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TEST OF WHEELED MOBILITY (TOWM)
And
THE WHEELIE TEST

Test protocol and procedures

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All photographs presented in the protocol are published with a written authorization from the participants.

TEST OF WHEELED MOBILITY (TOWM)

And

THE WHEELIE TEST

MATURITY PATTERN OF WHEELED MOBILITY SKILLS PERFORMANCE IN SPINAL CORD INJURY

Goals of the tests
The purpose of the tests is to evaluate the wheeled mobility skills of people with spinal cord injury. The results of these tests will provide useful information for further training and treatment; it will also allow making a comparison of the skill level among different persons with similar lesion levels.

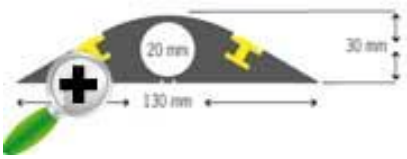
Time requirements
Including preparation and evaluation time, the estimated duration of the test is 40 minutes. The testing time will vary among participants and administrators and should be considered as a guideline.

Testing environment
The tests should be administered in a location with an even surface and a size big enough to execute the tasks. A gym or a similar multipurpose room generally suits these requirements. All of the tasks can be administered in this location.

In order to create a safe environment, a safety person will always have to be alert and stay close to the participant

Required equipment
The cost and space requirements are kept as low as possible. The following equipment will be needed to perform the test:

- 4 traffic cones or other marking devices.
- Stopwatch.
- 4 wooden platforms (dimensions 1.5m × 1.0 m; heights 5,10,20,40cm), able to hold a maximal weight of 200 kg.
- A portable wheelchair ramp with a length of 2.0m, a minimum width of 0.76m and able to support at least 250kg.
- 5 threshold ramps as portrayed in the figure below + 1 electric cable "hider".



- A daily wheelchair with brakes
- The participant should use his daily wheelchair throughout the test.
- Duct Tape
- Measuring tape 10m
- Video camera + tripod
- Scale (weight measurement)
- Inclinometer
- Paper and pencils
- Yoga mat

General testing guidelines for the examiner

- Read the entire test protocol and procedures to get acquainted with the test items, scoring methods and necessary equipment.
- To create a reliable result, the participant should execute each task with maximal effort. The examiner will have to encourage him or her. Encouragement can be provided using various methods as preferred by the examiner.
- Because safety is very important, attention will have to be paid to limit the risk of accidents such as tipping backwards.
- The test instructions as given below contain the minimal information needed by the participant to complete the tasks. If this proves to be unclear, additional information may be provided to the participants.

General instructions for the participant

These instructions have to be given to the participants before the test can be administered.

- The participant needs to know the purpose of the test and the necessity of his maximal effort: "The goal of the test is to evaluate the wheeled mobility skills of people with spinal cord injury. The results of this test will provide useful information for further training and treatment; it will also allow a comparison of your skill level with other persons with a similar lesion level impairment. Therefore it is very important for you to put your maximal effort to succeed in the different tasks".
- Information must be given about safety issues and the choice to refuse to perform a specific task: "The test is considered to be a safe test, but accidents may happen. If you do not wish to perform a task, or you feel uncomfortable at any time during a task, please report this to the examiner. We want you to perform maximally and if you think you will be unable because of fatigue, please request a rest break".
- The participant must also be encouraged to ask questions if the instruction proves to be unclear.
- **"DO EACH TRIAL AS FAST AS POSSIBLE <u>BUT KEEPING CONTINUOUS CONTROL OVER YOUR CHAIR. SAFETY IS MORE IMPORTANT THAN SPEED"</u>**
- "You have only <u>1 trial</u> for each task, it is more important to execute each task safe and in a controlled way than doing it fast", if you fail, you may try once again (maximum 2 trials).

