Analysis of Mode Integration Facilities at Madiun Station

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ABSTRACT

One of the problems that occur at Madiun Station is the need for modal integration. Modal integration can be interpreted as a complete integration of the types or forms (transport) used to move people and goods fromone place (origin) to another (destination). Some problems related to modal integration at Madiun Station are not optimal pedestrian facilities, no clear drop zone point for public transport passengers, and more information instructions regarding connecting transportation. In this study, data collection methods were used by observing the existing conditions of the modal integration facilities in the Sriwijaya Earth Station area. Furthermore, a survey was conducted on LRT passengers at Madiun Station regarding the characteristics of LRT service users and the public's willingness to access modal integration facilities. This study uses the Modal Interaction Matrix and Trip Segment Analysis Method. The results of this study using the Modal Interaction Matrix analysis show that the modal integration facility in the Madiun Station area has an interaction level of -160 or can be categorized as a bad interaction. By providing a proposal for the location of the modal integration facility, it can be seen that the interaction value of the modal integration facility at the Sriwijaya Earth Station has increased to -80 or has a Good category. Furthermore, through calculations using the Trip Segment Analysis method, the greatest time value is for public transport users when they want to access the station or when they want to leave the station. The value of the time needed to access the station for public transport users is 15.3 minutes. And it takes 14.4 minutes for train service users who get off at Madiun Station and want to continue their journey using public transportation.

Keywords: mode integration facility; modal interaction matrix; trip segment analysis.

INTRODUCTION

Transportation is needed to support the movement of places from one place to another. Another use of transportation is that transportation is needed to move, encourage, and support the development of the region as an effort to equalize and increase development. The transportation system is arranged in one unit and the development system is carried out using integration in each component consisting of society, facilities, infrastructure, and existing rules and regulations that realise a sustainable roundness to support the progress of an area.

Madiun Station is one of the train stations under PT. KAI (persero) DAOP VII. Madiun Station serves many train departures and arrivals, so the facilities provided by the station as a service provider must provide comfort, convenience, security, equality and affordability for service users. One of the problems that occur at Madiun Station is the need for optimal mode integration. Mode integration can be interpreted as a complete integration of the type or form (transportation) used to move people and goods from one place (origin) to another place (destination). Some problems related to the integration of modes at Madiun Station are not optimal pedestrian facilities, there is no clarity on the drop zone point for public transportation passengers, and there is still a lack of information instructions related to advanced transportation Problems related to non-optimal mode integration facilities at Madiun Station can be said to be not in line with the goals of national railway transportation development. So that in serving passengers with good integration, it is a facility that must be provided by train service providers (Decree of the Minister of Transportation No. 296, 2020).

Based on existing problems, it is important to integrate train modes and other modes to improve the quality of services provided optimally. The problem of this study is that it aims to determine

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the performance of the integration of intermodal integration facilities at Madiun Station today, and the facilities needed to support integration to facilitate passenger mobility at Madiun Station.

Public transport services from the station to outside the station and to public transport stops are very important to ensure connectivity and comfort for passengers' travel. Train stations must be well integrated with various other modes of transportation such as buses, taxis, city transportation (angkot), and application-based transportation (ride-hailing). This can be realized through adjacent and easily accessible bus stops (Putri EM, Herwangi Y, 2023; Santoso GP, Dwiatmoko H, 2023; Sihombing SB et.al, 2021).

Public transport stops must be comfortable, safe and protected from the weather. Providing seating, sufficient lighting, and schedule information are very important. Safe and comfortable pedestrian paths between stations and public transport stops are very important to support passenger mobility. This route must be equipped with clear markings, signs and accessibility facilities for people with disabilities. Providing flexible and well-scheduled feeder transportation to connect areas that are not directly reached by the main mode of transportation with stations (Syaiful S, Rulhendri R, 2014; Syaiful S, Fadly A, 2020; Savitri A et.al, 2020; Syaiful S et.al, 2023).

Apps that provide real-time information about public transport schedules and routes, as well as digital payment options, can increase passenger convenience. Good public transport services from stations to outside stations and to public transport stops require close integration between various modes of transport, adequate infrastructure, and the use of technology to increase the comfort and efficiency of passenger travel. Investment in facilities and service innovation is critical to creating an effective and passenger-friendly transportation system (Fahrizal I, Dwiatmoko H, 2023; Sekarsari M, Dwiatmoko H, 2022; Chakam MF, Rakhmatulloh A, 2024; Arifin W, 2024).

