WOLF TIETZE, Dr. rer. nat.
Magdeburger Str. 17
38350 Helmstedt, Germany

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RAPID PASSENGER TRANSPORT IN NORTH AMERICA IN 21ST CENTURY

ABSTRACT

The occurrence of outstanding transport innovations may lead to monumental reconstruction in large urbanised regions such as North America. The decisive factor in this is the introduction of Transrapid, a new rapid transport technology based on the principle of magnetic levitation (Maglev).

This paper uses the urban network of North America East of the 100th meridian, together with the smaller region of California, to demonstrate the advantages of innovative transport technology as the optimal link between road and air transport. Despite requiring less energy input, achieving better adaptation to the topography of the country, causing less noise and being subject to less wear and tear, Transrapid achieves almost twice the speed of conventional trains.

KEY WORDS

rapid passenger transport, North America, 21st century

1. INTRODUCTION

A fundamental, though often ignored, insight of research in Urban Geography is the fact that towns cannot exist as a singular feature, but only in coexistence with others, i.e. by conducting a lively exchange with other towns. Since time immemorial, such exchange concerned certain goods and performances, the specific quality and quantity of which could only be produced at certain locations in accordance with an economy based on the division of labour and producing in excess of its own requirements. Exchange is a service, its means transportation, and its essence trade. The latter is our independent wealth creation. Production, trade and culture are the most important characteristics of urbanity, the level of which is the result of the best ethical and technical capabilities of those people who are urbanity's moving force. It is part of human competitiveness constantly to strive for improvement of those capabilities, and transport is their medium.

In what follows, some observations on development perspectives in the eastern half of the USA (c. 3.25 mill km²/1.25 mill sq. miles) and in California (c. 400.000 km²/156.300 sq. miles) in the 21st century will be presented. In the past 100 years, this area has witnessed the foundation of the hitherto largest and most competitive urban network in a uniform economic region. To begin with, a dense railway network enabled this development, but by the middle of the 20th century, and within a few decades, railways had already been replaced by faster and more flexibly operating road transport for freight and short-distance movement of people, as well as an extraordinarily dense network of air-lines for long-distance business or holiday travellers. Both freight traffic and passenger transport on the railways have declined to a fraction of their former volume. All organisational and technical attempts at halting or even reversing the trend towards a shrinking market share have misfired. Goods traffic by inland or coastal navigation, as well as by pipeline, is excluded here.

To manage the necessary access and distribution services, air traffic relies almost 100% on an effective system of road transport. As far as short distances are concerned, public and private car or bus services, hotel shuttles, taxis and rent-a-car services are coping with the correspondingly high demand. The limit of this airport feeder traffic is set by the economic viability of the travel times involved. On its transitional fringe, airport-orientated road traffic thus dovetails with helicopter taxis and short-distance public transport. Depending on the economic viability of even those means of transport, the link area may extend over 150 to 1500 km. An excessive example is provided by the repeated landings of jumbo aircraft for long-distance transport within such transition zones, as it amounts to a considerable loss of time for the aircraft concerned, as well as for its passengers.

What is more, the time required for catching a connecting flight (Table 1) is amazingly long. In short, even in North America, services for interurban transport are not particularly satisfactory. There is much room for a thoroughgoing improvement.

2. A NEW TRANSPORT TECHNOLOGY: THE TRANSRAPID ITS APPLICATION IN THE EASTERN HALF OF NORTH AMERICA

Long-distance passenger transport in North America would be especially improved if the major airports were linked by a network of Transrapid, the fast magnetically-operated levitation guideway, with additional stops at freeway junctions near important cities. If further Transrapid lines branch off at these stops or intersect, the traveller would be able to take advantage of diverse interchange possibilities within a few minutes. Top speeds of c. 500 km/h, together with excellent acceleration, guarantee travelling speeds of c. 400 km/h. In comparison with the modern high speed trains of conventional railways (Shinkansen, TGV, ICE), Transrapid can cope with curves of double the severity, can overcome ascents which are twice as steep, needs only 60% of the energy, and is only half as noisy. Its tracks are easily adapted to the terrain; and the amount of land it requires is c. 60% of that of a conventional railtrack. Transrapid needs no locomotive, no transmission and pantograph, no wheels, brakes or suspension, it glides free from all contact and without any vibrations, and it cannot come off the guideway (Figure 1). There is, therefore, no wear and tear. Magnetic travel technology may prove to be the ideal link between air and road transport.

