Trafikudvalget
TRU alm. del - Bilag 257
Offentligt

RUF
DANMARK

Til
Medlemmer af Folketingets trafikudvalg
Christiansborg
1240 K

Dato: 5-2-07

Vedr.: Ny RUF klima rapport

Den nye rapport fra FN og den tidligere Stern-rapport peger på at det er meget nødvendigt at gøre tingene radikalt anderledes i fremtiden – også i trafikken.

Brint biler og etanol biler kan ikke udnytte energien særlig effektivt.

RUF har potentialet til at øge effektiviteten af transporten tilstrækkeligt til at imødekomme kravene om 4 gange mindre energiforbrug.

Trafikministeriet har hele tiden undskyldt sig med at der er nogle problemer med RUF, men man vil end ikke mødes med RUF for at diskutere disse potentielle problemer.

Jeg mener at trafikudvalget må initiere en seriøs udredning af potentialet i RUF og samtidig give RUF mulighed for at blive afprøvet på en 2 km lang prøvebane, som kan ligge ved Næstved.

RUF er nødt til at starte som kollektiv trafik og der er flere muligheder for at drage nytte af RUF teknologiens store effektivitet. Ring 3 forbindelsen er en simpel linieføring hvor det er let at implementere RUF. Som det fremgår af vedlagte rapport om RUF som Ringmetro, kan denne også tiltrække langt flere rejsende end den 1% andel af bilisterne, som man forventer at den nu planlagte Ringmetro kan. Der bør laves en seriøs analyse af denne mulighed.

RUF er et klart eksempel på den slags miljø innovation, som Danmark skal leve af i fremtiden. Det koster ikke særlig meget at etablere en demonstrationsbane for RUF. 20 til 50 mio. kr. alt efter ambitionsniveau.

Jeg står naturligvis til rådighed dersom udvalget ønsker en dybtgående introduktion til RUF konceptet og dets muligheder.

Med venlig hilsen

Palle R Jensen
Civilingeniør og opfinder af RUF

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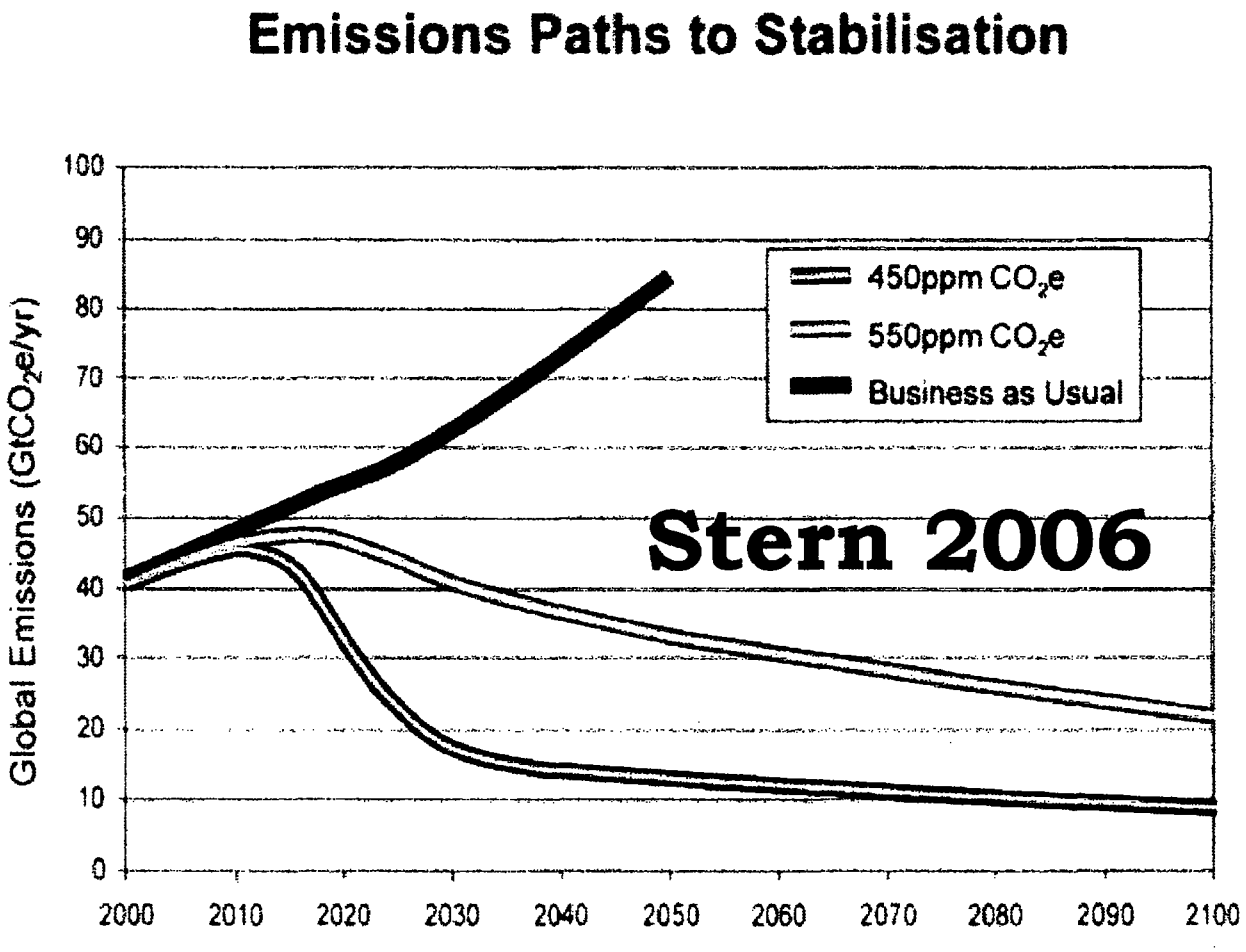
RUF climate so

RUF

Palle R Jensen, RUF International, prj@

Resumé

Recent studies (Stern 2006) have shown that in order to avoid catastrophic climate effects, the equivalent CO2 emission levels must be reduced by a factor 4 in the 21st century.



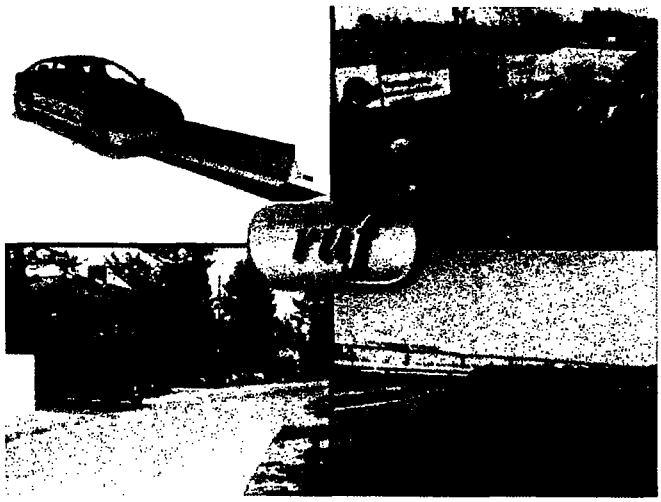
This is a very demanding task, especially in the transportation sector.
The growing population in China and India will insist on the same level of mobility as we in the west take for granted. This is not possible unless the transportation sector reduces its CO2 emissions to far below 20% of its present level.
Current car technology can be improved approx. 30% over the next 20 years but at the same time traffic volumes will increase more than 30% in the western societies and even more in China and India.
It is very important to realize that new technologies must be developed in order to solve the problems.