Mode Integration

Integration in general has the meaning of intermingling or integration until it becomes a whole or rounded whole. While mode is a form or type. Indonesia is an archipelagic country so it is inevitable to exchange modes of transportation on a trip for passengers and goods from the place of origin to the destination. The cost of transportation from the place of origin to the destination is a combination of the transportation costs of each mode plus the cost of transit from one mode to another (Tamin Ofyar 2008).

Network integration is the key to the success of the public transportation service system in an area or city. This is because with an integrated public transportation network system, the best network route can be determined which is not only based on the demand for people's travel needs but also the optimal service coverage mechanism (Hadas and Ceder, 2010). Network integration can impact the emergence of other integrations, such as physical integration, schedules, and tariffs. So the integration of transportation modes can be interpreted as a complete integration of the type or form (transportation) used to move people and/goods from one place (origin) to another place (destination).

According to (Dempsey, 2000) in intermodal transportation services, it is necessary to pay attention to several technical aspects including the following:

1. Linkages
2. Choice
3. Integration
4. Collaborate

Mode Integration Concept

The following are the condos of mode integration, between:

1. Connecting Modes, *namely Connecting modes are defined as connecting before and after the main mode being used* (Krygsman, 2004). The previous mode or access mode is used from

home to public transportation stops (bus stops/stations/terminals) such as walking, bicycles, cars or motorbikes, and taxis. After mode or *egress* mode is defined as the mode used from the stopping place (bus stop/station/terminal) to the destination).

2. Main *Modes*: The main mode is usually used in the longest and longest journey of the other modes. There has been a lot of research and development of this main mode, about the development of public transportation, synchronization of schedules between one mode and another.
3. Transfer Point Facility: Mode switching facilities are also very important to attract private transport passengers who can integrate with public transportation. Sufficient parking facilities to accommodate the needs will attract private transportation passengers to leave their private cars in this place and then connect with public transportation. Especially if parking fees in the city center are expensive.
4. Intermodal Transfer Point *Facility : The* Intermodal Transfer Point facility is very important because it connects two types of modes from two networks. For example, between river networks and road networks, or railways. (Spek 2001) has studied the theory of architectural development of intermodal transfer point buildings. The result is the building design concept of multimodal system architecture that is integrated, combined, flexible, and has a multilayer network.

Mode Integration Facility

The Mode Integration Facility which includes networks, terminals and other facilities functions as an interconnected intermodal physical connector and realizes one seamless journey. Infrastructure integration can be done by bringing closer or building an access that connects the two modes making it easier for passengers to change modes. In the Decree of the Minister of Transportation Number 15 of 2010, integrated and integrated transportation is supported by the construction and development of supporting facilities and multimodal transportation transfer facilities at train stations, terminals, airports and bus stops.

Intermodal facilities are also a link between transit network nodes that facilitate passenger accessibility from one mode to another and from one destination to another. Based on integration standards set by the Multimodal Research and Development Center and on research conducted by Nugroho Indiro in 2021 which explains the reference in node services from stations to BRT shelters/other modes. The integration standard has several reference variables for assessing facilities at nodes such as proximity, connectivity, convenience, safety, security, and attractiveness.

Supporting Factors for Mode Integration Services

In the Intermodal Transport Interchange for London (2001), there are 3 (three) supporting factors from intermodal transportation services and their existence is closely related. These factors are::

1. Infrastructure includes networks, terminals and facilities.
2. Information System, divided into in-vehicle and off-vehicle information systems.
3. The compatibility of facilities and infrastructure of each mode strongly supports intermodal cooperation.

Modal Interaction Matrix

Intermodal relationship analysis is an important step in knowing the intermodal relationship with the facility, and how the facility supports each other. In other words, facilities must be designed as well as possible to optimize the performance of a mode, for example displacement facilities to support multimodal performance. *The modal interaction matrix* is used to evaluate the level of interaction between modes and determine whether an alternative creates an acceptable level of interaction (Alan J. Horowitz, 1994). Here is an example of a MIM analysis.

