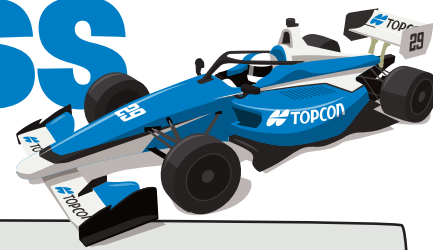


# THE ROAD TO SUCCESS

SPONSORED BY  TOPCON



HELLO THERE! I'M *YUMI*, THE WILD CAT NINJA FROM *TOPCON*, AND MY TEAM HAS BEEN BUSY ALL ACROSS THE '*GET KIDS INTO SURVEY*' CIVIL ENGINEERING SCENE! IN FACT, WE'VE BEEN DOING SUCH A GOOD JOB THAT WE'VE BEEN GIVEN A CHALLENGE SO EXCITING I NEARLY CHOKED ON A FURBALL! WE NEED TO BUILD A BRAND NEW *RACETRACK* -- BUT THERE'S JUST ONE PROBLEM... IT NEEDS TO BE COMPLETED IN RECORD TIME! CAN YOU HELP US STAY ON TRACK? LET'S GO!

## TASK 1: MAKING THE EARTH MOVE

(MATHS OBJECTIVES - UNITS OF MEASURE / MONEY AND BUDGETS)

Have a look at E,4 on the exploration poster and you'll see an excavator hard at work, diligently digging up the buried craft of an extraterrestrial visitor! But the truth is, wherever building is happening, digging will be done! Whether that's to form foundations or make trenches for water pipes and other utilities - or simply to reshape the landscape to make it ready for construction - all this earthmoving is complicated, difficult, and **expensive**. That's right - sometimes it can cost the Earth to move earth! If we are going to have to shift some soil to make way for our new racetrack, we need to be able to control the cost of the operation... or we'll run out of money before a single tyre touches the tarmac!

Can you use your maths skills to complete the 'Making the Earth Move' challenge sheet - which will help us to find the most cost-effective way to ditch the dirt and prepare the space for our rad racetrack!



## TASK 2: STICKY STREETS

(SCIENCE OBJECTIVES - FORCES/FRICTION)

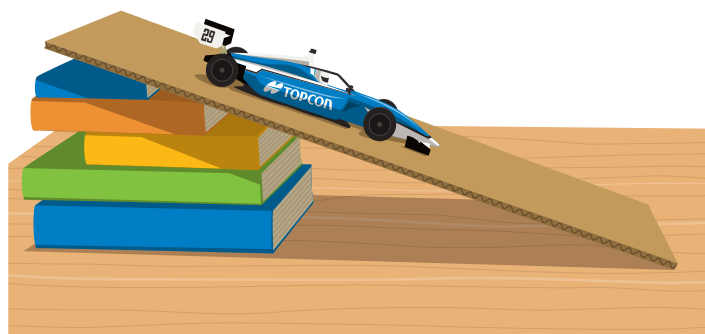
Once we've done with the digging and put an end to the prep, it's time for some perfect paving! Have a look in G,5 and you'll see a machine that lays asphalt, called a 'paver'. It works by having asphalt mix loaded into it, which the paver spreads out and lays down. The asphalt is then levelled and compacted by another part of the machine called the 'screed'.



These mega machines will come in handy when we're laying down the track at our speedy new raceway - but they won't be able to put down any old asphalt! Racetracks around the world have very specific needs when it comes to the quality of the tarmac on the track, and it's all about grip, or friction. If the track

generates too much friction force, the tyres on the cars will wear too quickly; they might even burst! But, if there's not enough friction, the tyres will struggle to grip, and that could be a recipe for crash-disaster!

Can you use the 'Sticky Streets' challenge sheet to complete an experiment, testing different surfaces and materials for their friction-generating abilities? This will help you understand how important grip will be to your super speedway!