Scoring guidelines

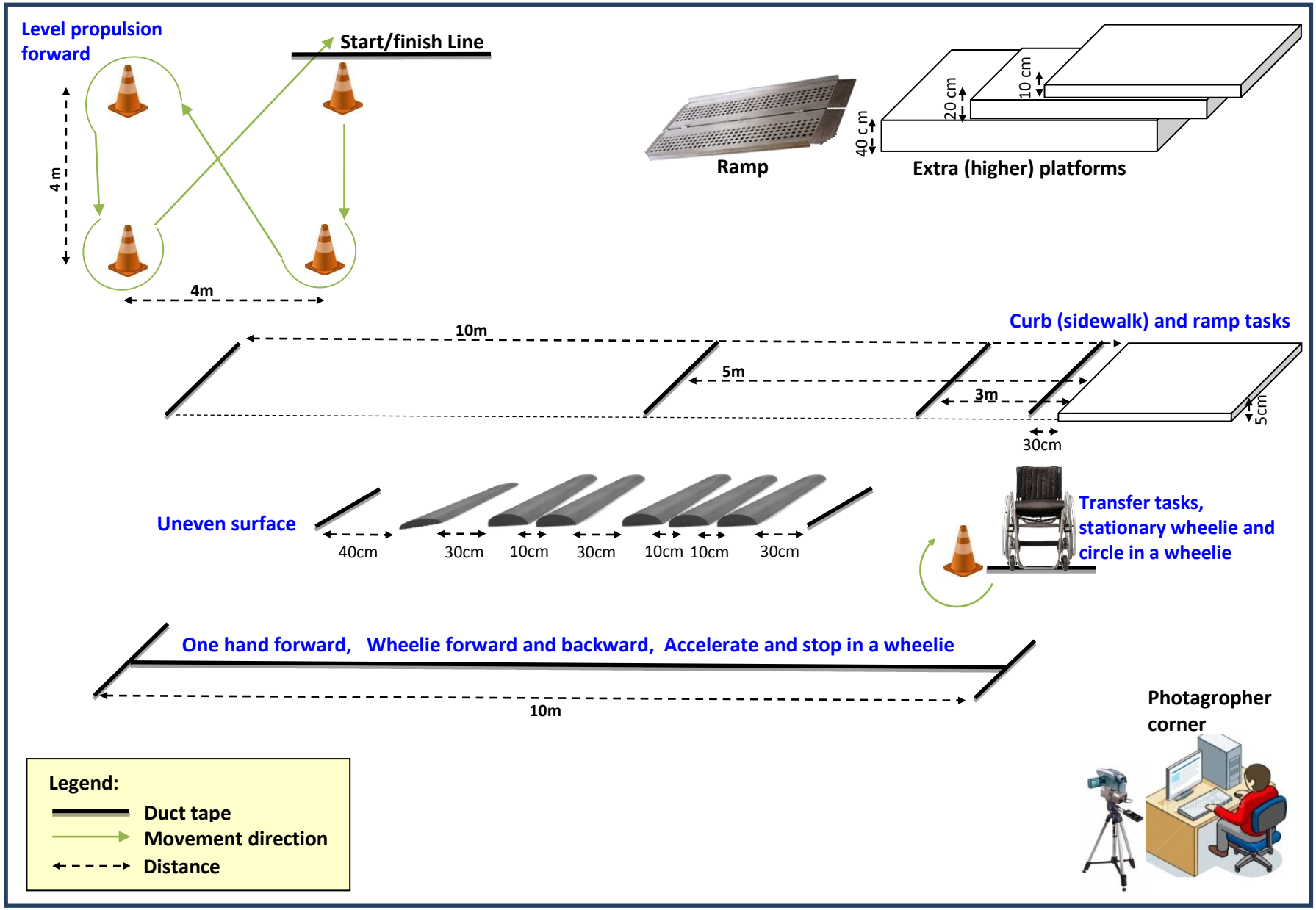
- Each task is scored:
  - **Ability score**: Yes/No (1/0), if a person succeed only the <u>second</u> trial, he receives 0.5 point. The *total ability score*, is the sum of all points,
  - **Anxiety score**: VAS scale (0-10) before each trial. The *total anxiety score* is the average of all scores
  - **Time score** (sec): only for 6 tasks that include propulsion forward/backward and sprint. The *total time score* is the average/sum of the time scores.
  - **Maximal height** (cm): only for curb and ramp task, refers to the highest height a person was able to do
  - **Quality score**: Each WM skill includes 4-5 components that are presented as performance criteria. In general, these criteria represent a mature pattern of the skills. The scoring method is as following:
    1. Require the participant to perform 1 trial for video analysis, or 3 trials for field analysis, of each WM skill
    2. Observe the participant performing the skill and concentrate on the performance criteria
    3. Mark a ✓ in the appropriate box in the correct assessment column. Where a participant performs a component correctly, he receives 1 point. Give a quality score only for the tasks where the participant receives ability score (when he succeeds the task). The *total quality score* is the sum of the tasks points.