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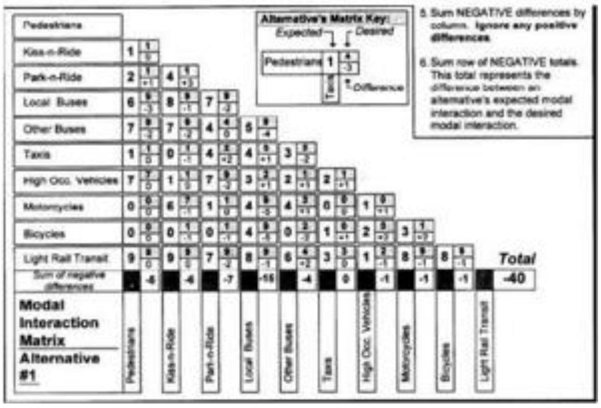

Figure 1. Mode Interaction Matrix Sources: Evaluation Of Intermodal Passengers Facilities, 1994

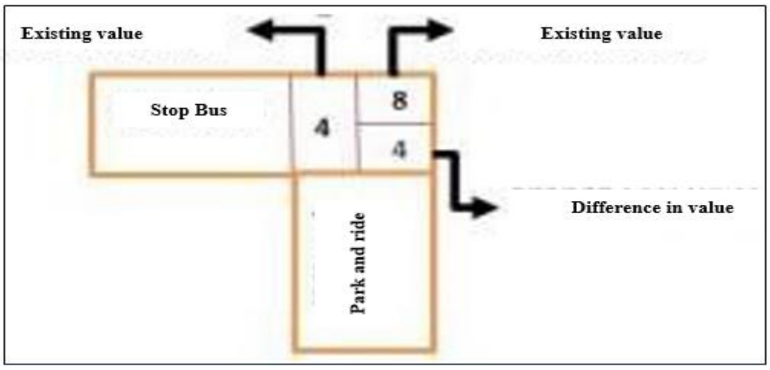

Figure 2. Comparison Matrix Sources: Evaluation Of Intermodal Passengers Facilities, 1994

The following are the stages of the analysis of the *Modal Interaction Matrix* :

1. Define the capital or integration facility on the node.
2. Compiling a matrix of capital interactions.
3. Measures the value of walking distance between predetermined components.

Trip Segment Analysis

This analysis is used to determine the measure of ease of travel between facility segments and modes within nodes. This analysis compares the disutility of segments by service users with each mode used. (Horowitz, 1994). *The purpose of Trip Segment Analysis* is to determine the size of ease of travel that is often done near and within the facility. For example, to move modes from public transportation to ships seen from the availability of existing facilities at the port. In this analysis calculation there is a segment disutility calculation. The calculation formula for Trip Segment Analysis can be seen in the following formula.

Segment disutility = total segment disutility of the selected mode ((time)(weight)+resistance)

Figure 3. The calculation formula for Trip Segment Analysis Source: Evaluation of Intermodal Passengers Facilities, 1994

Table 1. Score for Pedesterian

Value	Description	Interval distance (m)
1-2	Very bad	>100

3-4	bad	61-100
5-6	Enough	21-60
7-8	Good	6-20
9-10	Very good	0-5

Source: Evaluation Of Intermodal Passengers Facilities, 1994

1. Enter the values between the desired components based on walking distance in the interaction matrix.
2. Perform calculations by reducing the distance value of existing facilities with the desired distance value, so that a negative value is obtained in the interaction matrix.
3. After getting the negative value, then the value is multiplied by 100 and then divided by the number of existing capital columns.

Obtained from negative value. Nomalized scores are intended to identify flaws in the design, so that positive differences are not incorporated into the calculation.

$$\text{Normalize score} = \frac{100 \text{ x Total negative value}}{\text{Number of matrix columns}} \quad (1)$$