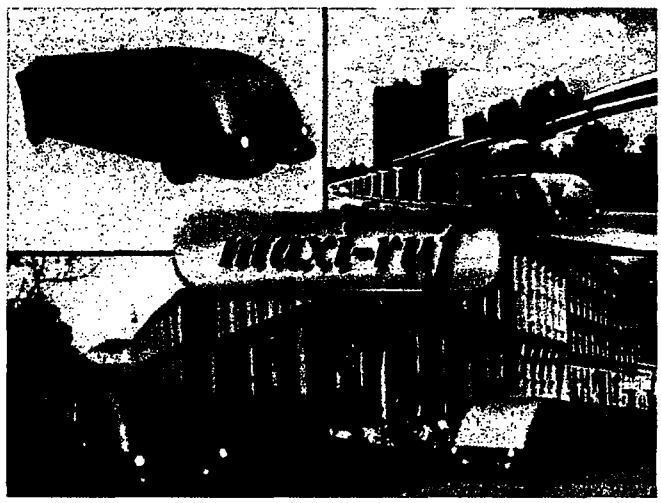
The good news is that it is possible using a new transport technology called dualmode to meet the demands and at the same time offer massive user advantages.

RUF (Rapid Urban Flexible) is such a system. See: www.ruf.dk

What is RUF ?

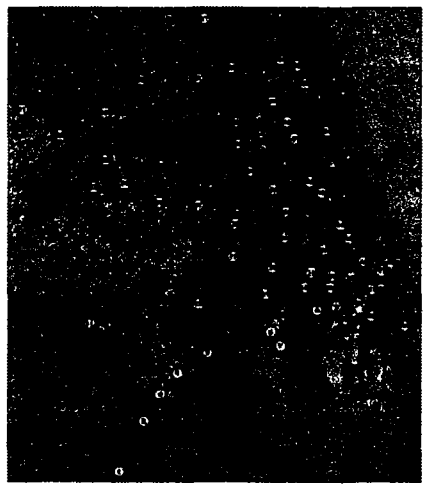
RUF





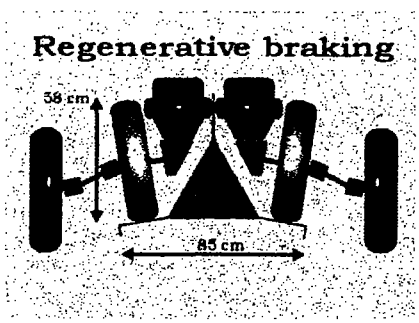
RUF (Rapid Urban Flexible) is a new transport system based upon the dualmode principle.

RUF uses a network of electrified guideways to supplement the highway system.



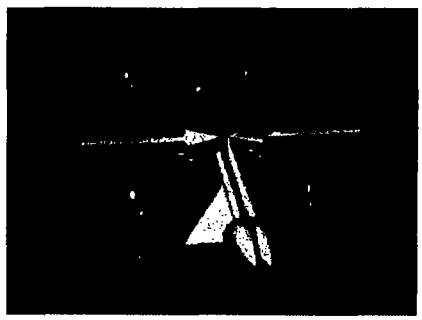
Ruf (individual electric car)
A typical user will drive a few kilometers on the small roads driven by small batteries. The long distances at high speed (150 km/h) will be driven on the monorail, closely coupled with other rufs, in a small train. The air resistance will be much reduced.

The vehicles need no friction to steer and brake while on the monorail. The electric motors work as motor brakes and a special rail brake is used as an emergency brake.
This will reduce the rolling resistance and braking energy will be regained.



RUF can solve congestion problems by adding more capacity to the traffic system while at the same time save enough energy to limit the climate problems.

Maxi-ruf (electric public transport)
A typical user will call the system and ask for transport. He will be given several options or, he can be transported door-to-door with high comfort if he wants to pay for it. He can also pay less and be transported at a lower level of service. He might have to walk to a pick-up place and he might have to transfer during the trip.
The expensive option is faster than by car today and he doesn't have to worry about parking at the destination. He can also use the travel time constructively, since he rides in the same seat for the entire trip.
Maxi-ruf is a light-weight bus/train and it runs on demand, so the number of passengers is high. RUF public transport is very energy efficient, quiet and non-polluting.



How can RUF help

RUF

RUF cars

RUF can reduce the air resistance by 4/5 at high speed.

[redacted]r a ruf in a train of 10 rufs on the monorail = 20

RUF can reduce the rolling resistance by ½.

[redacted]norail = 50

RUF can use electricity directly so losses are small.

[redacted]

RUF can use regenerative braking to save energy.

[redacted]

RUF does not run idle.

[redacted] losses from a ruf standing still with lights on = 10

RUF as public transport

RUF as public transport has the same qualities as the RUF cars and since the number of passengers per vehicle is much higher, the advantages for the climate are even greater.

RESULT:

RUF can run 4 times longer per energy unit than a gasoline car.

RUF can run on renewable sources that do not emit CO2

What is wrong with...

RUF

Cars are beautiful, convenient and fast.
The cars are so attractive that the are being strangled by their own success. What can be done to keep the best features of the car and at the same time reduce their problems.

If you take a step back and look upon the car as a machine for moving people, you will discover some fundamental characteristics of the car as we know it:

Cars need to be separated from each other all the time. This means that every car has a vortex of turbulent air behind it consuming a lot of energy at high speed. It also means that that a car takes up far more space than its own dimensions.

Cars need friction between the tires and the road all the time. If they don't have it, they will not be able to steer and brake.

Car engines are very inefficient. Normally only approximately 15% of the energy from the gasoline is available for propulsion at the wheels.

Car engines idle when the car is stopped at a traffic light or in congestion. It uses energy without moving.

The car chassis has to be heavy and strong in order to be able to withstand high speed collisions.

The car cannot safely drive itself. The driver has to be alert all the time even if the trip most times is exactly the same: from home to work and back.

What is the car of the future ?

RUF

The car of the future has to be able to provide an answer to the following dilemmas:

Roadspace is limited in existing cities yet the demand for cars is increasing

Oil supply is limited yet the demand is ever increasing

The climate effects are increasing yet the cars keep emmitting more CO_2

The hydrogen car ?
A hydrogen car will be stuck in congestion like any other car. It may not depend on oil, but it uses energy very inefficiently. See: www.ruf.dk/hydrogen.doc

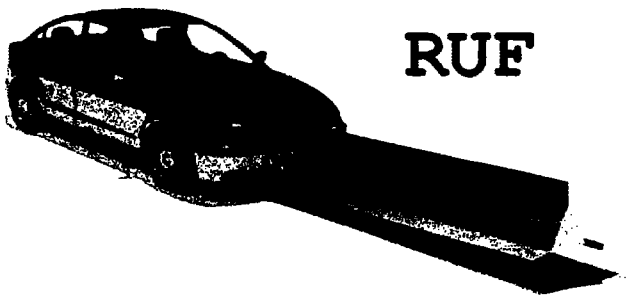
The ethanol car ?
A car running on ethanol will be stuck in congestion like any other car.
It takes a lot of valuable land area to grow enough biomass to produce the ethanol. It would be far better to burn the biomass in power plants as a substitute for coal.

