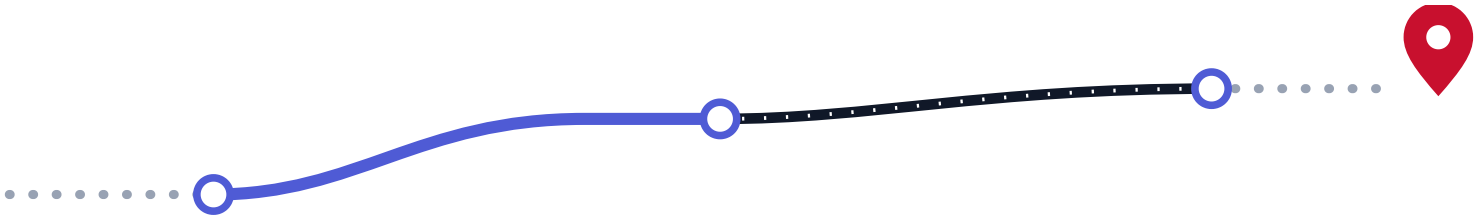
MALAYSIA TRANSIT + SG-JB TRANSIT

TECHNICAL WHITE PAPER · NOVEMBER 2026

Journey planning with MOTIS and GrabMaps

Why Malaysia Transit and SG-JB Transit left Google Maps Platform, how the open-source MOTIS journey planner and GrabMaps place search work, how they compare with OpenTripPlanner and Google, and what they cost.



9–110 ms
to plan a journey, on our own server, from every timetable the apps show

1.5 GB
of memory for the whole planner, beside the live apps on one small server

95%
less than Google Maps Platform at 100,000 journeys and searches a month

Appendix E of the white paper **Malaysia Transit and SG-JB Transit**

Version 1.0 · 27 November 2026

AT A GLANCE

Journey planning with MOTIS and GrabMaps

Since 27 November 2026, every journey on Malaysia Transit's and SG-JB Transit's websites and apps is planned by MOTIS, an open-source journey planner we run on our own server, and every place search is answered by GrabMaps, through Amazon Location Service. Together they replaced Google Maps Platform, whose terms don't allow its results on our own maps, and whose bill grows with every rider.

27
timetables MOTIS plans on: 15 from data.gov.my, 10 of our own, Singapore's buses and trains

25
test journeys against Google: MOTIS quicker on 15, one of them a trip Google couldn't plan, and level on 1

35 s
to load the night's fresh timetables, checked with a test journey before use

US$70
for 100,000 place searches a month, against about US$990 with Google's Places UI Kit

In five points

- **Allowed on our maps.** MOTIS is ours to run (MIT licence), and Amazon's terms allow GrabMaps' results on any map. Google's terms don't allow its results on a map that isn't Google's.
- **Plans on our own data.** Every timetable the apps show, including the ones we put together: Causeway Link's AA1, S19, SRT's shuttle to Hat Yai, KLIA Ekspres, the Penang ferry, and Singapore's buses, MRT and LRT.
- **Small and fast.** One program capped at 1.5 GB of memory, answering in 9 to 110 milliseconds. OpenTripPlanner keeps everything in memory, and would have strained our server.
- **At least as good.** As quick as or quicker than Google's on 16 of 25 test journeys, including Seremban to KL Sentral, which Google couldn't plan.
- **A fraction of the cost.** Nothing per journey; US$0.20 per 1,000 place suggestions and US$0.50 per 1,000 lookups, against US$2.83 to US$20 per 1,000 for Google's.

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BACKGROUND

Why we left Google Maps Platform

Google planned our journeys and found our places for years. Its terms never fitted products with their own maps, and its bill was set to grow with every free rider.

1 What Google did for us

FEATURE	GOOGLE SERVICE	USED BY
Planning a journey	Directions API: a transit search with alternatives, walking legs, and extra searches to piece together the S19, SRT and Causeway Link corridors by hand	Both websites and both apps
Search as you type	Places Autocomplete	Both websites and both apps
The chosen place's position	Place Details	Both websites and both apps
Naming a point on the map	Reverse geocoding and Place Details	Both websites and both apps
A typed address to a position	Geocoding API	The developer API and the chatbot
Route lines along the roads	Directions API (replaced first: the companion paper *Enhanced route lines from OpenStreetMap*)	Both live maps

The apps never called Google themselves: they draw with MapLibre and ask only our servers. So everything could be replaced on the two servers, and the websites and apps kept working unchanged.

2 The terms

On 26 November 2026 we read Google Maps Platform's terms as they stood (the Service Specific Terms of 24 November 2026) against how both products used Google. For every service we used, the terms say Google's content "must not" be used "in conjunction with a non-Google map". Our websites draw with Leaflet on an OpenStreetMap map, and the apps with MapLibre.