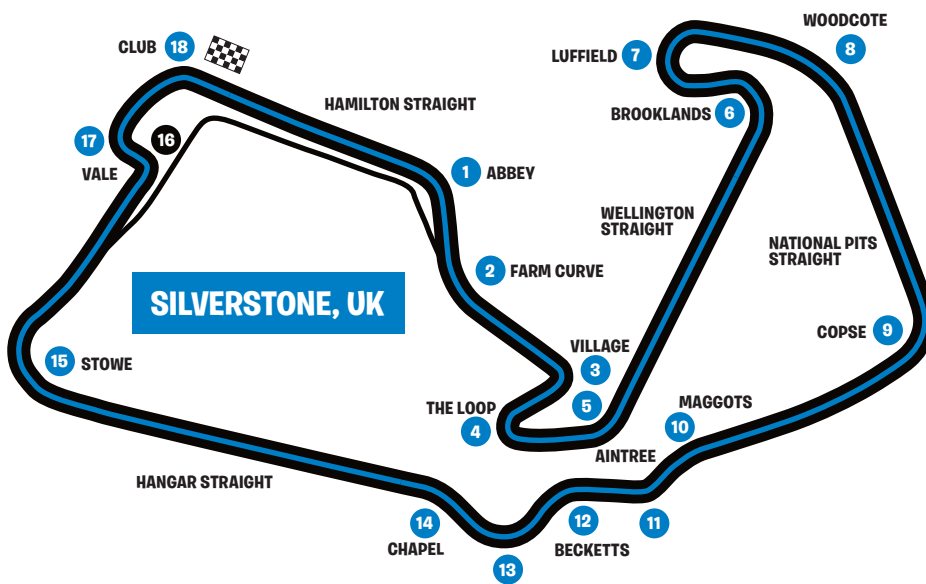
## TASK 3: HUNTING DOWN HAZARDS

(DESIGN TECHNOLOGY OBJECTIVES - EVALUATION)

Have a look in B,4 and you'll see a Topcon vehicle scanning the road - it's checking for defects and damage, and collecting tons of data about the surface of the street. It's part of a process we call SmoothRide, which allows surveyors to collect 100 scans per second as they drive along - and they don't even have to close any roads to do it!

It will be extremely important to check the smoothness, safety and quality of our new track once the asphalt has been laid. We don't want any of the race cars to get damaged by going over bumps!

Use the 'Hunting Down Hazards' challenge sheet to identify all the possible hazards on the street map. The scanner picked up ten - can you do even better?



## TASK 4: PIECE BY PIECE

(ENGLISH OBJECTIVES - FIND AND RECORD NON-FICTION INFORMATION)

The Topcon team has worked on some of the most famous racetracks in the world - including Silverstone in the UK, Yas Marina in Abu Dhabi, and the Marina Bay Street Circuit in Singapore - so they know their way around a speedy circuit!

Before we start work on the new track, can you use the 'Piece by Piece' challenge sheet to reassemble the broken tracks and find out some key facts about these world-famous racetracks? You could even have a go at sketching out your own track layout - including names for the corners and the straights!

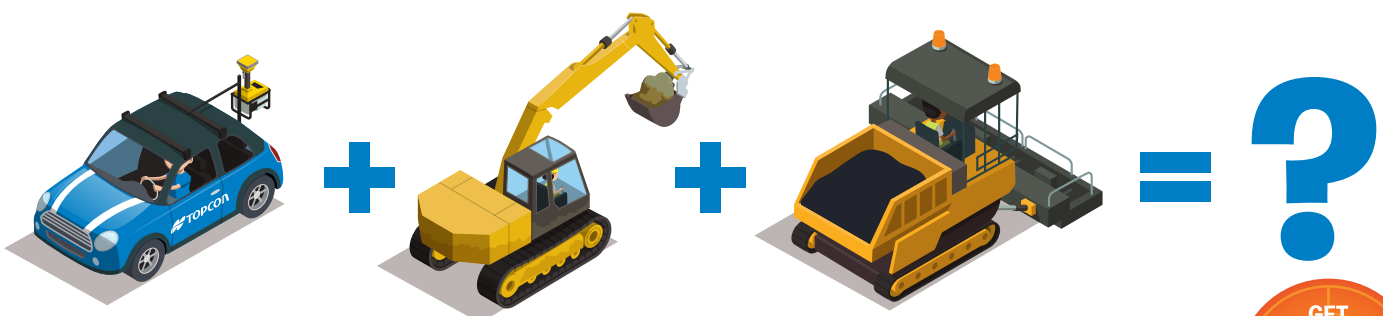
## TASK 5: THE ULTIMATE ROAD-MAKING MACHINE