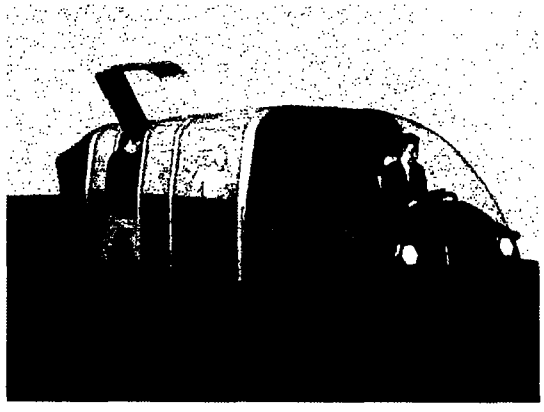
The electric car (EV) ?
An electric car will be stuck in congestion like any other car.
The EV requires heavy batteries and a long charging period in order to function conveniently. It is more efficient than normal cars and very silent and non polluting in the near environment. The battery capacity can be used to store electricity from windmills and solar cells.

The Automated Highway System ?
Platooning of cars will increase the capacity of a highway, but is is very difficult to make it safe enough in all weather conditions. Implementation on an existing highway requires a very difficult transition period. Almost no energy savings are obtained.

Personal Rapid Transit (PRT) ?
PRT is a concept with individual "cars" using a special guideway to move the car automatically at a speed of typically 40 km/h. PRT is very energy efficient, but it cannot be used as a substitute for the car without building guideways everywhere.

RUF dualmode transport system !
RUF vehicles (busses and cars) do not suffer from highway congestion. RUF is very energy efficient and requires no oil as it runs on electricity.
RUF automation allows the driver to use commute time constructively.





What is wrong with RUF

Public Transport is necessary in all societies because people who don't own a car or who are not able to drive one, need to be able to get around.

In order to provide affordable Public Transport, many people are squeezed into large units like busses and trains.

The difference in comfort level between the car and Public Transport is simply too large to attract passengers other than those who are forced to use it.

The farebox cannot normally cover the operating costs so the authorities try to limit the costs. This will reduce its attractiveness further and so fewer will use it.
It is a vicious downward spiral.

Capacity of a fully-loaded bus is large when it can operate at a reasonable speed and does not have to stop too often.

The reality today is, that busses are trapped in the traffic so the potentially high capacity cannot be used.

Standing passengers in Public Transport are in danger of being hurt when the bus or train suddenly needs to stop.

Even if there are seats enough, passengers need to leave their seat before the bus stops in order to be ready to leave the bus during the short stopping period. The chauffeur is under great pressure to keep up with the schedule so passengers often have a rough ride.

Passengers in Public Transport are sometimes exposed to the ill-health problems of other passengers.

Passengers in Public Transport feel insecure because they do not know the people with whom they share the limited space.

Bus vehicles in Public Transport are large and heavy. They make noise and some pollute with diesel particles. They also often destroy pavements because of their weight.

Large units are not mass produced like cars, so they are relatively expensive.

Public Transport vehicles are only energy efficient when they are full. In a typical schedule, they run nearly empty many hours of the day.

What is P.T. of the RUF

A maxi-ruf is a small electric bus, 2 m wide and 7 m long.

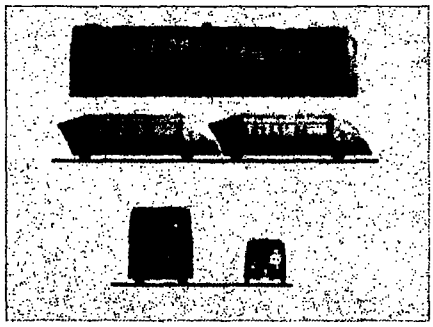
It is a dualmode bus. It can drive as a bus or as a train. The transition from road to rail is guided by magnetic fields and take place at 20 mph .

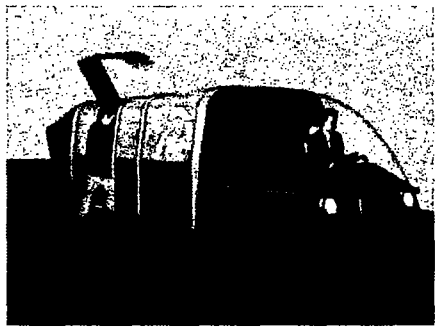
Access to the bus is extremely easy. There is a door for every seat.

Every passenger has a private seat with the same comfort as in a car.
No stranger is going to sit next to you.

It makes very little noise and produces no local pollution.

Maxi-ruf is a very energy-efficient way of moving people.





Travel time, from door-to-door, will often be shorter than using an auto.
See: www.ruf.dk/rufcph.exe

Best of all, there will be no parking problems at the destination.

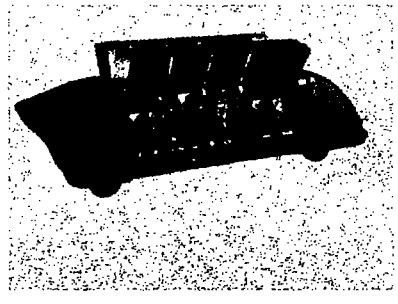
Up to 3 maxi-ruf can be coupled and driven along the streets with one chauffeur. On the monorail typically 5 maxi-rufs are coupled in a train (with or without a chauffeur).

Higher fares would allow you to order a highly attractive door-to-door trip or you can choose the lowest fare which means you will have to walk to a pick-up place and may have to transfer a couple of times during the trip.

Public transport with RUF can also be obtained by renting a public ruf. Ordering and payment would be via electronic personal devices.

A high capacity version of maxi-ruf is called mega-ruf. It can carry 20 passengers using a different seating arrangement.





Air resistance

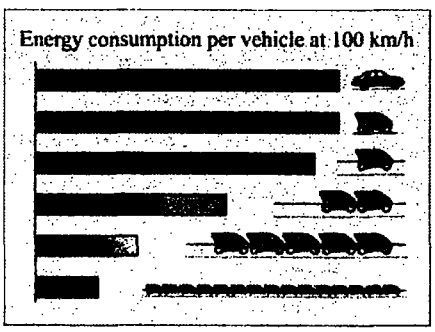
RUF

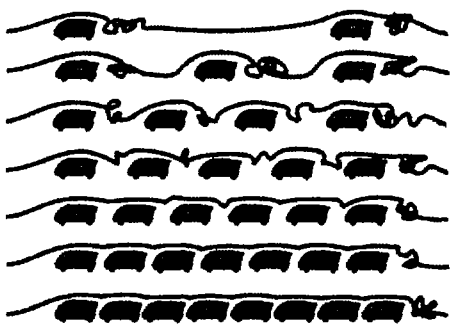
A car driving at 100 km/h along a highway will create a vortex of air behind the vehicle all the time. This vortex will consume a lot of the energy delivered to the wheels.