SERVICE	NOT WITH A NON-GOOGLE MAP	WHAT MAY BE CACHED
Directions	Section 4.2	Latitudes and longitudes only, for 30 days (4.3)
Places	Section 14.2	Latitudes and longitudes only, for 30 days (14.3)
Geocoding	Section 6.2	30 days; longer only per end user (6.3)
Places UI Kit	Allowed "with or without any map" (15.1)	We would answer for not exporting its content or making content from it (15.3)

The review found five problems, the most serious first:

1. **Google's results drawn on non-Google maps**, on both websites and in both apps.
2. **Google-made route lines kept for good** in four of our timetables, and in a permanent cache on SG-JB Transit's server. The general terms forbid storing Google's content or building new content from it (section 3.2.3).

3. **Passing Google's results on.** Malaysia Transit's public tools for AI assistants offered journey planning and place search to any client.
4. **Keeping results too long:** plans cached for up to 10 minutes as whole answers, journey legs for 30 minutes, and share links for 7 days.
5. **No Google credit** where its results showed.

Breaking the terms lets Google suspend access. If it did, everything Google-backed would stop at once: the journey planner, place search, geocoding and the AI tools, and possibly other projects on the same Google account. And a business partner can't take Google-derived routes or data from us, which closes off working with others on the planner's results.

3 The bill

Google gives each paid service a free monthly allowance, then charges for every 1,000 calls:

FOR	GOOGLE ITEM	FREE EACH MONTH	THEN, PER 1,000
Journey planner	Directions (Essentials)	10,000	US$5.00
	Directions Advanced (Pro)	5,000	US$10.00
Suggestions as you type	Autocomplete requests	10,000	US$2.83
The chosen place	Place Details: Essentials, Pro, Enterprise	10,000 / 5,000 / 1,000	US$5 / 17 / 20
Address to position	Geocoding	10,000	US$5.00
Places UI Kit	Autocomplete, per session; Query	10,000 each	US$10.00; US$1.00

Google Maps Platform's pricing list, read on 27 November 2026: the first paid tier after the free allowance.

At today's traffic the bill was small. But one journey search made several Directions calls (the main transit search, the walking legs, and the corridor searches), and both products are free for riders: a cost per search grows with every new rider and earns nothing back. The RTS Link between Johor Bahru and Singapore would bring far more people to the planner.

4 What we needed

- **For journeys:** allowed with our own maps, with results we may keep and share; plans on every timetable the apps show, our own included, across Malaysia, Singapore and Hat Yai; door to door, walking along real streets; fast enough for a phone; free for commercial use, maintained, with a documented API.
- **For the server:** fits beside the live apps on one netcup VPS (8 CPUs and 15 GB of memory, about 6 GB of it free on 26 November 2026, with swap already in use), so 1 to 3 GB at most, and refreshes its data without taking the apps down.
- **For places:** good on Malaysian and Singaporean places (shops, malls, condominiums, offices, bus terminals), in several languages; allowed with our maps; cheap per search; answered through our server as before, so the websites and apps need no change.
- **For riders:** nothing to notice but better answers: the same journey cards, fares, ways to pay and live times, in 13 languages.

THE PLANNER

MOTIS: the journey planner

MOTIS is an open-source journey planner from the research world, built to plan across whole countries on modest hardware. It reads the same open timetables and map the apps already use.

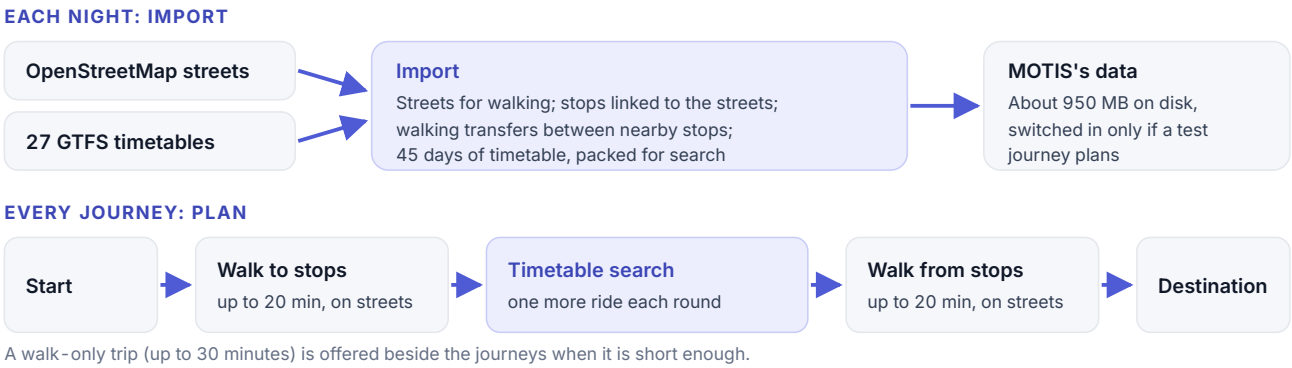
5 MOTIS, in brief

MOTIS began at the Technical University of Darmstadt in Germany, in Professor Karsten Weihe's algorithms group, as a research journey planner developed with Deutsche Bahn and the consultancy datagon. Its name first stood for "Multi Objective Travel Information System"; its own documentation now calls it the "Modular Open Transportation Information System". It became open source in 2020, and was rewritten from 2023 as MOTIS 2 (version 2.0 in December 2024), led by Felix Gündling of TU Darmstadt, whose company triptix offers support and hosting for it. It is written in C++ and published under the MIT licence. The version we run, 2.11.4 of 21 October 2026, was the newest release when this paper was written.