(DESIGN TECHNOLOGY OBJECTIVES - DESIGN AND EVALUATE A PRODUCT / ENGLISH OBJECTIVES - MAKING ANNOTATIONS)

By now you've explored earthmoving, paving, road scanning and racetrack construction - now it's time to get working on Topcon's next big project! But there's just one problem: the deadline has been cut even shorter than we thought! We need you to design a machine that can scan, dig and pave all in one, so we can do the job in record time! Fortunately, we have our very own Topcon-sponsored pro-racer

James Roe at the ready. Can you use 'The Ultimate Road-Making Machine' challenge sheet to design the perfect vehicle for racetrack-making? You will need to combine and annotate the key features of all three vehicles - and you can even add some extras of your own - whatever you think will get the job done quickly!

With an adult's help, you can share your designs with \*INSERT EMAIL\* for a chance to be featured online!



## TASK 1

# MAKING THE EARTH MOVE

CAN YOU USE YOUR MATHS SKILLS TO COMPLETE THIS CHALLENGE SHEET -- WHICH WILL HELP US TO FIND THE MOST COST-EFFECTIVE WAY TO DITCH THE DIRT AND PREPARE THE SPACE FOR OUR RAD RACETRACK!



## EARTH MOVING PRICELIST

Here's a list of costs that a company charges for moving different amounts of earth:



	1 Ton or less	5 Tonnes or less	10 Tonnes or less	20 Tonnes or less
	£100	£450	£800	£1400

You can separate the earth you need to move into as many loads as you need in order to keep the cost as low as possible. But from an ecological point of view, you should also think about the fewest loads possible to achieve the best price!

So, for example, if you had 9 tonnes to move, you could move it in:

- 9 lots of 1 ton or less ( $9 \times £100 = £900$ ), or
- 1 lot of 5 tonnes or less plus four lots of 1 ton or less ( $1 \times £450 = £450$ ,  $4 \times £100 = £400$ ,  $£450 + £400 = £850$ ), or
- 1 lot of 10 tonnes or less ( $1 \times £800$ ).

In this case, one lot of 10 tonnes or less is the cheapest, most efficient way to move the earth!

Now it's your go! Can you work out the cheapest, most efficient ways to move:

17 tonnes of earth	
24 tonnes of earth	
31 tonnes of earth	
8 tonnes of earth	
59 tonnes of earth	



## TASK 2

# STICKY STREETS

CAN YOU USE THIS CHALLENGE SHEET TO COMPLETE AN EXPERIMENT, TESTING DIFFERENT SURFACES AND MATERIALS FOR THEIR FRICTION-GENERATING ABILITIES? THIS WILL HELP YOU UNDERSTAND HOW IMPORTANT GRIP WILL BE TO YOUR SUPER SPEEDWAY!