Source: Evaluation Of Intermodal Passengers Facilities, 1994

RESEARCH METHODS

Flow Chart

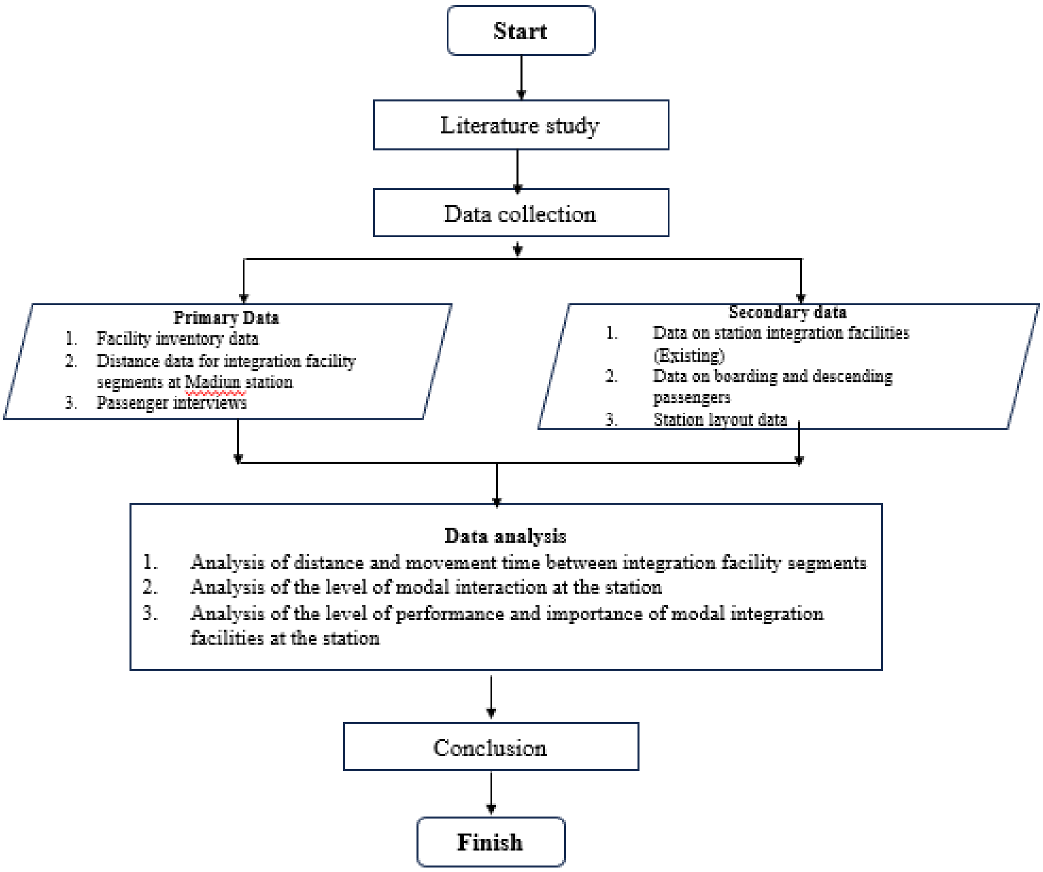

Figure 4. Flow Chart

Data collection in this study is a data collection activity, both primary and secondary data. Primary and secondary data are needed to solve the problems found. The primary data collection method is

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carried out using questionnaires that are distributed to a predetermined sample. In this study, the sample determined was train users who got on/off at Madiun Station. Primary data is also obtained through observations made at Madiun Station and its surroundings, from observations will be known data on the distance between facilities, the integration of modes and time in traveling these facilities.

In this study, an analysis was carried out related to the interaction of mode integration facilities at Madiun Station. The results of data processing using the *Capital Interaction Matrix* method will produce output in the form of *negative value* which is the total difference between the existing distance of the condition of the *existing* mode integration facilities at Madiun Station with the distance desired by the community in accessing the mode integration facilities. Furthermore, the existing output will be described according to the range of standard normal values in this Modal Interaction Matrix method. The value obtained using the Capital Interaction Matrix method can be used as evaluation material and as a proposal for the location of the mode integration facility desired by the community at Madiun Station.

Furthermore, analysis was also carried out using the Trip Segment Analysis method, this method was used to determine the size of ease of travel between facility segments and modes in the node. This analysis compares the disutility of segments by service users with each mode used.

RESULTS AND DISCUSSION

The results of the analysis contain calculation steps in processing data. The results of the analysis also presented a discussion and summary of the results of data processing that has been carried out, as for the results of analysis and discussion in this study, namely:

Modal Interaction Matrix *Analysis*

The Modal Interaction Matrix measures the Proximity aspect, which calculates the relationship between Madiun Station's existing mode integration facilities. This measurement uses variable distances between existing mode integration facilities compared to the community's willingness to access mode integration facilities.