PART	WHAT IT DOES	LICENCE
nigiri	The timetable and the transit search	MIT
osr	Routing on OpenStreetMap's streets: walking, wheelchair, bike and car, with indoor levels and lifts	MIT
cista	Storing all of it as compact binary data the server reads straight from disk	MIT
adr	Place search and naming points (switched off in our setup)	AGPL 3.0
tiles	Map tiles from OpenStreetMap (not used: our maps have their own)	MIT

Proven at scale. MOTIS powers Transitous, a free, community-run journey planning service started at the FOSDEM conference in 2024. By early 2025 it covered 94 regions with 1,417 timetables and 167 live feeds, and apps such as GNOME Maps, KDE Itinerary and Träwelling plan with it. Its public service is for open-source, non-commercial apps only, which is why we run our own copy (section 7).

6 How MOTIS plans a journey



A walk-only trip (up to 30 minutes) is offered beside the journeys when it is short enough.

MOTIS's two halves: an import that packs streets and timetables into its own data, and a search that answers each journey from that data in milliseconds.

The **import** reads the OpenStreetMap extract and every timetable, and builds MOTIS's own data: the street network for walking, each stop matched to the streets beside it, walking transfers between nearby stops routed along the streets, and the timetable for the days asked for. Each trip's running days are kept as a row

of bits, so a year of timetable costs little more memory than a month. The data is written as binary images the server reads straight from disk, partly through memory-mapped files, without unpacking them first. That is why the server runs in a few hundred megabytes.

The **search** answers each journey from that data:

1. **First and last mile.** From the start, it walks along the streets to every stop within the time allowed (20 minutes in our setup), and does the same backwards from the destination. A walk-only trip is offered too, when it is short enough.
2. **Round by round.** The timetable search comes from the RAPTOR family (round-based public transit routing, Delling, Pajor and Werneck, 2012). Round one finds the earliest arrival at every stop with one ride; each further round adds one more ride, scanning only the routes through stops that improved in the round before, then the walking transfers from them. A journey is kept only if no other beats it on both arrival time and number of changes, so the answer is a short list of real choices: the quickest, and those with fewer changes.
3. **Across the whole hour.** The search runs over the search window (an hour in our setup), so a rider is offered the good departures in that hour, not just one.
4. **Legs, with their lines.** Each journey comes back as walks along the streets and rides with their route, stops, times and line.

MOTIS also reads timetables in NeTEx, live updates (GTFS Realtime, SIRI and others) and bike and scooter sharing (GBFS). Our setup needs none of these today.

7 MOTIS against the alternatives

OpenTripPlanner, the best-known open-source planner, was the first idea. On 26 November 2026 it was compared with everything else on offer, on licence and cost, memory, features, whether it would fit our server, and the work involved:

OPTION	LICENCE AND COST	MEMORY AND SERVER	VERDICT
MOTIS 2, self-hosted	MIT: free, commercial use allowed; credit OpenStreetMap	Measured: import 1 min 16 s at a 2.7 GB peak, then about 365 MB to run	Chosen
OpenTripPlanner 2, self-hosted	LGPL: free	Keeps all its data in memory: its documentation puts all of Finland at a little over 10 GB	Too heavy for our server
Transitous (hosted MOTIS)	Free, but only for open-source, non-commercial apps, and it may stop serving any app	Nothing to run	Ruled out by its usage policy
Valhalla, GraphHopper	Open source	—	Strong for walking and driving, weaker for timetabled transit: walking routers only

OPTION	LICENCE AND COST	MEMORY AND SERVER	VERDICT
Our own planner engine	Ours	—	Possible (there was one before Google), but it would rebuild what MOTIS does
Paid routing services	Per request	Nothing to run	The same per-request bill and terms questions as Google
Keep Google Directions	US$5.00 per 1,000 after 10,000 free	Nothing to run	Not allowed with our maps

Why not OpenTripPlanner

OpenTripPlanner is the best-known open-source planner. It was started in 2009 with funding from Portland's transit agency, TriMet, is written in Java and published under the LGPL, and runs national journey planners for Entur in Norway and Digitransit in Finland. Its second version (2020), led by Entur, brought a RAPTOR-based transit search. It is mature and well documented. But it keeps all its data in memory, and its own documentation puts all of Finland at a little over 10 GB, and Germany at 95 GB: more than our server could spare beside the live apps. MOTIS imported our whole region at a 2.7 GB peak and serves it in a few hundred megabytes.

