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Evaluation of University Technology Malaysia on Campus Transport Access Management

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***Abstract*—**Access Management is the proactive management of vehicular access points to land parcels adjacent to all manner of roadways. Good access management promotes safe and efficient use of the transportation network. This study attempts to utilize archived data from the University Technology of Malaysia on-campus area to assess the accuracy with which access management display some benefits. Results show that usage of access management reduces delay and fewer crashes. Clustered development can improve walking, cycling and transit travel, reduce parking requirements and improve emergency responses. Effective Access Management planning can also reduce total roadway facility costs by reducing the number of driveways and intersections. At the end after presenting recommendations some of the travel impact, and benefits that can be derived if these suggestions are implemented have been summarized with the related comments.

***Keywords*—**Access Management, Delay, Density, Traffic Flow.

I. Introduction

ACCESS Management is a factor used by transportation professionals for coordination between roadway design and land use to improve transportation. It is defined as, "the process that provides access to land development while simultaneously preserving the flow of traffic on the surrounding road system in terms of safety, capacity, and speed." In practical terms, it means managing the number of driveways that a vehicle may encounter without hampering reasonable access to a property and removing slower, turning vehicles from the arterial as efficiently as possible [1].

Access Management involves changing land use planning and roadway design practices to limit the number of driveways and intersections on arterials and highways, constructing medians to control turning movements, encouraging clustered development, creating more pedestrian-oriented streetscapes, improved connectivity, and road space reallocation to encourage efficiency. Although Access Management is primarily intended to improve motor vehicle traffic flow, it can support TDM by integrating transportation and land use planning, and by improving transportation options [2].

It can help convert automobile-oriented strip development into more accessible land use patterns that are better suited to walking, cycling and public transit.

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II. Aims and Objectives

Aims are general things that people or organizations ultimately want to achieve, such as economic development, social equity, health and safety, and environmental quality.

Objectives are specific ways to achieve goals, such as improved access to education and employment, improved mobility options for disadvantaged people, increased public fitness, reduced accidents, and reductions in pollution emissions. Objectives are often defined as the inverse of a problem. For example, if traffic congestion is a problem then congestion reduction and improved accessibility can be considered planning objectives. A primary goal of this project to see how best the UTM transportation and parking planning is to provide convenient and affordable access to the College's campuses. Various other goals and objectives are defined in the following such as providing a framework for addressing transportation and parking problems, reducing traffic congestion around the campus and the total number of motor vehicles driven to campus, accommodating additional campus development, minimizing impervious surface and preserve greenspace, improving transportation within the context of developing an accessible, sustainable and environmentally conscionable service, improving mobility options to campus and reducing UTM Campus greenhouse gas emissions.

This paper summarizes the main findings from our group. Suggestions are included for supporting the key aspects of filling the gaps. A key theme that runs throughout the paper is that the goal of our group findings is not wide data collection, rather identification of what data and indicators are necessary for the University of Technology Malaysia leaders to make good decisions on sustainable campus transport access management.

III. Methodology

The University of Technology Malaysia (UTM) campus is a mountainous area and it height is between 12 meters and 150 meters from sea level. Located in the middle of the area of UTM is a number of small hills, and there is a small river which is the recreational lake and river in the university. Because of the existing hill in the centre of the university campus, the concept of centralization development was applied.

This was done base on the topography of the university. This concept uses the main road and the ring road to circle all the facilities that have been located mainly in the centre of the university. The mosque which is the top most priority of the university community is located on the top of the hill in the

centre of the university. The location of the mosque is in accordance with the university motto, 'Because of God for Human'.

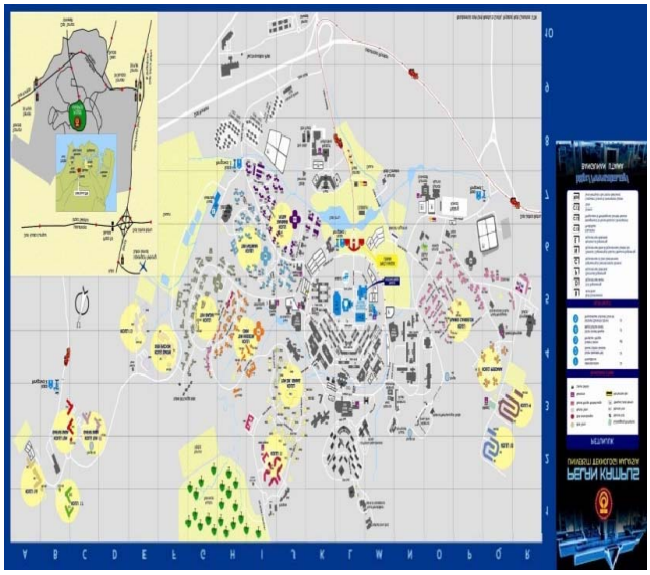

Fig. 1 Map of University Technology Malaysia (UTM)