The linking of the most important economic centres of North America between Minnesota and Texas in the West and the Atlantic coast in the East would require a network of c. 20,000 km. The Canadian St. Lawrence axis between Detroit/MI and Quebec could also be included. Assuming that the setting up of the network starts off by operating the most important tracks, their success might be able to finance the construction of all the other additions. The Boston-Washington axis, which connects up with the New-York metropolitan area by way of a station at Newark International Airport, is c. 750 km long, a distance which can be travelled within c. 2 hours whilst stopping at a total of 10 intermediate stations. An extension via Columbia/SC to Miami/FL adds another 1,750 km (4 hr 30 min) and at least 8 more stations. Starting from this Atlantic axis, the classic roads lead to the interior of the continent: from New York to the Great Lakes (Rochester-Buffalo, and further west via Cleveland to Chicago), 1400 km, c. 3 hr 30 min travelling time. An additional track from Cleveland through Pennsylvania to Wilmington/DE and Baltimore/MD to the Atlantic coast (c. 650 km) would serve another important transport connection. The same applies to a line from Washington/DC through southern Ohio (Cincinnati) to St. Louis/MO and beyond to Kansas and Texas. In the south, too, the Atlantic axis might pick up another two important east-west connections: from Columbia/SC via Atlanta/GA and Birmingham/AL to Texas (Dallas), as well as along the Gulf coast from Jacksonville and Gainesville in Florida to New Orleans/LA – Houston/TX etc. (Figure 2).

Similar, though N-S axes could start off from Chicago and the Great Lakes. This would result in interesting intersections, which would prove to be first class location factors for the cities concerned, and as magnets for further important investments and innovations.

The Maglev system offers the traveller considerably more conveniences than aircraft, not only inside the trains, thanks to great physical freedom of movement and better service (dining car, spacious washing facilities), but also, and above all, at the stations themselves. These are always designed as two-storey buildings with only one platform (Figure 3) serving two or three tracks reached, as a rule, by way of the station hall with check-in counters, baggage offices, car hire services, shops and connections with local road transport links. The platforms are shielded by a safety screen, the sliding doors of which only open after the trains have come to a halt at the precise point. Luggage compartments can be found at both ends of the train. They are serviced from separate platforms on the opposite side so as not to inconvenience the travellers. A train of nine sections is 234 m (765 ft) long, and consists of two luggage sections, one restaurant car, two first class and four second class ones. The station may be extended further in an upward direction by additional floors with offices, parking facilities, hotel and penthouse flats. Neither vibrations nor noise could possibly cause disturbance.

Particularly striking features of the convenience for travellers are the possibilities of changing trains in comfort, since 2 to 3 trains use a single platform simultaneously. Arrival times can be arranged very precisely. By contrast with changing aircraft, which is notorious for causing substantial delays, next to no time is lost here (Table 2). Transrapid thus achieves a more favourable ratio of maximum speed to travelling speed than any other mode of transport. These advantages make a considerable contribution to the system's economic viability. A Train can cover 6500-7000 km in c. 20 hours, before being withdrawn for a few hours for cleaning and maintenance. Most travellers, however, will use the train only for a distance of 300-1000 km. Thanks to their excellent connections, the stations permit fast interchange of travellers joining or leaving the train. The system thus becomes a useful part of much of the travel market. The efficiency of the system is determined by an intelligent choice of the routes, stations and service facilities. Whether operating as a shuttle service between two important termini, or running in large loops, the approach to operation of

Table 1 – Minimum Connecting Times of Major North American Airports Compared to Minimum Connecting Times of Transrapid Stations

City	Airport Code	Intern-national	Dom.-Intern. -minutes-	Intern.-Domestic	Intern.-Intern.	Transrapid stations
Atlanta	ATL	60	50	75	–	generally less than 3 minutes
Boston	BOS	45	60	90	75	
Chicago	ORD	45	75/160	90/160	90	
Dallas-Ft Worth	DFW		50	70	70	
Houston	IAH	30	60	60	75	
Los Angeles	LAX	30	60	120	120	
Miami	MIA	45	60	90	90	
New York	JFK	45	75	120	105	
JFK-La Guardia vv			80	150		
JFK-Newark vv			180	210		
Newark	EWR	45	60	150	150	
San Francisco	SFO	45	60	105	105	
Toronto	YYZ	45	90	90	90	
Washington	IAD	60	45	90	90	

Source: Lufthansa

The impressive speeds of modern aircraft when in flight, contrast massively with air traffic's tardiness when moving on the ground. In addition, air passengers must put up with substantial amounts of time lost when changing planes – which unfortunately thereby lose much of their superiority as a means of travel when flying non-stop.