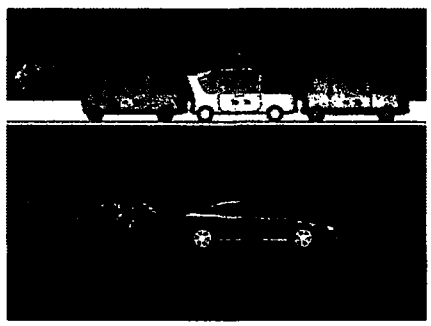
A RUF vehicle follows the RUF standard which requires that the vehicle must be able to be closely coupled to other vehicles to form a train. The RUF standard also requires that the shapes of the front and the rear fit reasonably well together.

According to an estimate from the Laboratory of Energy Technology at the Danish Technical University, a ruf in the middle of a train will only add 10% to the air resistance of the train.

A reasonably long train (10 rufs) will reduce the air resistance to 1/5 of the amount per vehicle if they all drove alone at the same speed.



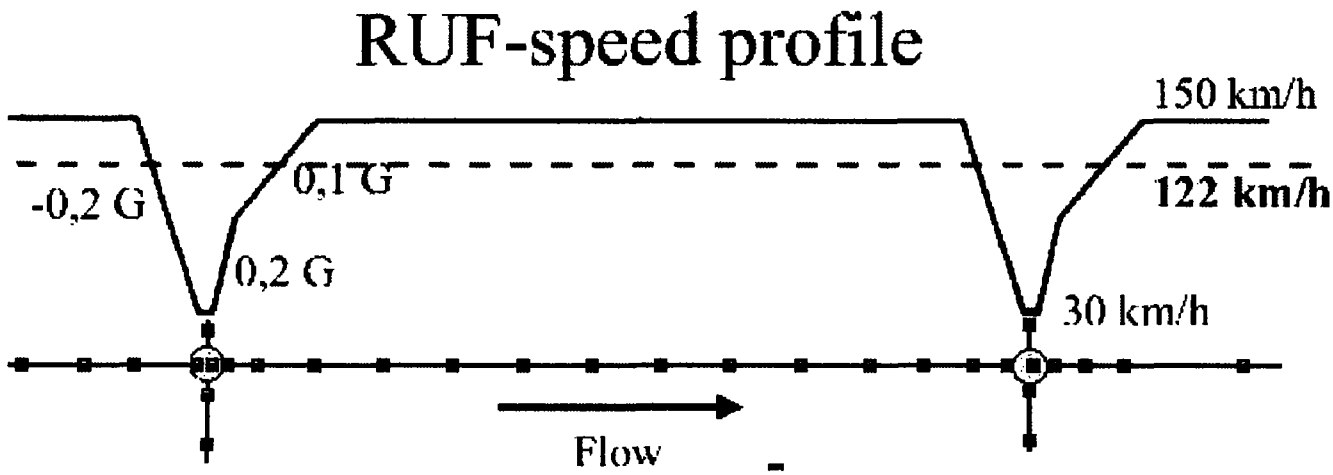




At high speed the air resistance is the dominant resistance, so this reduction effect is very important.

In a typical network, the distance between the junctions is 5 km. Most of this distance will be driven at high speed (150 km/h).

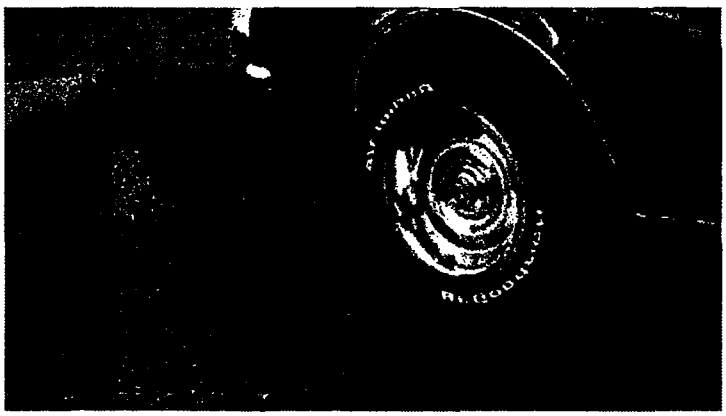
A ruf is slightly higher than a normal car due to the built-in channel in the middle. For this reason, the air resistance while driving on roads will be slightly higher than a car. Normally, conventional roads will only be used for a few km at limited speed to get to the monorail system, so this effect is very small.



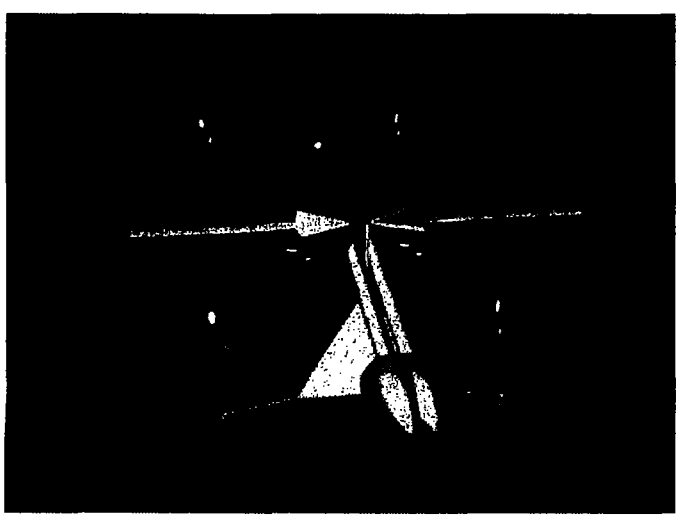
Rolling resistance

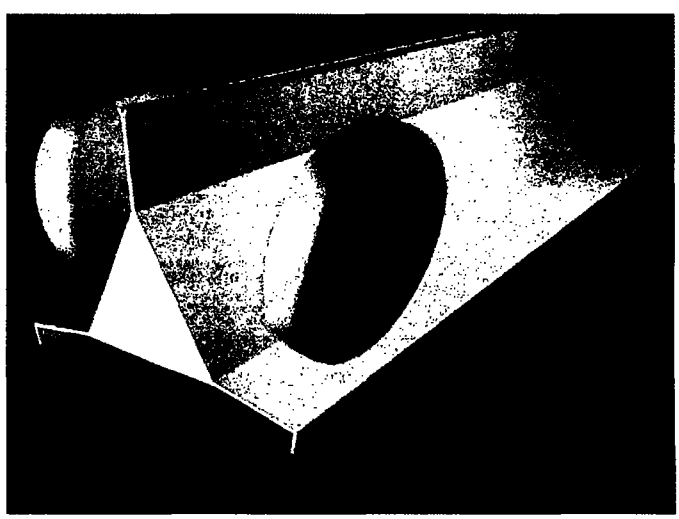
RUF

Cars use the roads all the time. Their steering and braking depend critically on the friction between road and wheels. If the road is slippery, an accident is often the result. The wheels need to be air filled in order to be able to handle potholes in the road.
The friction depends on the tire pressure. Low pressure can increase rolling resistance by as much as 20%. At high speed the vehicles can be lifted due to aerodynamic forces. If friction is decreased, a dangerous situation can arise.



