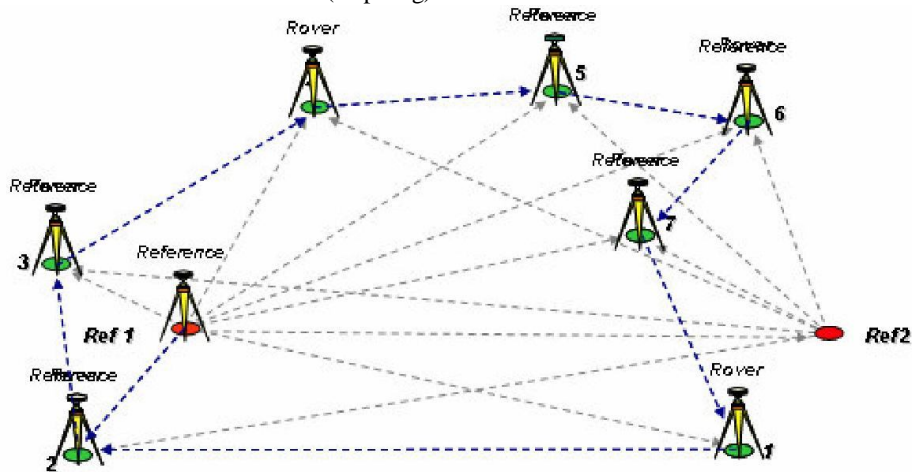
1 Reference and 1 Rover (leap frog)

Figure 5. Rapid Static Survey (STS) - 2/2 (1 Reference and 1 Rover (leap frog)

Stop and Go Survey / Kinematic - 1/2
Kinematik mode with static intervals Accuracy is 10 - 20 mm + 1 ppm Stop Mode
- Before the survey begins, the rover is required to resolve the ambiguities.
- The ambiguities are resolved using one of three techniques
- Initialization on the fly
- Static initialization
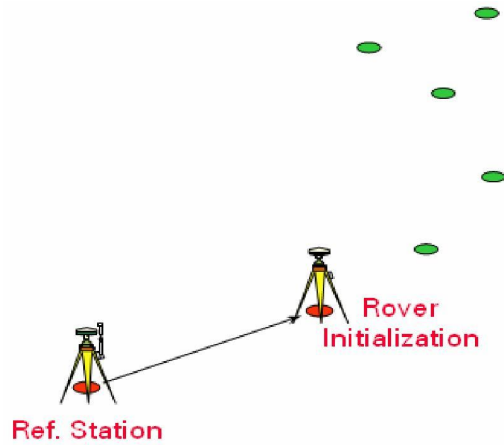- Initialization on a known point

Figure 6. Stop and Go Survey / Kinematic - 1/2

Stop and Go Survey / Kinematic - 2/2
Go Mode
- Once enough data is collected to resolve the ambiguities, user can now move the receiver
- Lock must be maintained on a minimum of 4 satellites at all time
- Each point visited requires only 1 epoch of data
- If lock is lost, the system must re-initialize
Applications:
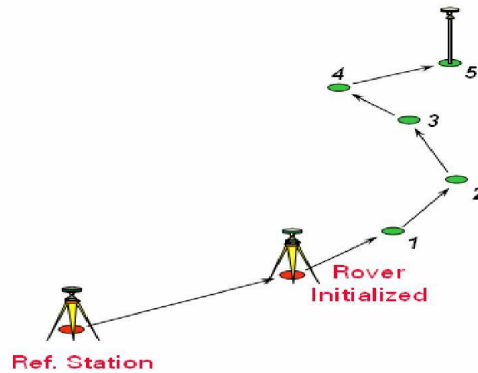- Detail and engineering surveys in open areas

Figure 7. Stop and Go Survey / Kinematic - 2/2

Real Time
Real Time Code, Real Time Phase
- No post processing required
- Results are instantly available
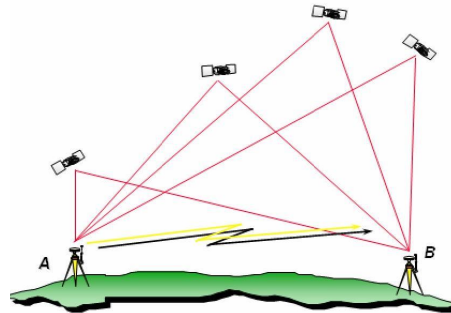- Can operate in two modes
- RTK
- RT-DGPS

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Figure 8. Real Time

CONCLUSION
Accuracy and Observation Times

Table 1.

Accuracy and Observation Times

Static :

Baseline Length	Number of Satellites	GDOP	Observation Time	Accuracy
20 - 50 Km	≥ 4	≤ 6	2 - 3 hr	3 mm + 1 ppm
50 - 100 Km	≥ 4	≤ 6	min. 3 hr	3 mm + 1 ppm
> 100 Km	≥ 4	≤ 6	min. 4 hr	3 mm + 1 ppm

Rapid Static :

Baseline Length	Number of Satellites	GDOP	Observation Time	Accuracy
0 - 5 Km	≥ 4	≤ 5	5 - 10 min	5 - 10 mm + 1 ppm
5 - 10 Km	≥ 4	≤ 5	10 - 15 min	5 - 10 mm + 1 ppm
10 - 20 Km	≥ 4	≤ 5	10 - 30 min	5 - 10 mm + 1 ppm

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