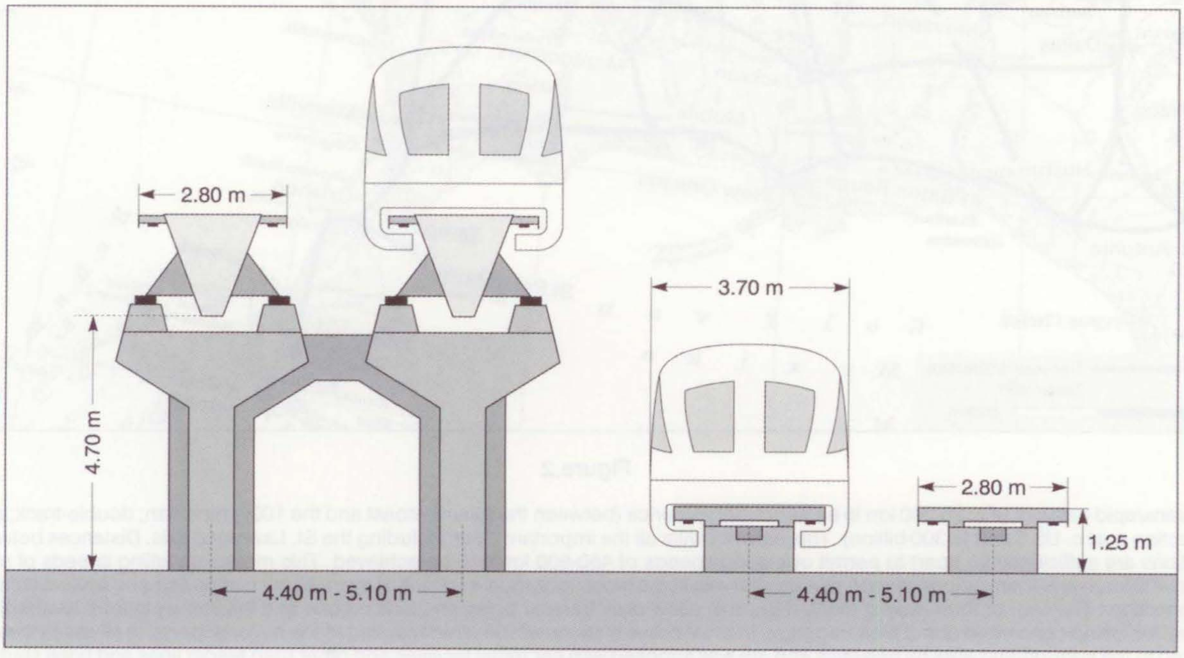

Figure 1

The Transrapid guideway is built using individual steel or concrete beams up to 62 m long. It can be installed elevated or at-grade. The concrete substructures are between 3 and 20 m above ground. Transrapid trains change tracks using bendable steel guideway switches. A continuous steel beam (78 to 148 m in length) is elastically bent by multiple electromechanical setting drives. The microprocessor controlled drives are monitored for function and safety by the central control system. There are two-way and three-way switches available. In straight position the trains may pass over the switches at normal operating speed (300-500 km/h). In turn-out position max. speed is 100-200 km/h.