All the buildings are built at the lower level from the mosque. The other main buildings in the centre of the university are the library of Sultanah Zanariah (Perpustakaan Sultanah Zanariah- PSZ) and the administrative building which are surrounded by the faculty buildings. The student residential colleges are located outside the centre of the university at strategic zones.

UTM campus has a low development density the development direction of the campus is outside the centre of the university. This type of development shows the total separation between the different land uses, such as residential colleges which are located far away from administrative area, faculty buildings, library and other infrastructure.

The separation between the faculty buildings and the residential colleges encourage the uses of personal vehicles. The arrangement of land use in the university is based on zoning where the faculties and administrative buildings are located inside the ring road and residential buildings are located outside the ring road. According to the university campus plan in1995, the physical basic planning concept divided the campus into seven land use zones namely: Academic and Administrative Zone, Student Hostel Zone, Staff Residential Zone, Sport, Recreation, and Social Activity Zone, Commercial Development Zone, Technology Park Zone, Green Area Zone. Table I shows the component of land use zone at the university campus.

A. Academic and Administrative Zone at UTM

The academic and administrative zone is the second biggest development zone in UTM after the student hostel zone.

TABLE I
COMPONENT OF LAND-USE ZONE AT UTM SKUDAI CAMPUS

Land-use Zone	Area (acre)	Percentage (%)
Academic and Administrative	415.64	14.69
Student Health	789.24	27.89
Green Area	1008.40	35.63
Sport, Recreational, and Social Activity	411.16	14.53
Commercial Development	39.00	1.38
Staff Residential	36.46	1.29
Technology Park	130.00	4.59
Total	282990	100.00

This zone is the focal point of UTM's students and staffs. All the 10 faculties in UTM are in this zone besides the other facilities such as library, mosque, hall, cafeteria and others.

B. Student Hostel Zone

In this zone, there are total numbers of 16 hostels also known as residential colleges. It is the biggest development zone in UTM campus covering about 28% of the total area of UTM where the green area zone is not considered as a development zone.

C. Staff Residential Zone

This zone is the smallest zone covering only 36.46 acre or 1.3 percent from the total area of UTM campus. This zone where the UTM staff stay and is built to the south-west area of UTM campus.

D. Green Area and Sport, Recreation and Social Activity Zone

Green Area Zone is an undeveloped area in UTM. This zone is the biggest area in UTM which covers about 1008.4 acres or 36 percent from the total area of UTM campus. Most part of this zone is an active oil palm plantation and part of it is also used for sport, recreation and social activities. This area is a total of 14.53 percent from the total area of UTM campus.

E. Commercial Development Zone

This zone is the second smallest development zone in UTM. The area is 39 acres or about 1.4 percent from the total area of UTM campus. Commercial Development Zone provided to students and staffs with computer, retail, photocopy, and barber shop, food stall, bookstore, hair and beauty salon (only for women) and others. This zone is located near the residential colleges and faculties.

F. Population of UTM

The increasing population of students and staff will generate problems to the campus planning in terms of providing adequate and good quality facilities. In the early 1980s, the original campus development planning of the university only expected to accommodate about 15000 students, but currently, the total number of students in the university is as high as more than 20000 especially between

the years 2000 to 2006 academic session. Although the total number of students is decreasing, still more than what was originally planned for the campus development in 1980. Table II shows the total number of students for the current academic year and the past eight academic years.

TABLE II
TOTAL NUMBER OF STUDENTS IN UTM SKUDAI CAMPUS

Year (session)	No. of Students
2000 - 2001	24695
2001 – 2002	24140
2002 – 2003	23059
2003 – 2004	21983
2004 - 2005	21195
2005 - 2006	20883
2006 - 2007	19595
2007 – 2008	18944
2008 – 2009	29365

G. Road System and Traffic Flow

The main characteristics of UTM traffic and circulation system are the separation between vehicle and pedestrian and the time to walk between academics building is about 10 minutes. The routes in the campus are divided into two types namely as vehicle route and pedestrian route.