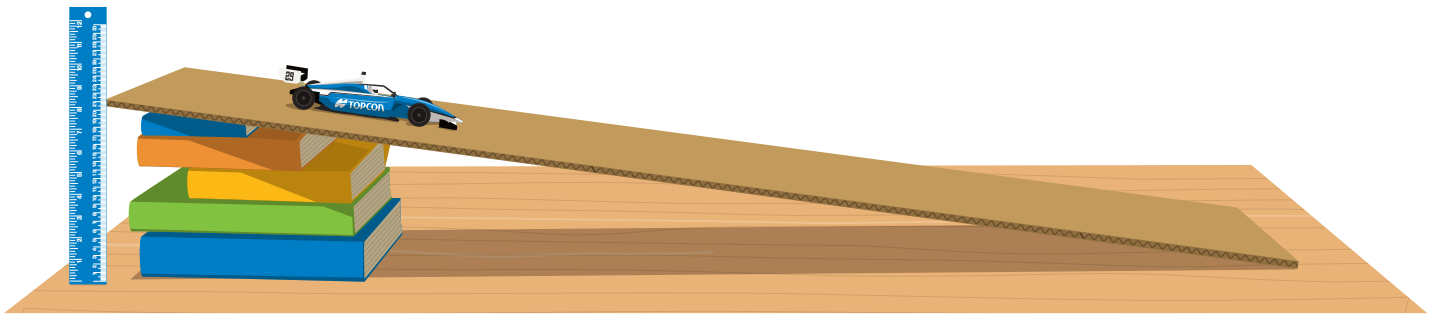


### Equipment needed:

- A strong piece of cardboard or a smooth piece of wood to make the ramp
- A small toy car
- A sheet of sandpaper
- A sheet of bubble wrap
- A piece of carpet
- A tape measure
- A ruler
- A stack of books

### The experiment:

- 1 Place the cardboard or wood on the edge of the stack of books to form a ramp - use the ruler to check the height of the ramp so that you can make sure it stays the same for each run.
- 2 Lay the tape measure down, starting at the bottom edge of the ramp, to measure how far the car travels each time.
- 3 Make some predictions for each material based on what you know about friction and resistance.
- 4 Place the first material over the ramp and send the car down - measure how far it travels once it leaves the ramp. Perform this step twice for each material.



MATERIAL	FIRST RUN	SECOND RUN
RAMP		
BUBBLE WRAP		
SANDPAPER		
CARPET		

Were your predictions correct?

Why do you think the material with the smallest distance slowed the car down so much?

Why do you think the material with the furthest distance allowed the car to move quickly?

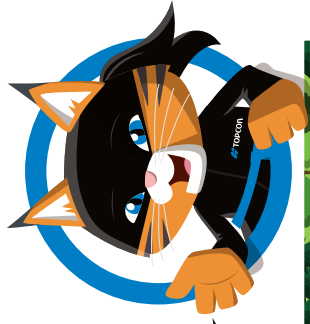




### TASK 3

# HUNTING DOWN HAZZARDS

USE THIS CHALLENGE SHEET TO IDENTIFY ALL THE POSSIBLE HAZARDS ON THE STREET MAP. THE SCANNER PICKED UP EIGHT -- CAN YOU DO EVEN BETTER?



# TASK 4 **PIECE BY PIECE**



CAN YOU USE THIS CHALLENGE SHEET TO REASSEMBLE THE BROKEN TRACKS AND FIND OUT SOME KEY FACTS ABOUT THESE WORLD-FAMOUS RACETRACKS? SEE IF YOU CAN DISCOVER THE YEAR THAT THE TRACK OPENED, THE COST TO BUILD IT, THE RECORD FOR THE FASTEST LAP, AND ANY OTHER INTERESTING THINGS YOU WANT TO INCLUDE! YOU COULD EVEN HAVE A GO AT SKETCHING OUT YOUR OWN TRACK LAYOUT -- INCLUDING NAMES FOR THE CORNERS AND THE STRAIGHTS!

Cut out each piece and stick them onto a separate sheet, then add your facts below the completed track.

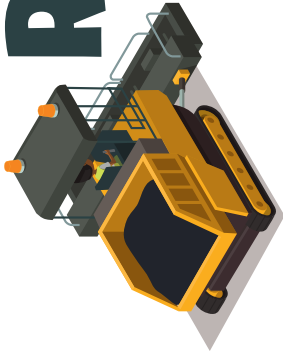
**MIAMI INTERNATIONAL AUTODROME**

**MARINA BAY STREET CIRCUIT, SINGAPORE**



# TASK 5

# THE ULTIMATE ROAD-MACHINE



CAN YOU USE THIS CHALLENGE SHEET TO DESIGN THE PERFECT VEHICLE FOR RACETRACK-MAKING? YOU WILL NEED TO COMBINE AND ANNOTATE THE KEY FEATURES OF ALL THREE VEHICLES -- AND YOU CAN EVEN ADD SOME EXTRAS OF YOUR OWN -- WHATEVER YOU THINK WILL GET THE JOB DONE QUICKLY!

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