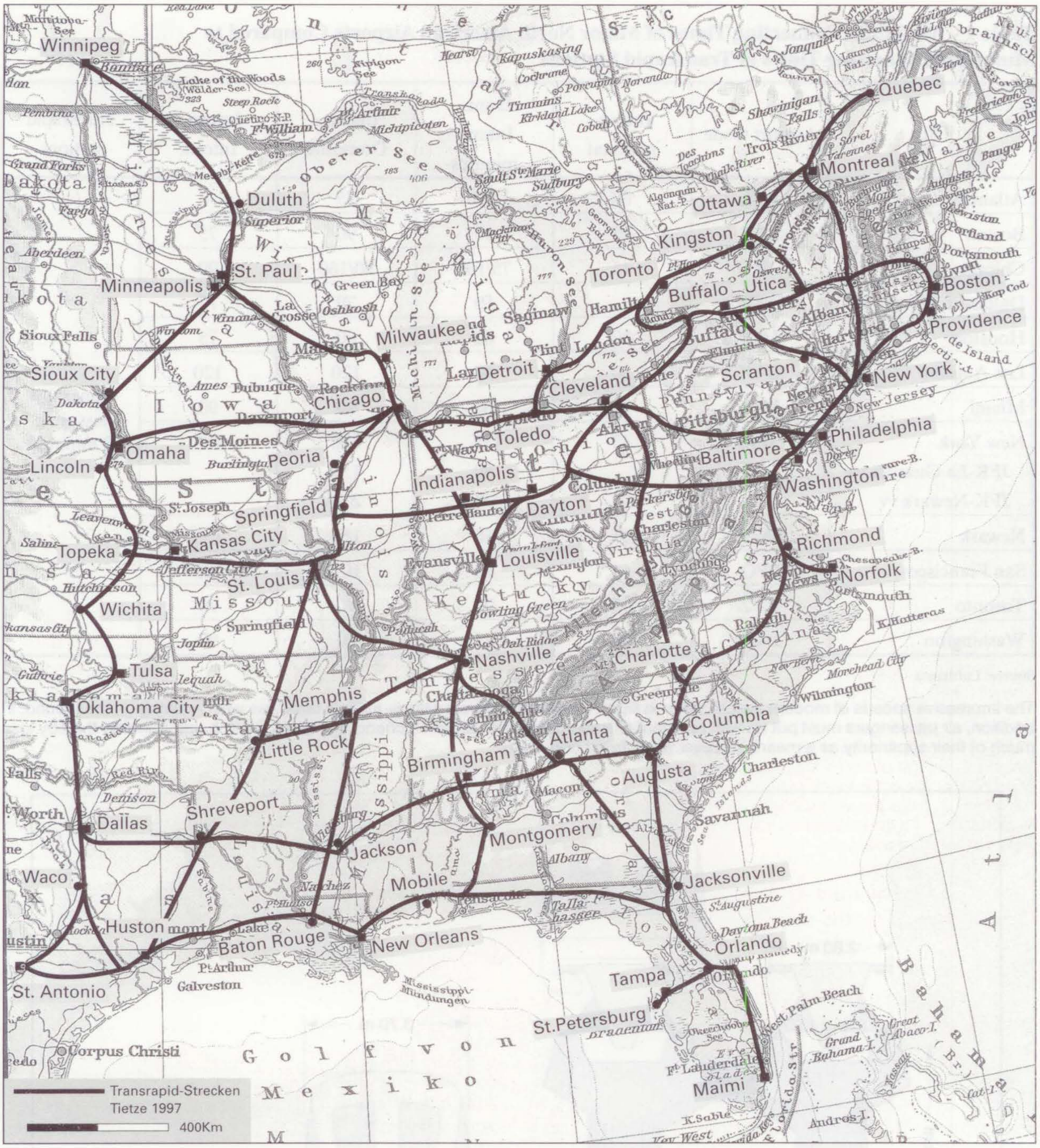

Figure 2

A Transrapid network of c. 20,000 km in eastern North America (between the Atlantic coast and the 100th meridian; double-track; construction cost c. US $ 240 to 300 billion). This network links all the important cities including the St. Lawrence axis. Distances between stations are sufficiently far apart to permit operating speeds of 450-500 km/h to be achieved. This means travelling speeds of more than 400 km/h and train sequences at 5 minute intervals at the most. Individual sections of the network can be used by several different connections The two- or three-way stations (Figure 4) allow easy transfer between trains on one and the same platform level without travellers being concerned about their baggage. In most cases stations will be directly linked to the major airports; in all cases they are linked to the surrounding area by freeways and are well supplied with car rental facilities and other road feeder lines and hotel shuttles. The network is exceptionally compatible with all surface and air traffic. The comfort of travelling is decidedly greater than in air transport. Lower maximum speed is almost totally compensated for by the very short minimum connecting times (Table 1) and – in contrast with airline travel – the superior range of destinations available (Table 2).

the system has a considerable influence on its profitability. A combination of the two variants may well produce the optimal solution. Although most lines will have to be constructed as double tracks in order to make it possible to run trains in short intervals, single tracks may be possible on a few end-of-line stretches.