The vehicle route is sub divided into three types namely as main road, secondary road and service road. The main road in the campus is the road connecting UTM with Skudai Pontian Highway and Taman University. This road is the main access to the university campus.

Fig. 2 Road connecting UTM and Taman Universiti

The Secondary road in UTM is the road connecting the residential colleges with the faculty and administrative buildings which are located at the centre of the UTM campus. On both sides of the secondary road is provided with pedestrian pathway.

H. Vehicle and Motorcycle Ownership

The ownership level of vehicles among campus community is high. The uses of motorized vehicles will create problems such as traffic jam, air pollution and others to the campus environment. Table III shows the categories of vehicle and motorcycle ownership in the university campus.

TABLE III
OWNERSHIP OF CARS AND MOTORCYCLES

Year (session)	Type of Vehicles			
	Motorcycle		Car	
	Staff	Student	Staff	Student
2001 – 2002	1125	3800	2900	1800
2002 – 2003	590	1100	3000	2200
2003 – 2004	700	3120	3100	3090
2004 – 2005	910	5440	4000	4010
2005 – 2006	1522	1571	6224	3580
2006 – 2007	1330	1295	6308	3551

Within the area of the campus, the limited time for student's vehicle to enter the area within the Ring of Knowledge (Lingkaran Iimu) in the office hour is one of the alternatives implemented by the UTM administrator in order to reduce the traffic problems in the central part of the campus and also lack of parking spaces for UTM staffs. Although the enforcement always implemented by Traffic Unit of UTM, students still drive and ride and enter the Ring of Knowledge (Lingkaran Iimu) during the office hour, park their vehicles at the parking space provided strictly for staffs. This situation cause the student receive the summon ticket from the Safety Union of the university Table IV shows the number of accident related cases in the university campus.

TABLE IV
STATISTIC OF ACCIDENT WITHIN UTM SKUDAI AREA

Year (session)	Type of Vehicles		
	Motorcycle	Car	Bus
2001 – 2002	20	28	2
2002 – 2003	34	36	1
2003 – 2004	38	34	1
2004 – 2005	30	21	1
2005 – 2006	66	50	0
2006 – 2007	34	22	0

I. Pedestrian Pathways

The current condition of pedestrian pathway in UTM campus is dissatisfied. This can be proven with only few places provided with perfect and complete pedestrian pathway while the other places are not. Some of the place even not provide with pedestrian pathways. Besides, the pedestrian pathway also got a few problems such as not connecting with each other, and not provided with enough shading. In some part of the roads sign boards built in the middle of the pedestrian pathway this affects the pedestrians to have quick and direct access to the path ways.

J. UTM Bus Service

Currently buses are the primary mode of public transport for students to and from lectures area with significant volumes of buses travelling to and from the area on a daily basis. UTM bus service is predominately provided by UTM

administration. There is one main bus terminal at the campus centre which almost all of the buses use. This bus terminal is conveniently located adjacent to the Faculty of Built Environment (FAB), approximately 100 meters from the site of the mosque, library, administrative building and the various faculties.

These buses were used to connect the residential colleges with the academic area. The total number of buses is 20 units. The service is run daily except public holiday within the campus. The service still run on weekend and semester break but the service is limited. There are four types of UTM bus route offering the service to different residential colleges. Although the travel is different, the route still entering the Ring of knowledge (Lingkaran Ilmu) as a main bus route and the bus stop in front of Faculty of Built Environment (FAB) is the main bus stop.

Besides that, there are many bus stops within the university grounds linking all student hostels and staff quarters to the centre of the campus (ring of knowledge).

As a whole, UTM bus service almost covering all the residential colleges except college 11. However, bus services at night are only at 7.50 p.m., 8 p.m., 10 p.m., and the last bus service is at 11 p.m. The bus service to outside campus is only to Taman University and only on weekends.

K. Traffic Counts at UTM

We undertake traffic counts at two locations, UTM main entrance from Taman University and the main entrance from Seri Pulai to UTM.