Two comparisons published elsewhere point the same way:

- **Switzerland (SKI+, for the Federal Office of Transport, November 2025).** Of nine open-source routers, MOTIS and OpenTripPlanner were tested in depth on 124 Swiss use cases. MOTIS fully supported 81% of them, against OpenTripPlanner's 62% (91% against 76% on average fulfilment), and answered them faster on average (317 against 402 ms). The study found both suitable, with no clear speed winner on comparable hardware: OpenTripPlanner more mature, MOTIS more adaptable.
- **Great Britain (TransCAPI, October 2026; a company's own report).** Moving from OpenTripPlanner 2.9 to MOTIS 2.11 took serving memory from about 26 GB to about 2.4 GB (plus memory-mapped files), the build from about 37 GB to a 9.5 GB peak in about 7 minutes, and the median search from 5.5 to 0.7 seconds. MOTIS gave the better journey in 243 of 400 test journeys, OpenTripPlanner in 42, though the author notes OpenTripPlanner was short of memory there.

Where OpenTripPlanner is ahead: a longer record as a national planner, a larger community and more documentation. For one small server, MOTIS's memory use decided it.

The others

- **Navitia** (Hove, France): its maker announced in 2023 that it would limit access to the source code of new versions.
- **R5** (Conveyal): built for accessibility analysis and scenario planning, not for riders' journeys.
- **Valhalla and GraphHopper:** excellent street routers with limited timetable support (Valhalla's transit mode can't plan "arrive by"); the Swiss study dropped GraphHopper after its first phase.

8 Our MOTIS setup

- **Where:** the netcup VPS that runs both products, in a container named `motis` running MOTIS 2.11.4 from its official 69 MB image, pinned to one exact build. It is capped at 1.5 GB of memory and 2 CPUs, restarts by itself, and is reachable only from the apps' private network on the server, never from the internet.

- **Streets:** Geofabrik's Malaysia–Singapore–Brunei OpenStreetMap extract with Songkhla province merged in (section 9): 261 MB.
- **Data on disk:** about 950 MB, with the previous day's copy kept beside it.

The 27 timetables

FROM	TIMETABLES
data.gov.my (15)	KTMB; BAS.MY in Alor Setar, Ipoh, Johor Bahru, Kangar, Kota Bharu, Kuala Terengganu, Kuching, Melaka and Seremban (two); Prasarana's Rapid KL buses, Rapid KL trains, MRT feeder buses and Rapid Penang
Ours (10)	Causeway Link, and its AA1 airport bus (the only bus to Senai Airport); the Singapore cross-border buses; City Public Link S19; SRT's Padang Besar–Hat Yai shuttle; KLIA Ekspres and KLIA Transit; the Penang ferry; BAS.MY Kuantan; Bas Muafakat Johor, in Johor Bahru and the rest of Johor
Built from LTA DataMall and OpenStreetMap (2)	Singapore's buses, and Singapore's MRT and LRT (section 9)

Readying the timetables

MOTIS reads timetables strictly, and plans only on dates a timetable's calendar covers. A preparation step repairs what it can before every import, and prints what it changed:

- **Calendars run on for 60 days.** Several feeds end within days or weeks: Ipoh's and Seremban's on data.gov.my give a calendar for today only.
- **Intercity rail left out** (KTMB's ETS, Ekspres Rakyat Timuran and Intercity shuttles): the planner offers commuter journeys, with fares it knows.
- **Route numbers:** Ipoh's and Seremban's feeds put a description where the route number goes, and the number in the route's id.
- **Strict-reader repairs:** service names matched to the calendar whatever their case, stations used as stops made stops, and times that run backwards reported.

The settings that matter

SETTING	OURS	WHAT IT MEANS
Days loaded	45, from today	Journeys can be planned up to six weeks ahead
Walking transfers	Along the streets, up to 15 minutes	Changing between nearby stops follows real footpaths, not straight lines
Least time to change	2 minutes	Where a timetable doesn't say
Walking links between stops	Within 100 m	Stops this close are joined by a walking transfer
Stops matched to streets	Within 25 m (250 m worked out ahead)	How far a stop may be from the street it is matched to for walking
Route shapes	Kept	A timetable's own lines are kept for each ride
Place search, live updates	Off	GrabMaps finds places; data.gov.my publishes no delay predictions to feed in

The nightly refresh

Every night at 04:15 Malaysia time (03:15 in Europe's summer), a script fetches data.gov.my's feeds (keeping the last good copy of any that fails), takes our own timetables from the running Malaysia Transit server and Singapore's data from SG-JB Transit's, rebuilds Singapore's two timetables, readies them all and imports them into a copy of MOTIS's data. MOTIS switches to the new data only if the import worked, and switches back if it then can't plan a test journey from KL Sentral to KLCC. An import of new timetables alone takes about 35 seconds at a 1.2 GB peak; with new streets, about 1½ minutes at a 2.7 GB peak. No import starts with less than 3.5 GB of memory free.