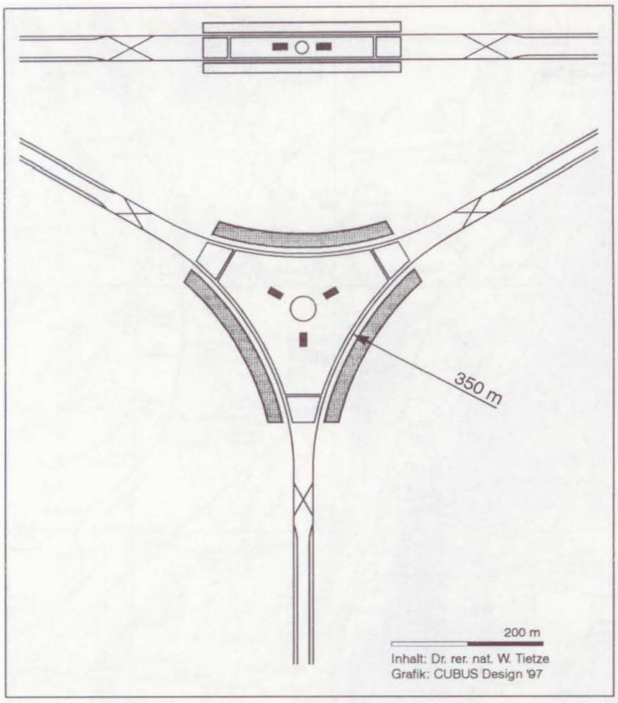

Figure 3

Two- and three-way Transrapid stations with one platform each. Each platform side can be approached from any direction. As a rule, trains stop on all sides at the same time in order to allow easy change-overs and thus a wide choice of destinations. The platform edges are secured by safety screens with automatic sliding doors which open only when a train stops exactly in front of them. Luggage and mail are loaded on separate platforms at the opposite side of the trains and at both frontal ends without inconveniencing the passengers. Stairs, escalators and lifts link the platforms with the station hall (above or below) where all requisite services are available.

A rough calculation of the costs of the system is therefore based on the assumption of a double track construction. The cost per 100 km is estimated at US $ 1.2 to 1.5 billion. In some cases it might be possible to reactivate the land ownership (rights of way) of the former railway companies. The companies that maintain feeder transport systems, such as airlines, rental-car firms etc., might develop an interest in partnership. Even the postal, courier and newspaper services potentially stand to profit from this innovation.

3. APPLICATION TO CALIFORNIA

Major technical innovations require testing in order to overcome inhibitions over investing in risky ventures. A region for Transrapid trials under American/United States conditions might be California. Its geographical structure is simple insofar as there are only two – albeit very large – metropolitan areas: the Bay area with San Francisco, Sacramento, Oakland and San José as the largest cities, and southern California with the metropolitan area of Los Angeles, together with San Diego. Both these conurbation are inhabited by c. 10 million people. Above all, however, they represent an enormous economic force in a worldwide market and are part of a large internal market. Both are home to several large universities and other research institutions with a dense, worldwide network of linkages. In spite of this, they are connected to global air traffic by only two airports: those of San Francisco and Los Angeles. The distance between them is about 650 km; and the other larger cities between the metropoles are each about 150 – 200 km apart. The very dense transport network is supported by an excellent freeway network, as well as a very dense system of short-distance air transport.

Under these conditions, a closer examination of the opportunities to operate a Transrapid system might be worthwhile. It would certainly result in a continuous axis from Sacramento to San Diego, with intermediate stops at Merced, Fresno and Bakersfield, linked and supplemented by local circular tracks around the Bay of San Francisco, together with one, or possibly several, across the Los Angeles metropolis, stretching as far as Santa Barbara and via Ventura County to San Bernardino and Riverside, Irvine, Long Beach and the junction of LA Airport. Due to too great a station density (c. 15 km distance), maximum speeds cannot be achieved in these metropolitan ring systems. Nevertheless, magnetic transport technology will prove to be far superior to all the other systems, and enable transportation to be considerably improved. The substantial pressure on freeways during the rush hour can be eased. The fact that hundreds of thousands of commuters will be saving time will noticeably support the acceptance of this innovation.