RUF vehicles only drive a short distance along conventional roads at low speed. Most of the distance is driven via the monorail where steering is no problem and braking uses either the drive wheels or the rail brake (emergency braking).
This means that the wheels carrying the vehicles can be smooth wheels with fixed rubber, low rolling resistance and low noise.
Aerodynamic lift is no problem. It is actually an advantage if the weight of the vehicle is partly lifted on the monorail. The RUF vehicles are always safely "locked" to the monorail. Since collisions on the monorail are almost impossible, the chassis of the vehicles can be made from light-weight material. Low weight produces low rolling resistance.





Regenerative braking

RUF

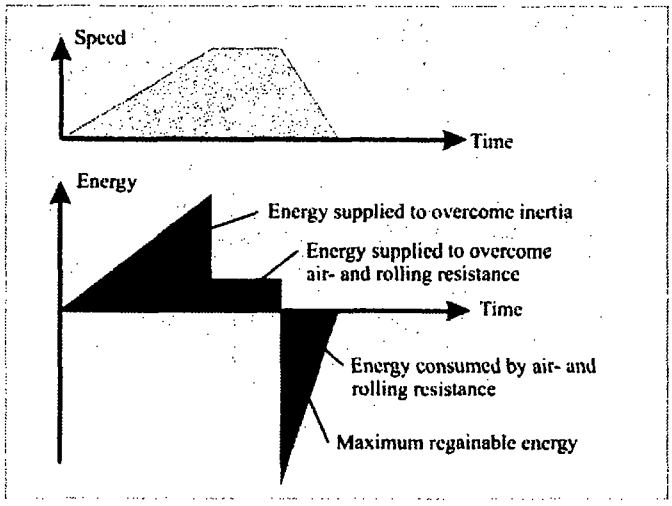
In city traffic, vehicles have to stop numerous times. Each time, the energy stored as motion of the vehicle mass, is wasted as heat in the brakes.
On a congested highway, cars have to slow down frequently from high speed, so they waste a lot of energy.
A normal car cannot regain any of this energy.
A normal electric car or a hybrid car can regain some of this energy by using the electric motors in reverse and sending power back into the battery.
This is not ideal since batteries cannot tolerate large charging currents. The critical life time of the batteries will be shortened and a battery replacement is expensive.

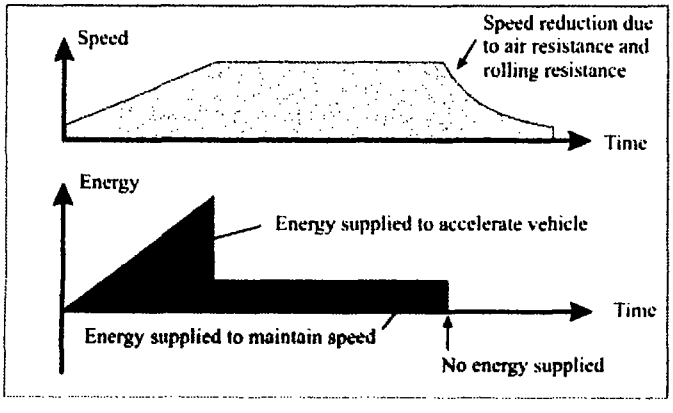
Since most of the typical trip in a RUF system takes place on the monorail, RUF can regain more braking energy than normal electric cars. In a normal commuter situation, the commuter will drive 2-3 km along minor streets to get to the monorail network. He or she will then use the network for 15 km (typically) and then again use the normal roads for the last 2-3 km to the destination.

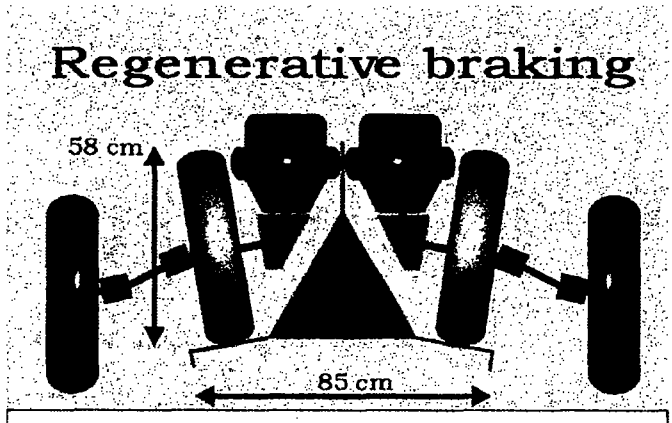
When RUF vehicles are using the monorail, the braking energy is not sent to the batteries but it is sent back into the power rails. This way, the batteries are not overloaded and almost all the braking energy can be sent back into the system.

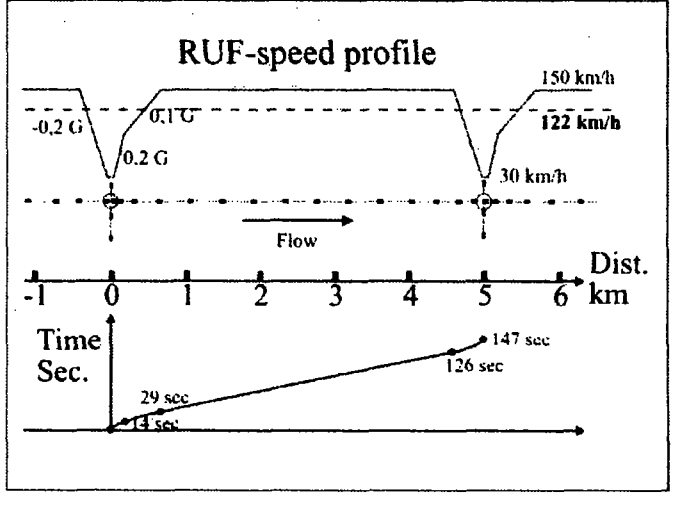
It is also possible to avoid braking completely on the monorail and use the air resistance and rolling resistance to gently slow down the train to 30 km/h at the next junction.

Since the automated part of the trip is system controlled, no unnecessary brakings will normally be required. In the case of an emergency braking, the rail brake will take over.