Measurements instructions

- Height (cm) – ask the participant to transfer himself to a treatment table/bed placed next to a wall, feet as close as possible to the wall. Using measurement tape from the top point of the head to the heals attached to the wall.
- While the participant is lying on the bed, weight his wheelchair on the scale (wheelchair weight)
- Measure the participant's weight (while seated in his wheelchair) - reduce the weight of the wheelchair
- BMI = (kg/m^2)
- COG - this measurement is based on Vanlandewijck et at, 2001- Wheelchair Propulsion Biomechanics – Implication for wheelchair sports.
  The horizontal and vertical position of the Cg of the wheelchair – person- combination (Wpc) determines the mobility-stability relationship of the Wpc. The fore/aft coordinate (x) of the COG of the Wpc, with respect to the axel of the rear wheel, is calculated as:
  $X = (F1 \cdot d) \cdot (m \cdot g)^{-1}$, with F1 as the **weight on the front wheel*** axel, d is the horizontal distance between rear and front wheel axle, and $m \cdot g$ as the total weight (N = person + wheelchair weight).
  The y coordinate of COG (vertical coordinate) is calculated as:
  $Y = x \cdot \text{cotg}\ (angl_{incl}**)$. $angl_{incl}$ is determined by the angle over which the wheelchair-user system had to be inclined to decrease x to zero.

  * To measure the **weight on the front wheel** (F1), place a wooden plate of 20 cm width, and at **the same height as the scale**, 15 cm before the scale (Figure 2). Place the rear wheel on the wooden plate and the front wheels on the scale. Ask the participant to hold the front frame of the wheelchair with maximal extension of the elbows, and maximal flexion of the head (chin faces the chest). Ask the person not to move.
  ** To measure $angl_{incl}$ – after measuring the weight on the front wheels, ask the person to remain in the same position exactly. Attach the inclinometer to the wheelchair frame as close as possible to footplate (reseat to zero). Tilt the person backward to wheelie position (balance on the rear wheel; the moment you reach the balance point (when you can hold the chair with effortlessness) you reached the $angl_{incl}$

Schematic test map (TOWM & Wheelie Test)



Part 1: Personal Information

Testing date	… /… /……
Date of birth	… /… /……
Date of injury	… /… /……
Self-efficacy in Wheeled Mobility (SEWM-score)	
Height (cm)	
Weight (kg) & Wheelchair Weight (kg) & BMI (kg/m²)	
Physical Activity level, PASIPD-score (MET-hr/d)	
Centre of gravity $Angle_{incl}$ (°)	
Distance front to rear wheels (d in cm)	
Weight on the front wheels (F_1)	
$x = (F1 \cdot d) / (m \cdot g)^{-1}$	
$y = x \cdot cotg\ (angle_{incl})$	

Neurological level
The most caudal segment of the spinal cord with normal motor and sensory function.

	R	L
Sensory		
Motor		

Complete or incomplete

Zone of partial preservation
Partially innervated dermatomes or myotomes below the neurological level in complete lesions

	R	L
Sensory		
Motor		

ASIA Impairment Scale (A-E)

Part 2: Test of Wheeled Mobility (TOWM)*

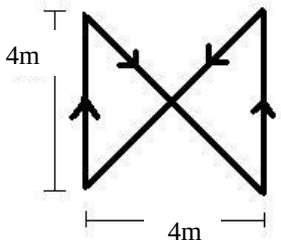
No anxiety **Maximal anxiety**

Note: **Before** performing each task, please ask the participant, to indicate on the 'anxiety scale', how anxious he is regarding performing this specific task. Anxious in this context does not mean anxious to fail the task but relatively to hurting one self.