Existing Distance Value Matrix

The existing distance value is obtained from calculating the distance between mode integration facilities at Madiun Station. Furthermore, the results of the existing calculations are given values according to the interval set at the value of walking. The following is the distance data of the mode integration facility after the assessment is carried out according to the interval:

Table 2. Distance Score

No	Origin-destination	Distance (meters)	Value
1	Station waiting room to Grab drop/pick up point	96	3
2	Station waiting room to public transport drop/pick up point	100	3
3	Station waiting room to Alfa Mart drop/pick up point	388	2
4	Station waiting room to the train log drop/pick up point	512	2
5	Grab drop point to public transportation pick up point	100	2
6	Drop point grab to pick up point Alfa Mart	300	2
7	Drop point grab to pick up point KA log	450	2
8	Public transport drop point to Alfa Mart pick up point	118	2
9	Public transport drop point to KA log pick up point	100	3
10	Alfa mart drop point to KA log pick up point	288	2

From the data that has been processed, a matrix can be formed as follows:

Ruang Tunggu Stasiun					
Drop off/pick up grab	3				
Drop off/pick up angkutan umum	3	3			
Drop off/pick up Alfamart	2	2	2		
Drop off/pick up KA Log	2	2	3	2	
Existing Interaction Matrix	Ruang Tunggu Stasiun	Drop off/pick up grab	Drop off/pick up angkutan umum	Drop off/pick up Alfamart	Drop off/pick up KA Log

Figure 5. A matrix can be formed

Expected Value Matrix

The hope value or *Desired Interaction Matrix* is the value of the community's desire for the distance of the existing mode integration facilities in the Madiun Station area. This expectation value was obtained through a survey using a questionnaire to train users who got on/off at Madiun Station. Furthermore, from the average desire of the community for the distance of the mode integration facilities are given a value according to the interval that has been set on the walking value. After measurement, the following results were obtained.

Table 3. Desired Distance Value

No	Origin-destination	Desired distance (meters)	Value
1	Station waiting room to Grab drop/pick up point	61-100	3
2	Station waiting room to public transport drop/pick up point	61-100	4
3	Station waiting room to Alfa Mart drop/pick up point	61-100	3
4	Station waiting room to the train log drop/pick up point	61-100	3
5	Grab drop point to public transportation pick up point	61-100	3
6	Drop point grab to pick up point Alfa Mart	61-100	3
7	Drop point grab to pick up point KA log	61-100	3
8	Public transport drop point to Alfa Mart pick up point	61-100	4
9	Public transport drop point to KA log pick up point	6-20	7
10	Alfa mart drop point to KA log pick up point	6-20	7

From the assessment and tabulation carried out, a matrix can be formed as follows:

Ruang Tunggu Stasiun					
Drop off/pick up grab	3				
Drop off/pick up angkutan umum	4	3			
Drop off/pick up Alfamart	3	3	4		
Drop off/pick up KA Log	3	3	7	7	
Desire Interaction Matrix	Ruang Tunggu Stasiun	Drop off/pick up grab	Drop off/pick up angkutan umum	Drop off/pick up Alfamart	Drop off/pick up KA Log

Figure 4. Desired Distance Value

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Matrix Interaction Mode

In the modal interaction matrix, there are three cells: the first cell is for the existing value or expected matrix, the *second cell is* for the expected value or *desired* matrix, and the third is for *negative value*. *Negative value* is the result of subtraction from existing and expected values, as seen in the following table.

Station Lounge										
Drop off/pick up grab	3	3								
		0								
Drop off/pick up public transport	3	4	3	3						
		-1		0						
Drop off/pick up Alfamart	2	3	2	3	2	4				
		-1		-1		-2				
Drop off/pick up KA Log	2	3	2	3	3	7	2	7		
		-1		-1		-4		-5		
Sum Of Negative Difference		-3		-2		-6		-5		-16
	R		D		D		D		D	

Figure 5. Mode Interaction Matrix

Based on the matrix table of mode interactions, the negative value at Madiun Station is -16 where the value is the value that will be entered into the normalized score formula.