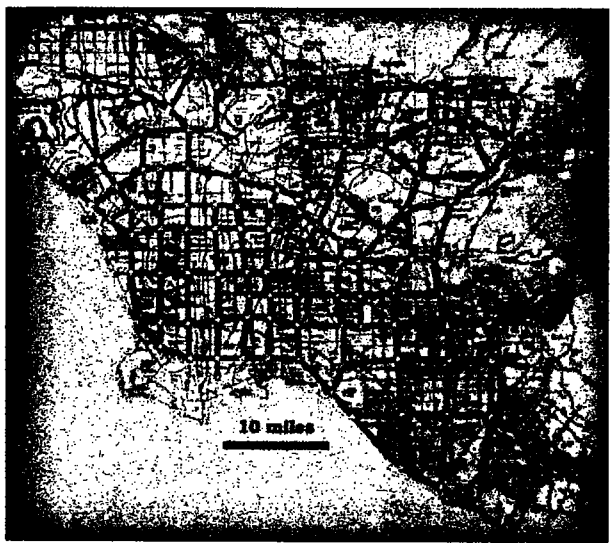


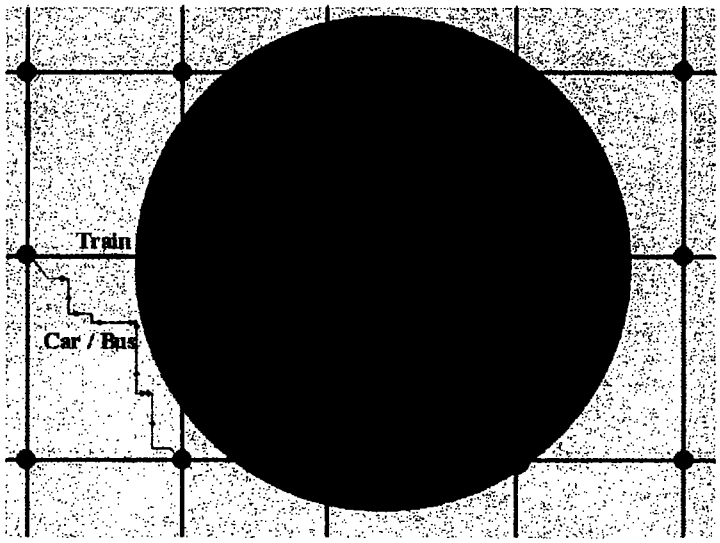
Other relevant aspects

RUF

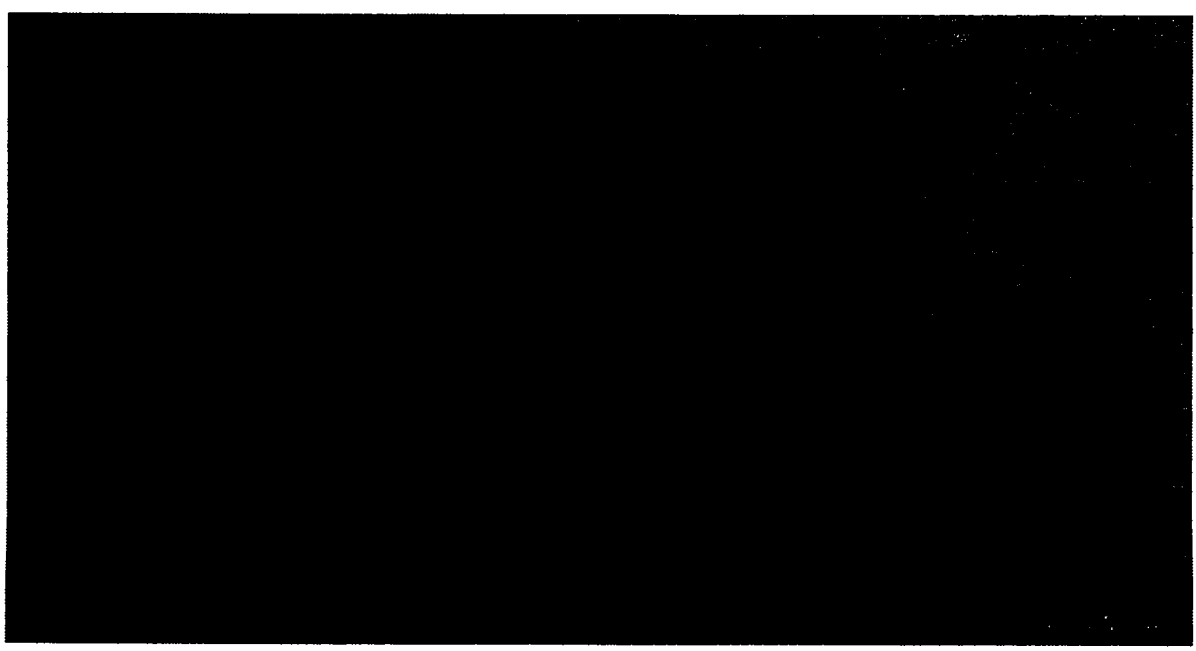
A city using a RUF network as its main transport system, will be better prepared for critical situations where the energy consumption has to be cut sharply and quickly.

Expanded network
If the density of the network is increased, the advantages will increase since a larger portion of the trip will be taken on the monorail. The RUF network can be very dense in the dense parts of the town (just like a dense PRT system).





Speed reduction
If the RUF vehicle is equipped with IT devices, many commuters will be able to use the RUF system as a moving working place. A fast internet connection will make it possible to open e-mail, surf the internet and talk on the (video)phone while the vehicle moves slowly along the monorail network toward the office. Safety is high all the time.
It will take a longer time to get to the office, but since you are sitting in a "rolling office" it is not a big problem if part of your work is done via computer anyway.
The energy consumption can be reduced to almost nothing in this way.



FingerRingMetro baseret på RUF

Af civ. ing. Palle R Jensen, RUF International, www.ruf.dk

Baggrund

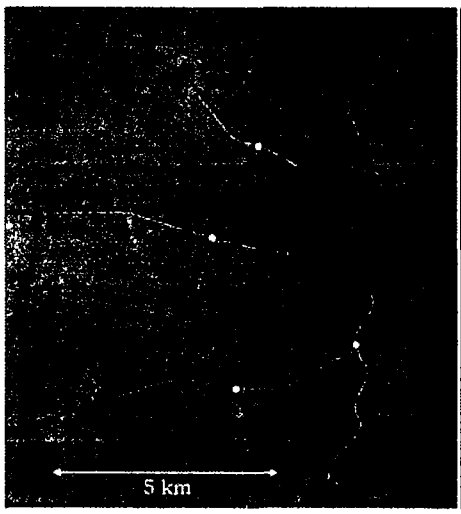
Det er glædeligt at der nu er en politisk vilje til at løfte kollektiv trafik i København op til et højere niveau. Det er der brug for.

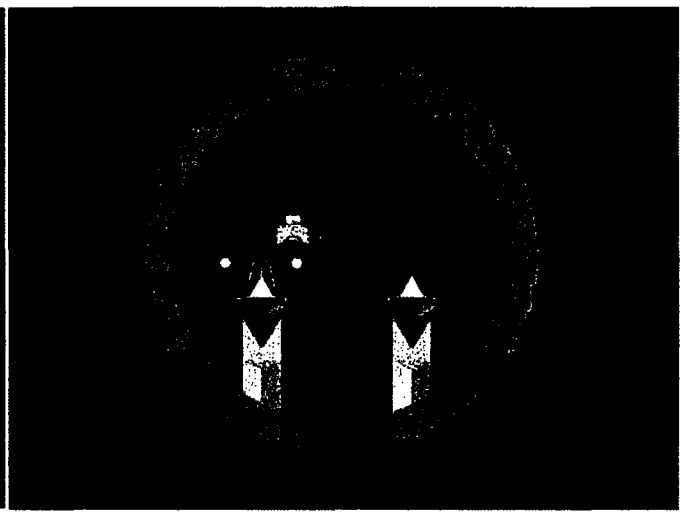
Netop nu (2007) er det strategisk vigtigt at gøre Danmark uafhængig af olien sådan at vi kan klare os når vores egen olie slipper op.

Bedre kollektiv trafik kan få mange bilister til at skifte til kollektiv trafik hvis den bliver udført på den rigtige måde.