1. Level propulsion forward (turns)

Preparations: Place four cones in a square with sides of 4m. The participant is positioned in standstill next to the first cone behind a line. **Instructions:** "Accelerate as fast as possible throughout the circuit as shown in the figure. Timing starts and stops when the front wheels cross the starting line".	**Measurements:** Ability Score: (yes/no), Reason (if not) Qualitative score (0-5) Time Score (s) Anxiety score (0-10)

Task in figure:



2. Level propulsion forward (one hand)

Preparations: Place 2 cones 10 meters apart. A straight line should connect both cones. Start and finish lines are marked vertically; The participant is positioned in standstill next to one of the cones. **Instructions:** "Move as fast as possible from line 1 to line 2 keeping the 10m line between the wheels. The preferred hand is only allowed to touch the rims on the side of the hand itself." Timing starts and stops when the front wheels cross the marked lines.	**Measurements:** Ability Score: (yes/no), Reason (if not) Qualitative score (0-5) Time Score (s) Anxiety score (0-10)

***All photographs presented in the protocol are published with a written authorization from the participants.**

3. Ascending / descending sidewalk starting with front wheels in front of a step (5cm, 10cm, 15cm, 20cm)

Preparations: The platform (starting with 5cm) is placed against the wall with the sharp edge. A 30 cm line is marked before the platform.

Instructions: "Place the front wheels in between the marked line and the platform and ascend it. Turn around but be aware that the platform is narrow, and descend the platform smoothly, keeping the wheelchair all the time under control".

Safety Note: examiner stands close and behind the participant, both hands are ready to catch the chair to avoid falling backward

Measurements:
Ability Score: (yes/no), Reason (if not)
Qualitative score for the 10cm tasks (0-5)
Maximal height (cm)
Anxiety score (0-10)


4. Ascending a sidewalk, starting with a run-up of 3m (5cm, 10cm, 15cm, 20cm)

Preparations: The platform (starting with 5cm) is placed against the wall with the sharp edge. A tape marks the 3m run-up.

Instructions: "Place the front wheels behind the marked line, move towards the platform and ascend it".

Safety Note: examiner stands close to the curb and behind the participant, both hands are ready to catch the chair to avoid falling backward

Measurements:
Ability Score: (yes/no), Reason (if not)
Qualitative score for the 10cm tasks (0-5)
Maximal height (cm)
Anxiety score (0-10)



5. Going up & down a ramp (5% [10cm], 7.5% [15cm], 10% [20cm], 15% [30cm], 20% [40cm], 26% [50cm])

Preparations: The platform (starting with 10cm) is placed against the wall with the sharp edge. Place one end of the portable ramp on the ground and the other end on top of the wooden plate and fix with screws. The participant is positioned with the front wheels on the platform.

Instructions A: "Go up the ramp in a straight line, turn around on the platform, go downhill and return to the floor,

Measurements:
Ability Score: (yes/no), Reason (if not)
Qualitative score for A-30 cm, B & C tasks (0-5)
Maximal height (cm) with / without run up
Anxiety score (0-10)


descend the way you like, if you consider a wheelie being necessary going down, then do so."

The level where the participant fails can be repeated with a run-up of 5m.

Instructions B: "Try to ascend the height you failed again with a run-up of 5m."

The last level succeeded will be repeated and the participant has to stop in wheelie while descending.

Instructions C: "Go up the ramp in a straight line, turn around on the platform, go downhill in a wheelie and stop in the middle of it, keep the wheelie for 3 seconds, continue downhill and return to the floor"

Safety Note: examiner stands close to the ramp and behind the participant, both hands are ready to catch the chair to avoid falling backward, a safety guard is needed.

6. Transfer from a wheelchair to another comparable wheelchair

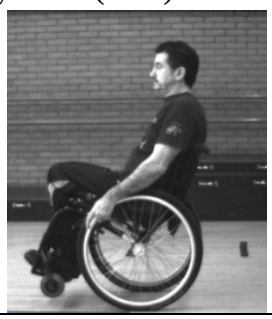
Preparations: Place a second wheelchair next to the participant's wheelchair in a position as preferred.

Instructions: "You are asked to perform this task 2 times in different conditions. In the first trial you may transfer yourself from a stable to an unstable chair. In the second transfer task, you will be asked to transfer from an unstable chair to another unstable chair also in a position of your choice".