The traffic flow were undertaking for both the morning peak hours (8:00 am – 9:00 am) and the evening peak hours (5:00 pm – 6:00 pm) and the total traffic generated into (inbound) and out (outbound) are summarized as shown in Table V.

TABLE V
INBOUND AND OUTBOUND- MORNING AND AFTERNOON PEAK HOURS

Type of Vehicles	Mode			
	Inboard		Outboard	
	Morning	Evening	Morning	Evening
Car	864	370	290	930
Motorcycle	338	233	179	440
Bus	8	6	6	9
Light Vehicle	77	29	47	59
Truck	19	2	16	17
Total	1306	640	538	1455

A summary comparison was then made between the total traffic flow for both inbound and out bound in the morning and evening peak hours and the result are as shown in Table V. As seen in table above we can see that there are more vehicles entering into the UTM campus in the morning peak hours than the ones leaving. This shows that there will be more traffic congestions in the morning peak hours than the evening peak hours.

IV. CONCLUSION AND RECOMMENDATIONS

University of Technology Malaysia faces various transportation access and vehicle parking challenges, including rising traffic and parking congestion, rising students and staff population, and limited number of bus services. It is impractical to expand local roadways or parking supply. There are currently no plans or funds for such projects, they would face considerable stakeholder opposition, they would take years to implement, and the added capacity would fill with generated traffic resulting in modest benefits.

This study indicates that per capita peak period trips and parking demand must be reduced 20-40% over the next decade to avoid severe traffic and parking problems and accommodate planned growth. Various trends (aging population, rising fuel prices, shifting consumer preferences, increasing environment and health concerns, etc.) and government policies (pedestrian and cycling plans, regional public transit improvements, fuel and road pricing, etc.) will help achieve these targets.

However, UTM will need to change its policies and implement new programs to achieve these objectives. No single strategy is sufficient. A variety of policies and programs will be needed to improve travel options and give commuters incentives to use more efficient modes. Improvement to public transit services, rideshare programs, cycling, walking and carsharing services, and special programs such as intercampus shuttles can help reduce trips.

Achieving demand reduction targets will also require reforming the current policy of offering free employee parking and no comparable benefit for other commute modes. In addition, parking fees can be adjusted to increase efficiency, with higher fees at congested times and locations, and discounts at off peak periods and less convenient locations.

This study analyzes current conditions, defines problems, evaluates potential solutions and provides specific recommendations for improving transportation access management and parking. This lays the foundation for a specific action plan. Such a plan can be flexible and responsive – including some to be implemented immediately and others that should be deployed as needed to achieve specific targets and address future problems. These policies and programs face various obstacles. These can be overcome by emphasizing the need for change and the positive.

This section provides specific recommendations for improving University of Technology Malaysia (UTM) transportation access management.

A. Change Management

Why: Many of the specific transportation and parking improvements recommended in this paper require changing current practices to allow new solutions and more integrated programs.

How: Here are some specific institutional reforms needed to effectively address UTM campus transportation access management and parking problems.

A paradigm shift in how transportation and parking problems are defined and solution evaluated. Emphasize more

efficient use of existing road and parking resources instead of expanding facilities whenever feasible and cost effective. Conventional solutions, such as expanding roads and parking facilities, and subsidized or cheap parking, tend to help solve one problem but exacerbate others by stimulating vehicle ownership and use.

Alternative solutions, such as improving travel options and efficient parking pricing, tend to provide a wider range of benefits. As a result, more comprehensive analysis tends to favor demand management solutions over capacity expansion.

New price structures and incentives. The campus currently offers free parking to all employees but no comparable benefit for users of alternative modes. These practices will need to change for more efficient and equitable transportation.

Changing the way people think about alternative modes, so walking, cycling and public transit are given as much support as automobile transportation.

These changes are occurring due overall social and economic trends, but can occur faster and with less conflict if given more administrative support. For example, if a commitment is made now to gradually and predictably raise parking fees over the next five years, individuals and planners can incorporate these changes into decisions that affect their future parking demands, such as where to live and which vehicle to buy.

B. Transportation Management Program (TMP)

Why: Many of the transportation and parking management strategies recommended in this study require ongoing administrative support. A Transportation Management Program provides an institutional framework for such activities.