Normalized Score

The following is the calculation of the normalized score from the negative value obtained from the mode interaction matrix.

$$\text{Normalize Score} = \frac{100 \times \text{Total Negative Value}}{\text{Number of matrix columns}}$$
$$\text{Normalize Score} = \frac{100 \times (-16)}{10}$$
$$\text{Normalize Score} = -160$$

Table 6. Distance Proposed Modal Integration Facilities

No	Origin-destination	Proposed distance (meters)	Value
1	Station waiting room to Grab drop/pick up point	96	3
2	Station waiting room to public transport drop/pick up point	100	3
3	Station waiting room to Alfa Mart drop/pick up point	388	2
4	Station waiting room to the train log drop/pick up point	90	4
5	Grab drop point to public transportation pick up point	100	3
6	Drop point grab to pick up point Alfa Mart	300	2
7	Drop point grab to pick up point KA log	98	3
8	Public transport drop point to Alfa Mart pick up point	188	2
9	Public transport drop point to KA log pick up point	50	5
10	Alfa mart drop point to KA log pick up point	60	5

Table 7. Range of Normal Values

Normal Value Range	Information
0< to -50	Excellent
-51 to - 100	Good
-101 to -150	Enough
-151 to -200	Bad
-201 to < -250	Very bad

Sources: Evaluation Of Intermodal Passengers Facilities, 1994

Based on the calculation of the normalized score in the table, a value of -160 is obtained, which means that the performance of intermodal facility integration at Madiun Station is categorized as poor, this is due to the large negative value between mode integration facilities in the Madiun Station area

Proposed Distance Value

The following is the value of the proposed distance given to increase the value of the interaction of existing mode integration facilities at Madiun Station Furthermore, the results of the existing calculations are given values according to the interval set at the value of walking. After measurement, the following results were obtained:

Interaction Matrix Proposed Mode

In the modal interaction matrix, there are three cells: the first cell is for the proposed value, the second cell is for the expected value or desired matrix, and the third is for negative value. Negative value is the result of subtraction from existing and expected values which can be seen in the table below.

Station Lounge										
Drop off/pick up grab	3	3								
		0								
Public transport drop off/pick up	3	4	3	3						
		-1		0						
Drop off/pick up Alfamart	2	3	2	3	2	4				
		-1		-1		-2				
Drop off/pick up KA Log	4	3	3	3	5	7	5	7		
		1		0		-2		-2		
Sum Of Negative Difference		-1		-1		-4		-2		-8
	St		D		P		D		D	

Figure 6. Proposed Mode Interaction Matrix

Based on the matrix table of mode interactions, the *negative* value at Madiun Station is -8 where the value is the value that will be entered into the *normalized score formula.*

Normalized Score

The following is the calculation *of the Normalized Score* from the proposed distance determined to improve the interaction of mode integration facilities at Madiun Station

$$\text{Normalize Score} = \frac{100 \times \text{Total Negative Value}}{\text{Number of matrix columns}}$$

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$$\text{Normalize Score} = \frac{100 \times (-8)}{10}$$
$$\text{Normalize Score} = -80$$

Passengers board using rental shuttles

This table shows the time passengers use to access trains using rental transportation modes with segmentation from dropoff point to train is 1.6 minutes. Furthermore, after multiplying by these obstacles, the total value of pedestrian time accessing the train by rental transportation is 7.9 minutes.

Penumpang Pengguna Moda Angkutan Sewa					Berjalan			
					Tidak Membawa		Membawa Beban	
Asal	Jarak (Meter)	Kecepatan (m/menit)	Waktu (menit)	Hambatan	Nilai	Nilai Waktu (NilaixWaktu)	Nilai	Nilai Waktu (NilaixWaktu)
Drop off point-Boarding Gates	96	79,2	1,2	2	1,25	3,939394	3	6
Boarding Gates-Ruang Tunggu Area Berbayar	17	79,2	0,2	2	1,25	0,697601	3	1,1
Ruang Tunggu Area Berbayar-Kereta	13	79,2	0,2	2	1,25	0,53346	3	0,8
Total	126		1,6			5,170455		7,9
Total Nilai Waktu								7,9

Figure 7. TSA Ride Using Rental Transport

Based on the calculation of the normalized score in the table, a value of -80 is obtained, which means that the performance of the integration of existing mode integration facilities in the Madiun Station area is in the good category.