9 Singapore and southern Thailand

Neither place had what MOTIS needs out of the box, so we built it.

Singapore's buses

LTA DataMall publishes each service's stops, its first and last buses, and how often it runs in four parts of the day, but no timetable. So trips run from the first bus to the last, at the middle of LTA's range for that part of the day ("09–16" minutes becomes every 12½); AM peak 06:30–08:59, AM off-peak 09:00–16:59, PM peak 17:00–19:29, and PM off-peak the rest. Times along the route come from LTA's distances at 25 km/h, at least a minute a stop. Weekdays, Saturdays and Sundays run apart, and public holidays on Sunday times. Result: **584 services and 152,170 trips**. Services 160, 170, 170X and 950 come from our cross-border timetable instead.

Singapore's MRT and LRT

LTA publishes station codes and order, but no timetables or positions. So each line's stations, in order, and their positions come from OpenStreetMap's route relations, and trains run at the usual headways: every 3 minutes in weekday peaks (07:00–09:00, 17:00–20:00), 5 otherwise and 6 after 20:00; LRT every 4, 6 and 8; the Changi Airport branch every 7. First trains 05:30 (06:00 on Sundays and holidays), last 23:45 from each end; 45 km/h between stations (LRT 30), plus half a minute at each. Result: **9 lines and 434 platforms**, each drawn along its track. The Jurong Region Line joins when it opens.

- **These are typical services, not real timetables.** A planned Singapore journey is right on route and roughly right on time. The live bus arrivals shown with it come from LTA's own predictions.
- **Hat Yai.** Thailand's streets weren't in our map, so a trip could reach Hat Yai's station but not a point in town. Songkhla province (Hat Yai and Songkhla) is cut from Geofabrik's Thailand extract and merged into ours, so Kangar to Hat Yai town now plans door to door, by bus R11 and SRT's shuttle.
- **The border.** SG-JB Transit's server adds the time to clear immigration at the Causeway and the Second Link to every journey that crosses.

10 How our server uses MOTIS

The websites and apps never talk to MOTIS. They ask our servers, which ask MOTIS and turn its answer into the journeys riders see.

STEP	WHAT THE SERVER DOES
Ask	One plan request (`/api/v6/plan`) from the start to the destination, leaving at or arriving by the time asked, over a one-hour search window, with up to 20 minutes' walk at each end and up to 30 minutes for a walk-only trip.

STEP	WHAT THE SERVER DOES
Choose	MOTIS gives every good journey in the hour searched: 28 for Tampines to HarbourFront at 08:30, with a train every few minutes. The server keeps those arriving soonest (leaving latest, for "arrive by"), at most two of each combination of routes so other ways still show, and drops any journey more than twice as long as the shortest, or more than 30 minutes longer, whichever allows more. (With AA1 hourly, Senai Airport to Eco Galleria once also offered a 763-minute overnight trip through Singapore beside a 155-minute one.)
Hard-to-place points	A point MOTIS can't place on its street map, such as a footway inside a mall that doesn't join the streets, is planned from the nearest stop within 700 m, with a straight walk to it.
Same shape as before	The answer is turned into the shape Google's answers had (walking and transit steps), so the planner's route matching, stops, fares, filters and sorting stay exactly as they were, and the websites and apps needed no change.
Draw	Each ride is drawn along its route's Enhanced line from OpenStreetMap (the companion paper *Enhanced route lines from OpenStreetMap*), as the route views draw it.
Add	Fares in ringgit and Singapore dollars (with Causeway Link's free-transfer rule), how to pay on each operator, live times and approaching buses on top of the plan, share links, and the hand-off between the two apps.

The switch is a setting on each server. Until Google's code is deleted, removing one setting brings Google back with a redeploy, as a way back if anything goes badly wrong.

11 Results

The trial (26 November 2026)

MOTIS 2.11.4 on the VPS, capped at 3 GB and 2 CPUs at low priority, with the Malaysia–Singapore–Brunei map and 23 timetables. The import took **1 minute 16 seconds** at a 2.7 GB peak and 918 MB on disk; the server then used about **365 MB** and answered each journey in **9 to 110 milliseconds**. It was as good as or better than the Google-based planner on most of 22 test journeys, and planned directly on our own timetables, the ferry, S19, Causeway Link and SRT's shuttle among them. What it got wrong at first came from our data, not from MOTIS:

IN THE TRIAL	CAUSE	FIX
KLIA T1 to KL Sentral offered the next day's 05:00 train	Our KLIA timetable held one sample train per direction	All 305 trains (118 KLIA Ekspres, 187 KLIA Transit): 08:39 by KLIA Ekspres, 30 minutes
No Penang ferry trips	Service names in two cases; a calendar that ended on 31 December 2025; terminals marked as stations	Rebuilt from the ferry's schedule with all three fixed
Komtar to Penang Airport by bus 302 (117 minutes)	The test's airport point was off the terminal	At the terminal MOTIS offers 401E and 102
No trip to a point in Hat Yai	Thailand's streets weren't in the map	Songkhla merged in: Kangar to Hat Yai town plans door to door
No trip from a point inside Ipoh Parade	The point couldn't be placed on the street map	Planned from the nearest stop within 700 m

IN THE TRIAL	CAUSE	FIX
Calendars ending too soon	Today-only calendars; KTMB's ending 10 December, Rapid Penang's 20 December	Calendars run on for 60 days before each import
Causeway Link trips after midnight ran backwards	Times written 00:xx instead of 24:xx	Fixed in the build script (28 trips)

Fixing our timetables for a strict planner also fixed the live sites' departure pages, which read the same files.

Against Google (Friday 27 November 2026, from 08:30)

JOURNEY	MOTIS	GOOGLE	ROUTES
KL Sentral → Suria KLCC	**19**	30	Kelana Jaya line (both)
Bangsar South → Mid Valley	**25**	37	
SS2 Petaling Jaya → Bukit Bintang	**52**	55	T816, Kajang line (both)
KLIA T1 → KL Sentral	**30**	35	KLIA Ekspres (both)
Shah Alam Seksyen 7 → KL Sentral	**75**	106	753, 750; Google: LRT
Kajang → Putrajaya Sentral	**63**	76	
Seremban → KL Sentral	**122**	error	N50, N57, KLIA Ekspres
Komtar → Penang Airport	67	**50**	401E (102 also offered, 52); Google: 102
Penang Sentral → Weld Quay	**19**	39	Ferry (both)
Batu Ferringhi → Komtar	**43**	45	102 (both)
Bukit Mertajam → Penang Sentral	56	**45**	701; Google: CT14, KTM
JB Sentral → Larkin Sentral	29	**22**	CW2 (both)
JB Sentral → Kranji MRT	**21**	26	160; Google: 170X
Taman Universiti → JB Sentral	64	**53**	J31, J30; Google: P211, J30
Kulai → JB Sentral	**64**	99	J30; Google: P411, J30
Kuching Waterfront → Kuching Sentral	**14**	36	Q15; Google: Q14
Serian → Tebedu	62	**60**	S19 (both)
Ipoh station → Ipoh Parade	**10**	12	A33B (both)
Melaka Sentral → Jonker Street	22	22	M22; Google: M13
Kangar → Hat Yai town	187	**176**	R11, SRT shuttle; Google adds R105
Kangar → Hat Yai Junction	179	**169**	The same
KB Mall → Kota Bharu bus terminal	29	**27**	D50 (both)
Pasar Payang → UMT Kuala Terengganu	**60**	66	T10 (both)
Kuantan Sentral → East Coast Mall	41	**26**	C30, C50; Google: C33
Alor Setar station → Aman Central	**12**	18	K50; Google: K30

Minutes door to door; the quicker in bold. MOTIS was quicker on 15, level on 1, and Google quicker on 9, by 2 to 17 minutes.

- **Seremban to KL Sentral** isn't a fault. While the line is upgraded, KTMB's own timetable runs Seremban Line trains through Seremban only at peak times (5 each way on weekdays, northbound 05:56–07:21,

and 2 at weekends). MOTIS takes them when they run, and otherwise a bus and KLIA Ekspres. Google returned an error.

- **To Penang airport**, MOTIS also offers the 102 (52 minutes) but lists the 401E first, because it arrives earlier.
- **In Kuantan**, Google's C33 runs past Stadium Darul Makmur, while in the Kuantan timetable our maps show, the C33 from that stop heads into town, so MOTIS doesn't offer it.
- **Where Google is quicker elsewhere**, it mostly takes another route (CT14 and KTM from Bukit Mertajam, P211 from Taman Universiti, R105 towards Hat Yai), or a timetable's stop positions slow the trip, as P101's do at JB Sentral. Those are now ours to look into and improve, which Google's data never was.

PLACE SEARCH

GrabMaps: finding the places

A journey starts with a place a rider types: a mall, a condominium, a clinic, an address. GrabMaps knows South-East Asia's places, and its terms let us show them on our own maps.

12 GrabMaps, in brief

GrabMaps is the map of Grab, South-East Asia's ride-hailing and delivery company. Grab began building it in 2017, launched it as a service for businesses in June 2022, and runs its own apps on it. Its data comes from Grab's own community: millions of rides and deliveries a day, its driver and delivery partners (some paid to collect places, street names and street-level imagery with Grab's own cameras), merchants and customers, on OpenStreetMap as the base layer. Amazon says a local team of more than 1,000 people maintains it.