4. GLOBAL OUTLOOK

At the outset, reference was made to linkages between economically active towns to a network of the highest human creation of values, and to their significance for the development of culture in general. It is imperative to examine the suitability of every technical innovation for dealing with this task. This paper has presented suggestions for such an examination by applying them to differently sized North American subregions: to the "Great East" east of the 100th meridian and to California. Geographers and planners who wish to picture the development of the 21st century will be interested in considering the future of transport in the large urban regions of Europe, China and India. In view of this, smaller regions elsewhere in the world, too – be they in SE Brazil, SE Australia, or Java – will deserve our attention, as was demonstrated by the example of California. It will need the co-operation of many disciplines to achieve useful results.

Figure 4

A Transrapid system of a special kind offers itself for California, which is appropriate to the remote location and geographical structure of the US state. The two metropolitan areas of San Francisco (with Oakland, Sacramento and San José) and Los Angeles, are linked by two long distance connections. The termini of the two long distance connections are the two international airports of San Francisco and Los Angeles. These points are linked to local Transrapid systems with a greater station density (and therefore necessarily lower travelling speed). An extension may be built southwards from Los Angeles as far as San Diego. The High Tech industry, research centres (universities), the film industry and Disney Land, are the most important destinations and sources of long distance traffic. Their easy access to the major airports is of paramount interest. A more detailed investigation of these perspectives is to be recommended.

5. ACKNOWLEDGEMENT

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Table 2 – 90-Minute Excerpt from an Imaginary Transrapid Timetable of the Cleveland-Akron/Ohio Station

From:		To:
Chicago..Toledo..	8:30	Pittsburgh..Baltimore..Washington..Norfolk
Lincoln..Omaha..Chicago..Toledo	8:40	Buffalo..Rochester..Newark
Toronto..Buffalo	8:40	Columbus..St. Louis..Topeka
Charlotte	8:40	Toledo..Chicago..Minneapolis..Winnipeg
Minneapolis..Chicago	8:50	Charlotte..Jacksonville..Miami
Boston..Buffalo	8:50	Chicago..Omaha..Dallas..San Antonio
New Orleans..Birmingham..Nashville	8:50	Buffalo..Toronto..Montreal..Quebec
Toronto..Detroit	9:00	Dayton..Nashville..Memphis..Baton Rouge
Chicago..Toledo	9:00	Buffalo..Rochester..Boston
Charlotte..	9:00	Detroit..Toronto
Washington..Pittsburgh	9:10	Chicago..Lincoln
Minneapolis..Chicago	9:10	Charlotte..Jacksonville..Miami
San Antonio..Houston..St. Louis	9:10	Pittsburgh..Philadelphia..Newark
Boston..Buffalo	9:20	Dayton..Nashville-Birmingham..New Orleans
Dallas..Atlanta..Charlotte	9:20	Detroit..Toronto..Montreal
Boston..Newark..Philadelphia..Pittsburgh	9:20	Chicago..Minneapolis
Topeka..St. Louis..Indianapolis..Dayton	9:30	Buffalo..Toronto..Montreal..Quebec
Miami..Atlanta..Nashville..Dayton	9:30	Detroit..Toronto
Chicago..Toledo	9:30	Pittsburgh..Baltimore..Washington
Quebec..Ottawa..Montreal..Toronto..Buffalo	9:40	Dayton..Memphis..Dallas
Washington..Pittsburgh	9:40	Toledo..Chicago..Des Moines..Lincoln
Detroit..Toledo	9:40	Charlotte..Jacksonville..Orlando..Tampa
San Antonio..Houston..Birmingham..Dayton	9:50	Buffalo..Rochester..Newark
Newark..Rochester..Buffalo	9:50	Toledo..Chicago
Miami..Charlotte	9:50	Detroit..Toronto
Detroit..Toledo	10:00	Buffalo..Rochester..Albany..Boston
Montreal..Toronto.Buffalo	10:00	Dayton..Birmingham..Dallas
New Orleans..Birmingham..Dayton	10:00	Toleto..Chicago..Minneapolis..Winnipeg

As a rule, three trains stop simultaneously at the three-way platform in order to make use of the greatest possible number of transfer connections (as an advantage to passengers as well as for postal and courier freight). Within this short period trains from at least 80 other stations arrive and proceed to at least 80 other stations. During this interval there are 7 connections to Chicago, 6 to Toronto, 2 to Washington, 3 to Newark (New York). All these connections offer several further destination multiplication in chase of further, very convenient, train changes. The system permits an extraordinarily dense network.

In this example, the train frequency is 10 minutes. It can be increased to 6-5 minutes, should certain traffic peaks require it (36 trains each with some 300 passengers = c. 12,00 passengers per hour).