Trip Segment Analysis

Based on the guidelines for the Evaluation of Intermodal Transfer Facilities, the segmentation division between boarding passengers and disembarking passengers at Madiun Station is as follows:

Passengers disembarking using rental shuttles

Penumpang Pengguna Moda Angkutan Sewa					Berjalan			
					Tidak Membawa		Membawa Beban	
Asal	Jarak (Meter)	Kecepatan (m/menit)	Waktu (menit)	Hambatan	Nilai	Nilai Waktu (NilaixWaktu)	Nilai	Nilai Waktu (NilaixWaktu)
Kereta-Pintu Keluar	86	79,2	1,1	2,0	1,25	3,5	3,0	5,4
Pintu Keluar-Ruang Tunggu	12	79,2	0,2	2,0	1,25	0,5	3,0	0,8
Ruang Tunggu-Pickup Point	10	79,2	0,1	2,0	1,25	0,4	3,0	0,6
Total	108		1.4			4,4		6,8
Total Nilai Waktu								6,8

Figure 8. TSA Disembarking Using Rental Trans**port**

This table shows the time passengers leave the station using the rental transportation mode with segmentation from train to pickup point rental transportation is 1.4 minutes. Furthermore, after multiplying by the obstacle, the total value of time pedestrians leave the station by rental transport is 6.8 minutes.

Passengers disembark using public transport

Penumpang Pengguna Moda Angkutan Umum					Berjalan			
					Tidak Membawa		Membawa Beban	
Asal	Jarak (Meter)	Kecepatan (m/menit)	Waktu (menit)	Hambatan	Nilai	Nilai Waktu (NilaixWaktu)	Nilai	Nilai Waktu (NilaixWaktu)
Kereta-Pintu Keluar Area Berbayar	86	79,2	1,1	2,0	1,25	3,5	3,0	5,4
Pintu Keluar Area Berbayar-Pintu Masuk Bangunan Stasiun	110	79,2	1,4	2,0	1,25	4,5	3,0	6,9
Pintu Masuk Bangunan Stasiun-Titik Naik/Turun Angkutan Umum	32	79,2	0,4	2,0	1,25	1,25	3,0	2,0
Total	228		2,9			9,4		14,4
Total Nilai Waktu								14,4

Figure 9. TSA Disembarking Using Public Transport

This table shows the time passengers leave the station using public transportation modes with segmentation from train to Public Transport Boarding/Drop-off Point is 2.9 minutes. Furthermore, after multiplying by these obstacles, the total time pedestrians leave the station by public transport is 14.4 minutes.

Passengers board using public transport

Penumpang Pengguna Moda Angkutan Umum					Berjalan			
					Tidak Membawa		Membawa Beban	
Asal	Jarak (Meter)	Kecepatan (m/menit)	Waktu (menit)	Hambatan	Nilai	Nilai Waktu (NilaixWaktu)	Nilai	Nilai Waktu (NilaixWaktu)
Titik Naik/Turun Angkutan Umum-Ruang Tunggu Luar	150,0	79,2	1,9	2,0	1,25	6,2	3,0	9,5
Ruang Tunggu Luar-Boarding Gates	62,0	79,2	0,8	2,0	1,25	2,5	3,0	3,9
Boarding Gates-Ruang Tunggu Area Berbayar	17,0	79,2	0,2	2,0	1,25	0,7	3,0	1,1
Ruang Tunggu Area Berbayar-Kereta	13,0	79,2	0,2	2,0	1,25	0,5	3,0	0,8
Total	242,0		2,9			9,4		15,3
Total Nilai Waktu								15,3

Figure 10. TSA Ride Public Transport

This table shows the time passengers use to access trains using public transportation modes with segmentation from Public Transport Boarding/Drop-off Points to trains is 2.9 minutes. Furthermore, after multiplying by these obstacles, the total value of pedestrian time accessing the train by public transportation is 15.3 minutes.

Passengers disembark using motorbikes

Penumpang Pengguna Moda Motor					Berjalan			
					Tidak Membawa		Membawa Beban	
Asal	Jarak (Meter)	Kecepatan (m/menit)	Waktu (menit)	Hambatan	Nilai	Nilai Waktu (NilaixWaktu)	Nilai	Nilai Waktu (NilaixWaktu)
Kereta-Pintu Keluar Area Berbayar	86,0	79,2	1,1	2,0	1,25	3,5	3,0	5,4
Pintu Keluar Area Berbayar-Tempat Parkir	65,0	79,2	0,8	2,0	1,25	2,7	3,0	4,1
Total	151,0		1,9			6,2		9,5
Total Nilai Waktu								9,5

Figure 11. TSA Descending by Motorbike

This table shows the time passengers take to leave the station using a private motor mode with segmentation from train to parking lot is 1.9 minutes. Furthermore, after multiplying by these obstacles, the total time pedestrians leave the station by private motor mode is 9.5 minutes.