Amazon Location Service has offered GrabMaps since January 2023, and since March 2026 through its newer Places operations, with nothing to set up beyond a key, in two regions: Asia Pacific (Singapore) and Asia Pacific (Malaysia), which we use. It covers eight countries and over 500 cities: Malaysia, Singapore, Thailand, Indonesia, the Philippines, Vietnam, Myanmar and Cambodia. Brunei is not among them.

13 How place search works

Our servers call four of Amazon Location Service's Places operations, in its Asia Pacific (Malaysia) region, where they answer with GrabMaps' data:

OPERATION	USED FOR	PRICE BUCKET
Suggest	The search box: suggestions as the rider types (GrabMaps has no Autocomplete)	Label: US$0.20 per 1,000
GetPlace	The position and address of the suggestion picked	Core: US$0.50 per 1,000
ReverseGeocode	A name for a point picked on the map, and "where am I"	Core: US$0.50 per 1,000
SearchText	A typed address or place name to one position, for the developer API	Core: US$0.50 per 1,000

- **What the server asks for:** up to 20 suggestions, near the rider (or the area on screen), in Malaysia, Singapore and Thailand for Malaysia Transit (Thailand for Hat Yai), and Singapore and Malaysia for SG-JB Transit, in the rider's language where GrabMaps has it (English, Malay, Chinese, Thai, Indonesian, Vietnamese and five more); other languages get English.
- **Its own ordering, at no extra cost.** GrabMaps barely weighs where the rider is: "Komtar" typed in Penang put a Johor Bahru food court first, and "Hat Yai" put Singapore shops called Hatyai first. So the server reorders: names that start with what was typed, or places in the town it names, come first; within that, places in the rider's own country.
- **Tidied answers.** In Malaysia and Thailand GrabMaps puts the state where the town would be, and writes some states in Malay; the server reads them right (Johor, Penang, Kuala Lumpur, Putrajaya, Songkhla), so the planner still tells Johor from the rest of Malaysia. A picked place's text starts with its name ("KOMTAR - Main Lobby, Lebuh Tek Soon, ..."), and a typed address takes the best of five answers.

- **Our own entries first.** Airports come from the planner's own list, ahead of GrabMaps' answers.
- **Nothing kept.** Answers are used for the request and not stored, as the terms ask; the key goes only to Amazon and is never logged; and both products' privacy policies say searches go to Amazon Location Service.

14 GrabMaps against Google

Google's own answer to the terms problem is Places UI Kit, which may be shown on any map. It would have done, had it worked the way our search does. It doesn't, and the comparison on 26 November 2026 went like this:

	GOOGLE PLACES UI KIT	GRABMAPS THROUGH AMAZON	PHOTON (OPENSTREETMAP)
With our maps	Allowed (15.1)	Allowed: Amazon's terms (Service Terms, section 82) put no limit on showing GrabMaps' results on our maps	Allowed, with the credit
Places	Google's: the most complete	Grab's own, curated for South-East Asia	OpenStreetMap's: thinner for shops, condominiums and buildings
Works like our search	No: Google's own widget, not our list; no React Native version, so native work in both apps; a suggestion gives only an id, and its position needs a second, paid component	Yes: our server calls it and answers as before, so nothing else changes	Yes, self-hosted
Planning from the place	A grey area (15.3): would need Google's written OK	Fine: don't store results unless the request says so, keep Grab's credit, and don't merge Grab's places into OpenStreetMap data	Fine
At 100,000 searches a month	About US$990	About US$70	Free, on our server

GrabMaps was chosen, with self-hosted Photon recommended as a fallback (and for Brunei, which GrabMaps doesn't cover). MOTIS has an OpenStreetMap place search of its own, but OpenStreetMap has fewer of Malaysia's shops and condominiums than Google or Grab, so it is switched off and GrabMaps does the job.

Prices, side by side

AMAZON, ASIA PACIFIC (MALAYSIA)	PER 1,000
Suggest (Label, what we ask for)	**US$0.20**
Suggest with extra fields (Core)	US$0.50
GetPlace, ReverseGeocode, SearchText (Core)	**US$0.50**
With hours, contacts and similar (Advanced)	US$1.50
Marked for keeping (Stored)	US$4.00

SEARCHES A MONTH	GRABMAPS	PLACES UI KIT
10,000	US$7	Nothing (free allowance)
100,000	**US$70**	**US$990**

Amazon's price list for Asia Pacific (Malaysia), published 11 September 2026, and Google's pricing list, both read on 27 November 2026. One suggestion request and one lookup per search, after the free allowances; Amazon's free tier gives 10,000 suggestions and 20,000 lookups a month for the first three months. Suggestions go out as the rider types: a search with five suggestion requests costs about US$1.50 per 1,000 searches, still a fraction of Google's.