Measurements:
Ability Score: (yes/no), Reason (if not)
Qualitative score for stable to unstable chair (0-5)
Anxiety score (0-10)

Part 3: The "Wheelie test"

1. Stationary wheelie

Preparations: A clear space on an even surface of at least 4 Sqm (2m X 2m). **Instructions:** "Lift up the front wheels and balance stationary only on the rear wheels during 15 seconds using two hands." **Safety Note:** examiner stands close and behind the participant, both hands are ready to catch the chair to avoid falling backward	**Measurements:** Ability Score: (yes/no), Reason (if not) Qualitative score (0-5) Anxiety score (0-10) 

2. One handed wheelie

Preparations: A clear space on an even surface of at least 4 Sqm (2m X 2m). **Instructions:** "Lift up the front wheels, using only one hand (place the other hand on your lap) and balance stationary only on the rear wheels. As soon as you gained balance continue for 15 seconds in the wheelie using only one hand". **Safety Note:** examiner stands close and behind the participant, both hands are ready to catch the chair to avoid falling backward	**Measurements:** Ability Score: (yes/no), Reason (if not) Qualitative score (0-5) Anxiety score (0-10) 

3. Rolling wheelie forward and backward

Preparations: A clear space on an even surface of 10m. A cone is placed near the 10m mark. (The command "Go" when all 4 wheels on the floor) Timing starts and stops when the front wheels cross the marked lines. **Instructions A:** "Lift up the front wheels and balance on the rear wheels only. Move 10m forward as fast and as safe as possible. **Instructions B**: "Lift up the front wheels and balance on the rear wheels only. Move 10m backward as fast and as safe as possible.	**Measurements:** Ability Score: (yes/no), Reason (if not) Qualitative score (0-5) Time Score (s) Anxiety score (0-10)

Safety Note: examiner stands close and behind the participant, both hands are ready to catch the chair to avoid falling backward	

4. Circle forward 2 hands

Preparations: A clear space on an even surface of at least 9 Sqm (3m X 3m) and a cone. Starting line defining when the circle starts and ends. **Instructions:** "Bring the wheelchair into wheelie. Make one complete circle forward around the cone; Do not make a turn in place. The task is finished when crossing the starting line. **Safety Note:** examiner stands close and behind the participant, both hands are ready to catch the chair to avoid falling backward	**Measurements:** Ability Score: (yes/no), Reason (if not) Qualitative score (0-5) Anxiety score (0-10)  

5. Negotiating uneven surface in a wheelie

Preparations: The 6 threshold ramps are placed as shown in the figure (The command "Go" when all 4 wheels on the floor) **Instructions:** "Bring the wheelchair into wheelie. Go over the 6 thresholds without letting the front wheels touch the ground, do it as fast and as safe as possible, but be aware you have only 1 trial so don't fall". Timing starts and stops when the front wheels cross the marked lines. **Safety Note:** examiner stands close and behind the participant, both hands are ready to catch the chair to avoid falling backward	**Measurements:** Ability Score: (yes/no), Reason (if not) Qualitative score (0-5) Time Score (s) Anxiety score (0-10) 

6 Accelerating and stop in wheelie

Preparations: 15m of clear space on an even surface. Position the participant 10m from a clear line marked on the floor, while ensuring at least 3m of clear space (marked on the floor) behind the mark. (The command "Go" when all 4	**Measurements:** Ability Score: (yes/no), Reason (if not) Qualitative score (0-5) Time Score (s) from start to crossing 10m line Anxiety score (0-10)

wheels on the floor) **Instructions:** "Accelerate as fast as possible towards the 10m line and when you reach the line in maximum speed, stop the wheelchair in a wheelie position without losing control and keep the wheelie controlled for 3s". **Safety Note:** the examiner should stand close to the line marked on the floor, ready to help in case of losing the balance.	

7. Backward over 5cm step in a wheelie

Preparations: Place the 5cm platform against the wall with the sharp edge. Place the yoga mat on top, 30 cm from the rounded edge. Position the participant with his back against the platform. **Instructions:** "Start in a wheelie with the rear wheels against the curb. Go backward over the curb, controlling the wheelie. When the entire wheelchair is on top of the platform, keep the wheelie controlled for 3s and then bring down the front wheels." **Safety Note:** the examiner should stand close to the participant and behind him, ready to help in case of losing the balance.	**Measurements:** Ability Score: (yes/no), Reason (if not) Qualitative score (0-5) Anxiety score (0-10)  

TOWM and Wheelie test score sheets

Name or subject ID	Assessment date	Name of examiners
……	…/…/……	……

Part 1: Personal Information

1. Date of birth	…/…/……		13. Neurological level		R	L
2. Date of injury	…/…/……			Sens		
3. SEWM-score				Mot		
4. Height (m)			14. Zone of partial preservation		R	L
5. Weight (kg)				Sens		
6. Wheelchair Weight (kg)				Mot		
7. BMI (kg/m²)			15. ASIA Impairment scale			
8. PASIPD score (MET-hr/d)			16. Complete/Incomplete			
9. Center of gravity	Angle (°)					
	Dist. (cm)					
	Front Wheel Weight (kg)					
	X & y					