En meget effektiv måde at gøre dette på, er vist i MASTERPLANEN for København baseret på RUF systemet (www.ruf.dk/master.doc). Det vil koste under 20 mia. kr. og vil gøre trafikken omkring København meget effektiv og næsten uafhængig af olie.

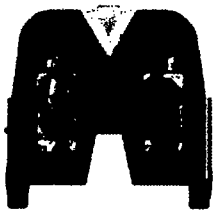
En RINGMETRO kan også være et fornuftigt projekt, hvis det udføres på den rigtige måde. Ved anvendelse af RUF teknologi kan en ringmetro bidrage bedst muligt og være fremtids sikret mod kommende oliekriser.

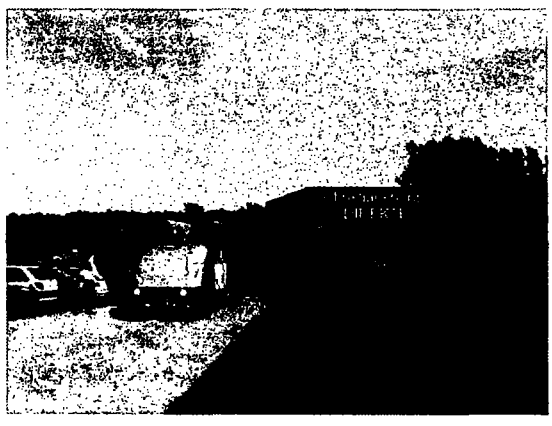




Mini_metro:
2,65 x 3,40 m

Maxi_metro:
2,00 x 2,00 m



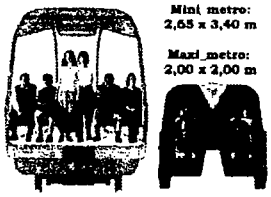


FingerRingMetro baseret på RUF er et projekt, som løser en lang række af de svagheder, som den foreslåede ringmetro løsning lider under:

Bedre udnyttelse

Der er kun brug for eet rør, da maxi-ruf fylder langt mindre end mini-metroens tog.
Det betyder langt lavere anlægsudgifter.
Det betyder også en bedre sikkerhed i tilfælde af et terror angreb på metroen. Det er lettere at evakuere passagerer via den anden skinne.

Højere komfort

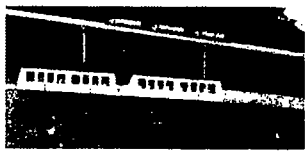


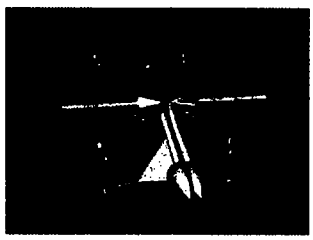
Der er ingen ståpladser i RUF metroen.
Det er vigtigt, fordi de passagerer, som ringmetroen skal tiltrække er bilister, som er vant til høj komfort.
Alle RUF sæder er enkelt sæder. Det betyder at ingen vil føle sig generet af at sidde ved siden af en fremmed person.

Større sikkerhed

RUF kan bremse meget effektivt i kraft af sin skinnebremse.
Da alle passagerer sidder ned, er det ufarligt at nødbremse.
God bremseevne betyder at togene kan køre relativt tæt sådan at tilstrækkelig høj kapacitet kan opnås sammen med høj frekvens.
Det er ideelt for passagererne.
Nødbremsning via skinnebremsen giver ikke ubehagelige kanter på hjulene. Dermed reduceres ubehaget og der spares vedligeholdelse.

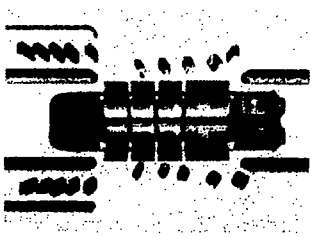
Større stige evne





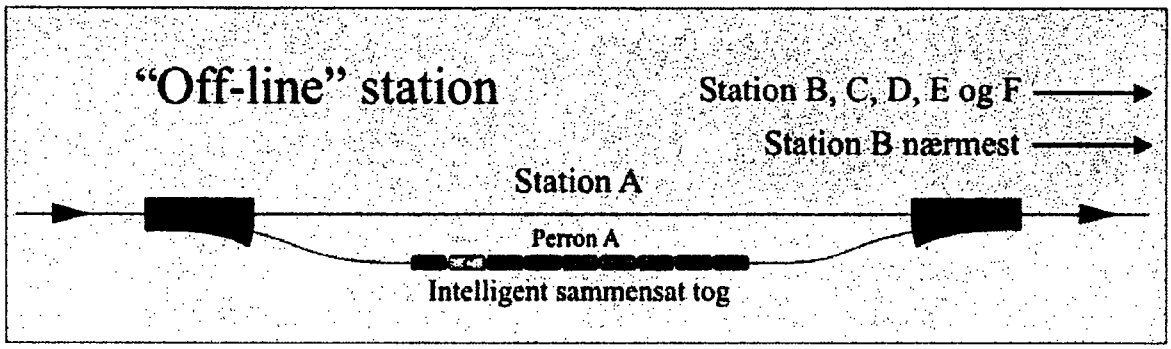
Det patenterede RUF drivsystem tillader større stigninger end mini-metroen, som kun kan klare ca. 5% stigning.
RUF kan klare mere end 10% stigning.
Det betyder at stationer i RUF metroen kan lægges nærmere overfladen uden at få store omkostninger ved gravearbejdet.
Det er muligt ved hjælp af denne placering af stationerne at udnytte tyngdekraften til at accelerere togene mellem stationerne sådan at energiforbruget bliver ekstremt lille. Mini-metroen kan ikke udnytte denne effekt fordi i tilfælde af et uønsket stop i bunden af tunnelen, vil toget ikke kunne komme op ved egen hjælp da friktionen ikke er stor nok.
Drivsystemet betyder samtidig at afsporinger er umulige i modsætning til mini-metroen, som er baseret på traditionel tog teknologi.
Drivhjulenes klemme om toppen af den trekantede skinne betyder desuden at kørekomforten bliver meget høj, da vognen ikke kan slingre sideværts.

Hurtig udstigning



Da der er en dør for hvert sæde og åbningen tager 4 sekunder, kan en total udskiftning af passagerer gøres på 12 sekunder hvor mini-metroen bruger 25 sekunder.
Udstigningen sker til begge sider og det stiller krav til indretningen af stationen. Hvis denne ligger på overfladen, er det meget let at indrette den så ind- og udstigning sker hurtigt og naturligt.

"Off-line stationer"



Stationer på linien kan organiseres som "off-line stationer".
Det betyder at de fleste vogne kører forbi uden at stoppe (de nedsætter hastigheden til 30 km/t). Kun de vogne, som er beregnet til at stoppe ved den pågældende station bliver ført til en perron parallel med linien hvor de ikke sinker de gennemgående vogne.
Det betyder en væsentlig reduktion af rejsetiden (typisk > 50% reduktion)

Attraktiv Parker og Rejs

Normalt er Parker og Rejs ikke nogen succes fordi bilisterne skal gå langt til en togperron og vente på toget.
I RUF systemet er det muligt at organisere Parker og Rejs langt mere attraktivt.
Bilisterne kan parkere på en plads, som er dedikeret de passengerer, som skal til en bestemt metro station. Her venter de en kort tid i deres egen bil indtil en maxi-ruf med chauffør henter dem ved deres bildør. De kan nu skifte ved at gå nogle få meter og maxi-ruf'en afgår lige så snart den er fyldt.