How: Define a Transportation Management Program (TMP) within Ancillary Services. It will be responsible for overall transportation planning and advocacy, parking planning and operations, and the following activities and programs:

Parking cash out or subsidized transit passes, Rideshare matching and promotion services, Guaranteed ride home programs, Secure bike storage and bike to work week promotions, Telework and flexible work hours, Special event transportation and parking management, Carsharing and campus vehicle pools (including evaluation and operation of efficient and alternative fuel vehicles if appropriate), Pedestrian and cycling improvements, Information and encouragement to try alternative modes, Multi-modal access information and way finding (signs and maps), Transport data collection and evaluation and Professional development.

C. Improving Transportation Options by Walking and Cycling

Why: Walking is the most basic form of transportation. Improved walking conditions may shift some trips from driving to walking, and supports use of ridesharing and public transport. In many situations, the most effective to encourage public transit travel is to improve walking conditions in destination areas. Many surveys and workshop attendees complained about poor walking conditions and supported walkability improvements.

Many surveys and workshop attendees complained about poor cycling conditions and supported cycling improvements. Cycling is an appropriate mode for trips of 0.5 to 5 kilometers.

How: Partner with municipal transportation agencies and other stakeholders to perform a pedestrian audit to identify obstacles to walking and improvement options around UTM campus. Establish targets and funding to implement improvements. Establish a pedestrian advisory committee to support and oversee these audits and improvements.

Partner with municipal transportation agencies and other stakeholders to perform a cycling audit to identify obstacles to cycling and improvement options on streets around UTM campuses. Establish targets and funds for implementing improvements. Establish a cycling advisory committee to support and oversee these audits and improvements.

D. Carsharing and Taxi Services

Why: Carsharing (vehicle rental services designed to substitute for private vehicle ownership) and taxi services (such as campus payment of taxi rides) can help reduce personal vehicle ownership and use.

How: Arrange to have carshare vehicles parked on campus for use by students, employees and nearby residents. Arrange for convenient and affordable taxi service when needed for errands and emergencies.

E. Telework

Why: Telecommunications can substitute for some trips. Some surveys and workshop attendees recommended telework improvements and incentives.

How: Establish telework policies and support services. Establish high quality video conference capability at each campus. Encourage administrators, instructors and campus organizations to use video conferences as a substitute for physical travel.

Access Management activities can have a number of impacts. Changing vehicle access can harm some businesses and property owners, while benefiting others. Benefits include smoother vehicle flow, reduced delay and fewer crashes. Tables VI, Table VII and Table VIII give some of the travel impact, and benefits that can be derived if these suggestions are implemented. Rating is from 3 (very beneficial) to –3 (very harmful). A 0 indicates no impact or mixed impacts.

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TABLE VI
TRAVEL IMPACT SUMMARY

Objective	Rating	Comments
Reduce Total Traffic	1	May include features that reduce vehicle travel, but other features increases total traffic
Reduce Peak Period Traffic	0	No impact
Shift Peak to off-Peak Periods	0	No impact
Shifts Automobile Travel to Alternative Modes	1	Can improve non motorized travel conditions and transit service
Improves Access Reduces the need for Travel	1	May include land use features that improve access
Increased Ridesharing	0	No impact
Increased Public Transit	2	May improve transit service
Increased Cycling	1	May improve cycling conditions
Increased Walking	1	May Improve walking conditions
Increased Telework	0	No impact
Reduce Freight Traffic	0	No impact

TABLE VII
BENEFIT SUMMARY

Criteria	Rating	Comments
Treats Everybody Equally	-1	Some vehicle owners may feel unfairly treated
Individuals Bear the Costs They Impose	1	Reduces some externalities (congestion and crash risk)
Progressive with Respect to Income	0	No impact
Benefits Transportation Disadvantaged	1	Can improve walking cycling and transit
Improve Basis Mobility	1	Can improve alternative modes and emergency access

TABLE VIII
EQUITY SUMMARY

Objective	Rating	Comments
Congestion Reduction	2	Improve arterial flow may encourage alternative modes
Road and Parking Saving	1	Clustering can reduce road and parking requirements
Consumer Saving	0	No impact
Transport Choice	1	Improves nonmotorized and transit transport
Road Safety	2	Reduce crash risk
Environmental Protection	1	Clustering can reduce automobile travel and pavement area
Efficient Land Use	1	Can encourage more transportation efficient land use
Community Livability	2	Can reduce local traffic impacts and improve pedestrian conditions

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