Passengers ride by motorbike

Penumpang Pengguna Moda Motor					Berjalan			
					Tidak Membawa		Membawa Beban	
Asal	Jarak (Meter)	Kecepatan (m/menit)	Waktu (menit)	Hambatan	Nilai	Nilai Waktu (NilaixWaktu)	Nilai	Nilai Waktu (NilaixWaktu)
Tempat Parkir-Ruang Tunggu Luar	78,0	79,2	1,0	2,0	1,25	3,2	3,0	4,9
Ruang Tunggu Luar-Boarding Gates	62,0	79,2	0,8	2,0	1,25	2,5	3,0	3,9
Boarding Gates-Ruang Tunggu Area Berbayar	17,0	79,2	0,2	2,0	1,25	0,7	3,0	1,1
Ruang Tunggu Area Berbayar-Kereta	13,0	79,2	0,2	2,0	1,25	0,5	3,0	0,8
Total	170,0		1,8			5,7		10,7
Total Nilai Waktu								10,7

Figure 12. TSA Ascending by Motorbike

This table shows the time passengers use to access the train using a private motor mode with segmentation from parking lot to train is 1.8 minutes. Furthermore, after multiplying by these obstacles, the total value of pedestrian time accessing the train by private motorbike is 10.7 minutes.

Passengers get off by car

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Asal	Jarak (Meter)	Kecepatan (m/menit)	Waktu (menit)	Hambatan	Tidak Membawa		Membawa Beban	
					Nilai	Nilai Waktu (NilaixWaktu)	Nilai	Nilai Waktu (NilaixWaktu)
Kereta-Pintu Keluar Area Berbayar	86,0	79,2	1,1	2,0	1,25	3,5	3,0	5,4
Pintu Keluar Area Berbayar-Tempat Parkir	80,0	79,2	1,0	2,0	1,25	3,3	3,0	5,1
Total	166,0		2,1			6,8		10,5
Total Nilai Waktu								10,5

Figure 13. TSA Descending by Car

This table shows the time passengers take to leave the station using a private car mode with segmentation from train to parking lot is 2.1 minutes. Furthermore, after multiplying by these obstacles, the total time pedestrians leave the station by private car mode is 10.5 minutes.

Passengers board by car

Penumpang Pengguna Moda Motor					Berjalan			
Asal	Jarak (Meter)	Kecepatan (m/menit)	Waktu (menit)	Hambatan	Tidak Membawa		Membawa Beban	
					Nilai	Nilai Waktu (NilaixWaktu)	Nilai	Nilai Waktu (NilaixWaktu)
Tempat Parkir-Ruang Tunggu Luar	93,0	79,2	1,2	2,0	1,25	3,8	3,0	5,9
Ruang Tunggu Luar-Boarding Gates	62,0	79,2	0,8	2,0	1,25	2,5	3,0	3,9
Boarding Gates-Ruang Tunggu Area Berbayar	17,0	79,2	0,2	2,0	1,25	0,7	3,0	1,1
Ruang Tunggu Area Berbayar-Kereta	13,0	79,2	0,2	2,0	1,25	0,5	3,0	0,8
Total	185,0		2,0			6,4		11,7
Total Nilai Waktu								11,7

Figure 14. TSA Ascending by Car

This table shows the time passengers use to access the train using a private car mode with segmentation from the parking lot to train is 2 minutes. Furthermore, after multiplying by these obstacles, the total value of pedestrian time accessing the train by private motorbike was 11.7 minutes.

CONCLUSION

Based on the results of the research that has been done, it can be concluded that, the interaction value of the mode integration facility at Madiun Station is calculated using *the Modal Interaction Matrix* method displaying a *negative value result* of -16. The result *of this negative* value is then calculated *Normalized Score* and obtained a value of -160 or included in the bad category according to the normal value range table. Furthermore, after a recommendation for the placement of mode integration facilities, a *Normalized Score* of -80 or included in the good category was obtained. This calculation is based on the existing distance of mode integration facilities at Madiun Station compared to the willingness of the distance of people walking in accessing mode integration facilities. Based on analysis calculations using the *Trip Segment Analysis* method, the greatest time value is on public transportation users when they want to access the station or when they want to leave the station. The value time needed to access the station for public transport users is 15.3 minutes. And it takes 14.4 minutes for Train service users who get off at Madiun Station and want to continue the journey using public transportation.

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