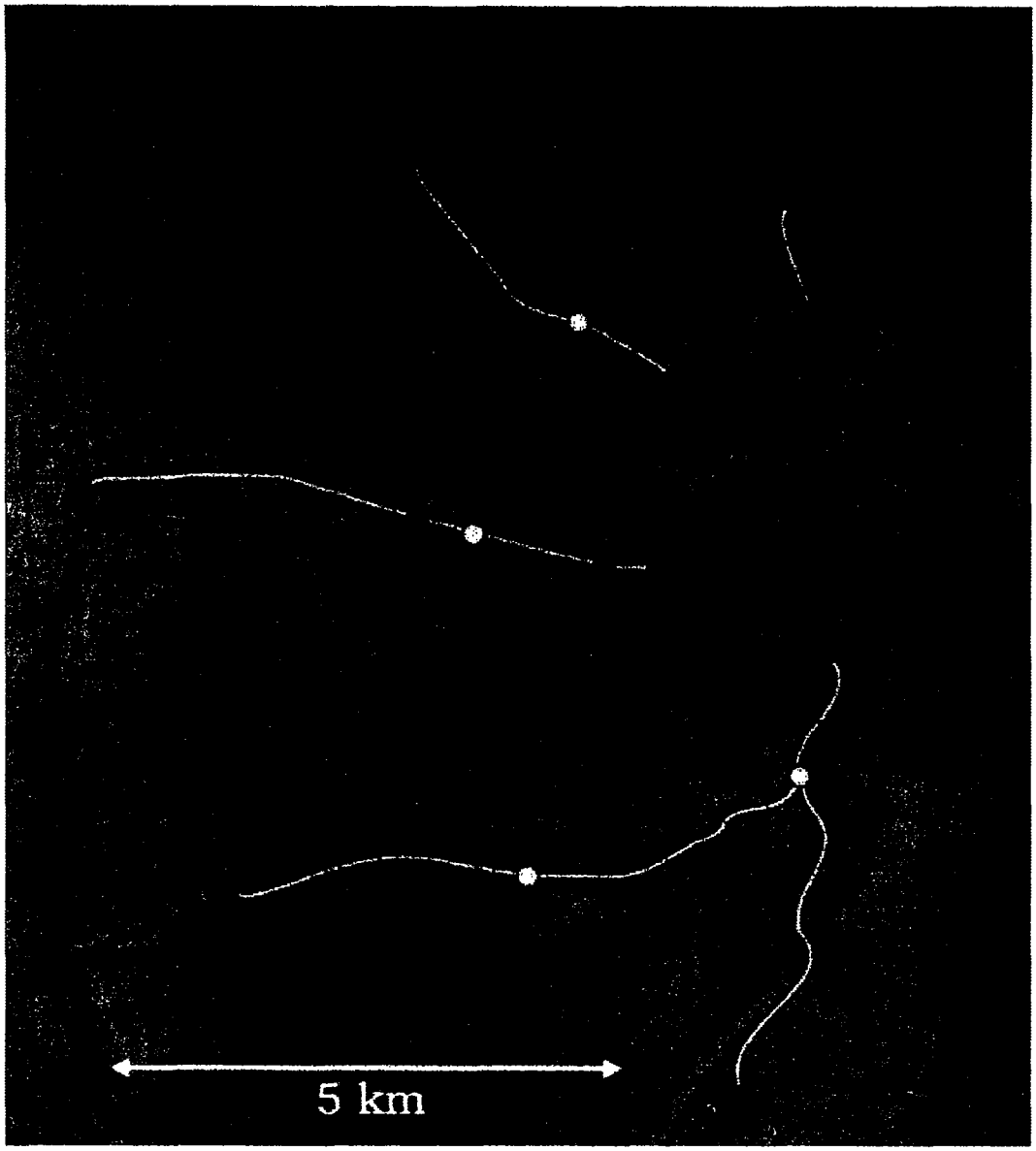
Fail safe kontrolsystem

RUF kontrolsystemet, styrer køretøjerne på en måde, som er "fail-safe". Det betyder at kun hvis alle kritiske funktioner er OK kan køretøjerne køre med den maksimale hastighedsprofil.

Når alt kører perfekt, følger alle køretøjer en bestemt hastighedsprofil med en topfart på over 100 km/t. Hvis nogle mindre ukritiske fejl opstår, sænkes hastigheden af alle tog på den pågældende strækning. Hvis en kritisk fejl opstår, stoppes alle tog straks.

Strømforsyningen er både fra skinnen og fra batterier. Det betyder at et strømsvigt i skinne strømmen ikke vil være et problem. Toget kører blot videre på strøm fra batterierne.

FingerRingMetro baseret på RUF er langt mere relevant end den isolerede RingMetro



Ved at udnytte den besparelse, der fremkommer ved kun at lave eet rør, til at supplere ringen med 5 tilbringer linier baseret på RUF skinner som højbane kan der opnås langt mere aflastning af biltrafikken i byen end det er muligt med ringmetroen.
Der anbringes store parkeringspladser for enden af de radiale motorveje. Disse parkeringspladser betjenes af maxi-ruf'er, som henter bilisterne tæt ved deres bildør og bringer dem direkte til den ønskede station langs ringen. Da hastigheden er stor, er det ikke nødvendigt at køre førerløst.
Hvis stationen er placeret på overfladen, kan maxi-ruf'en endvidere fortsætte som elektrisk bus drevet af batterier, som er blevet opladet på skinnen. På denne måde kan byen betjenes i gadeniveau meget miljøvenligt.
Der kan også køres med flere maxi-ruf'er sammenkoblet til en slags sporvogn. Det koster næsten ingen penge at anlægge en linie da der ikke skal lægges skinner i gaden eller hænges ledninger op.

Konklusion:
Det er meget vigtigt at der igangsættes en seriøs afprøvning af RUF teknologien

RUF International
Forhåbningsholms Alle 30
1904 Frederiksberg C.

Onsdag den 8. februar 2006

Vedr. RUF systemet

Jeg har den 30-1-06 fået detaljeret kendskab til RUF trafiksystemet og de spændende nye muligheder, der ligger i at kombinere bilens og togets fordele.

RUF (Rapid Urban Flexible) har potentiale til at blive en løsning på mange af trafikkens problemer: Kapacitets problemer, olieforsyningsproblemer, klima problemer, sikkerhedsproblemer samt problemet med at få skabt et attraktivt kollektiv trafik tilbud.

Hvis RUF systemet kan realiseres, vil mange af disse problemer kunne løses på en måde, som også kan gavne dansk erhvervsliv.

Jeg støtter derfor helhjertet, at der etableres muligheder for at foretage en seriøs afprøvning af RUF, så de lovende perspektiver kan dokumenteres, og at der fremskaffes og afsættes midler, der kan medvirke hertil.

Med venlig hilsen

Flemming Damgaard Larsen
Formand for Folketingets Trafikudvalg

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