Part 2: Test of Wheeled Mobility	Anxiety (VAS)		Why not? / Remarks	Ability (1/0)		T		Q
1. Level propulsion forward (4x4)								
2. One hand propulsion (10m on a marked line)								
3. Ascend sidewalk 5cm (start between 30cm line)								
4 Descend sidewalk 5 cm								
5. Ascend sidewalk run up 5cm (3m run up)								
6. Ascend sidewalk 10cm								
7. Descend sidewalk 10 cm (help Asc. If need)								
8. Ascend sidewalk run up 10cm								
9. Ascend sidewalk 15cm								
10. Descend sidewalk 15 cm								
11. Ascend sidewalk run up 15cm								
12. Ascend sidewalk 20cm								
13. Descend sidewalk 20 cm								
14. Ascend sidewalk run up 20cm								
15. Up a slope 5% (10cm) (front wheels on it)								
16. Down Slope 5% (10cm)								
17. Up a slope 7.5% (15cm)								
18. Down a slope 7.5% (15cm)								
19. Up a slope 10% (20cm)								
20. Down a slope 10% (20cm)								

Part 2: Test of Wheeled Mobility - continued	Anxiety (VAS)		Why not? / Remarks	Ability (1/0)		Time/Height		Q
21. Up a slope 15% (30cm)								
22. Down a slope 15% (30cm)								
23. Up a slope 20% (40cm)								
24. Down a slope 20% (40cm)								
25. Up a slope 26% (50cm)								
26. Down a slope 26% (50cm)								
27. Down a slope, stop in wheelie (last succeeded, with run up, write height)								
28. Up a slope with a run up (last failed, write height)								
29. Chair transfer stable - unstable								
30. Chair transfer unstable-unstable								

Part 3: The Wheelie Test	Anxiety (VAS)		Why not? / Remarks	Ability (1/0)		T		Q
1. Stationary (15 sec)								
2. One handed wheelie (15s hand face the camera)								
3. Forward 10m ("Go" with 4 wheels on floor)								
4. Backward 10m ("Go" with 4 wheels on floor)								
5. Circle forward (around a cone)								
6.Uuneven surface ("Go" - 4 wheels on floor)								
7. Accelerate and stop in wheelie (10m) Time score from start line to crossing 10m								
8. Backward over curb 5cm								

Total outcome measures

	Part 2: TOWM	Part 3: Wheelie test	Total
Total Ability score			
Total Time score			
Total Anxiety score			
Total quality score			
Maximal height of a curb			
Maximal slope			

Ability score (yes=1, no=0)
Why not= reason to refuse
Anxiety score (0-10)
T=Time score (seconds)
H=Height (cm)
Q=Quality score (0-5)
Asc = Ascend
Sens = sensor
Mot = Motor

TOWM and Wheelie test Quality Score sheet

Name or subject ID	Assessment date	Name of examiner
.....	.....	.....

The TOWM tasks	Performance criteria	
1. Level propulsion + turns forward (4X4)	• **SP***: grasps/frictions rims or tires at the highest point and bends forward • **Arms**: Push with two arms simultaneously • **Upper body:** moves forward approx. 10° or more when speeding up. • **Trunk** in turns: upright and bent laterally to the side of the turn, turning as close as possible to the cone • **Hands** in turns: slow down the inner wheel, pushes the outer wheel forward while completing the turn	☐ ☐ ☐ ☐ ☐
2. One hand propulsion (10 meters)	• **SP**: grasps rim or tires at the highest point with the pushing hand, upper body remains in natural position • **Upper body:** shifts weight towards the pushing side • **Pushing hand**: presses rim down, simultaneously to the creation of the peak compensation momentum from the opposite shoulder/upper body • **At the end** of the push, at 2 o'clock position, trunk and hand are back in starting position • **General Quality Note:** Maintain the same rhythm and speed throughout the task	☐ ☐ ☐ ☐ ☐
6. Ascend 10cm sidewalk	• **SP**: front wheels are slightly raised above the step and immediately placed on it • **Trunk**: bends forwards when placing down the front wheels • **Arms**: push with both arms symmetrically downward at the front of the rear wheels, when the front wheels come down • **Trunk** Straightened as soon as the rear wheels get on the step and the front wheels are lowered • **General Quality Note:** Ascend the sidewalk symmetrical y, in one confident push	☐ ☐ ☐ ☐ ☐
7. Descend 10 cm sidewalk	• **SP:** approaches the edge while staying on rear wheels • **Hands**: Push forward and breaking while lowering the wheelchair • **Pelvic/lower trunk:** pushed against the backrest • **At the end:** rear wheels contact the ground **first**, while **controlling** the wheelie, before placing front wheels down • **General Quality Note:** Descend the sidewalk symmetrical y, in an elegant and smooth landing	☐ ☐ ☐ ☐ ☐
8. Ascend 10cm sidewalk with a 3 meters run up	• **SP**: 2-3 pushes forward, **pelvic and lower trunk** are lowered and pushed against the backrest when reaching the step • **General Quality Note:** utilize the outcome run-up inertia to ascend the sidewalk without slowing down • **Trunk**: bends forwards when places down the front wheels • **Arms**: push downward at the front of the rear wheels, when the front wheels come down	☐ ☐ ☐ ☐ ☐