Quality, from the live test

- **Good:** malls, landmarks, stations and addresses across Malaysia and Singapore, in several languages, once reordered for the rider's town and country.
- **Weaker than Google on English descriptions:** "Kota Bharu bus terminal" finds only Thai bus terminals, while the Malay name, "Hentian Bas Kota Bharu", finds the right one.
- **Short names:** "City Square" typed in Johor Bahru brings up Singapore's mall; "JB City Square" works.
- **Names for map points** are sometimes odd (a point at Komtar came back as a rice mill), and one test lookup for "Stesen KTM Kulai" returned Kluang station.

TOGETHER

What the change adds up to

MOTIS and GrabMaps each do one job well. Together they cover everything Google did for our planner, on terms that fit our products.

15 The pair against Google alone

	GOOGLE ALONE (BEFORE)	MOTIS AND GRABMAPS (NOW)
Allowed with our maps	No: Directions, Places and Geocoding results may not be shown on a non-Google map	Yes: MOTIS is ours (MIT licence, OpenStreetMap streets), and Amazon allows GrabMaps' results on our maps
Suspension risk	Planner, search and geocoding could all stop at once	No Google dependency left in the planner or search
Journey cost	US$5 per 1,000 Directions calls after 10,000 free, several calls per search	Nothing per journey, on the server already paid for
Search cost	US$2.83 to US$20 per 1,000 calls after the free allowance	US$0.20 per 1,000 suggestions, US$0.50 per 1,000 lookups
As riders grow	Grows with every free rider	Planner: only server capacity. Search: grows, slowly
Our own timetables	Google planned on its own data; our services needed hand-built workarounds (S19, SRT, Causeway Link)	Planned directly on our timetables, plus Singapore's
Trips Google failed on	Seremban to KL Sentral returned an error	Planned: peak Seremban Line trains when they run, otherwise a bus and KLIA Ekspres
Speed	A call out to Google for each search	9 to 110 ms per plan, inside our server
Keeping and sharing	Coordinates only, for 30 days; nothing passed on	Journey results are ours; GrabMaps' answers aren't kept
Working with partners	A partner can't take Google-derived routes or data	Routing and route lines are ours to offer, with the OpenStreetMap credit

US$0
for 100,000 journeys a month with MOTIS, against at least US$450 with Google Directions

US$70
for 100,000 place searches a month, against about US$990 with Places UI Kit

95%
less for the two together at that traffic: about US$70 against about US$1,440

€12.60
a month for the server that runs the planner, both products' servers and more

16 Trade-offs and risks

Upkeep is ours

MOTIS is one more container to keep healthy on a server whose memory is tight. A failed nightly refresh keeps yesterday's data, so someone has to notice. New street maps are loaded by hand every month or two, and MOTIS's version is pinned, so upgrades are a deliberate job.

Only as good as the timetables

data.gov.my's feeds have quirks (today-only calendars, descriptions where route numbers go, stop positions that slow some trips), and the preparation step repairs what it can. Singapore's timetables are built from frequencies, not published.

No live delays in plans

data.gov.my publishes bus positions, not delay predictions, so plans follow the timetable. Our own live-arrival times are shown on top of each planned ride.

No second planner

With Google switched off, there is nothing to fall back to if MOTIS is down. Place search deliberately doesn't fall back to Google, since that is exactly what the terms forbid: a GrabMaps outage says suggestions are unavailable. Everything runs on one server.

GrabMaps' weak spots

English descriptions, short names and Brunei (section 14). The recommended Photon fallback isn't built yet.

Licences and terms to keep

Credit "© OpenStreetMap contributors" where its data shows. Don't store GrabMaps' answers, keep Grab's credit, and never merge Grab's places into OpenStreetMap-licensed data. MOTIS's own code is MIT, but its place-search library, adr, is under the AGPL, whose extra duties apply to changed copies offered over a network; we run the official image unchanged, with place search off.

17 What comes next

- **A fallback for places:** self-hosted Photon on OpenStreetMap, for GrabMaps outages and for Brunei.
- **Live delays in plans:** MOTIS reads GTFS Realtime trip updates. If data.gov.my publishes delay predictions, plans can follow them with a setting.
- **Google removed for good:** its code and keys, once the switch has proved itself.
- **New services:** the RTS Link between Johor Bahru and Woodlands, the Jurong Region Line, and Kota Kinabalu, each a timetable added to the nightly refresh.
- **Upgrades:** newer MOTIS versions, tried on the server first, as this one was.

18 Sources

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Place search fallback: Photon, github.com/komoot/photon.

Data: data.gov.my's GTFS feeds (CC BY 4.0); LTA DataMall (Singapore Open Data Licence); OpenStreetMap (© OpenStreetMap contributors, ODbL), through Geofabrik's extracts.

Malaysia Transit's own records: the plan, comparisons and trial results (`docs/google-maps-replacement-plan.md`), the server scripts and nightly refresh (`scripts/motis/`), the planner client (`lib/motisPlanner.js`) and the place search client (`lib/grabMapsPlaces.js`).