	• **Trunk** Straightened as soon as the rear wheels get on the step and the front wheels are lowered	
21. Up a slope 15% **(30cm)**	• **SP**: Leaning forward, places hands towards the back of the top of the tire • **Hands**: push forward and downward • **Elbow:** Flex the elbow repetitively in the same angle (angle is proportional to the incline of the slope) • **Hands**: Shortest recovery time • **Trunk and head** remains in the same leaning forward position while ascending	☐ ☐ ☐ ☐ ☐
22. Down a slope of 15% **(30 cm)**	• **SP**: pushes forward until the rear wheels touch the ramp • **Pelvic/lower trunk:** pushed against the backrest, adapts wheelchair decline position to the slope (the steeper the slope, the more inclination is needed) • **Hands**: allows rims glides through, in a controlled movement, keeps the acceleration constant until the desired speed is achieved • Hands places at the front of the tires/rims to control the speed in braking movements • **General Quality Note:** prefers to descend in a wheelie, rear wheels touch the floor first.	☐ ☐ ☐ ☐ ☐
27. Down a Slope stop in a wheelie for 3 sec.	• **SP**: Pushes forward until the rear wheels are over the edge • **Pelvic/lower trunk:** pushed against the backrest, adapts wheelchair decline position to the slope (the steeper the slope, the more inclination is needed) • **Hands**: allow rims glides through, in a controlled movement, Keeps the acceleration constant until the desired speed is reached • **Elbows:** to stop in wheelie, the elbows extend nearly to about 135° • **Head:** flex a bit forward during the wheelie	☐ ☐ ☐ ☐ ☐
28. Up a slope with a 5 meters run up	• **SP**: 2-3 pushes forward, Leaning forward when reach the ramp • **General Quality Note:** utilize the outcome run-up inertia to ascend the slope without slowing down • **Hands**: push downward, shortest recovery time • **Upper trunk and head:** leaning forward maximally (no contact with the backrest) • **Elbow:** Maximal flexion when nearly reaching the top	☐ ☐ ☐ ☐ ☐
29. Chair Transfer stable to unstable	• **SP**: Checks the position of the feet: flat on the floor and vertically beneath the knees so that the weight is over them • **Head and shoulders:** flexed throughout the transfer • **Hands:** one on the armrest or on the seat and the other on the seat of the other chair, lifting up • **Foot:** places the foot on the footplate • **General Quality Note:** transfer at once, (placing the pelvic directly on the next chair seat in one movement)	☐ ☐ ☐ ☐ ☐

The Wheelie Test	Performance criteria	
1.Stationary	• **SP:** Hands placed on the wheels in approximately the 10 o'clock position* • **Upper body**: stays still when the **hands** are pushed forward, the **head** bends slightly forward • **Hands** are in the 2 o'clock position, **Elbow**: approximately 140° flexion • **Hands**: Maintains position and balance, keeping the body completely still • **General Quality Note:** gets into balanced wheelie in less the 2 seconds	☐ ☐ ☐ ☐ ☐
2. One handed wheelie	• **SP:** 1 Hand placed on the wheels in approximately the 10 o'clock position • **Upper body**: stays still when the one **hand** is pushed forward, the **head** bends slightly forward • **Hand** is in the 2 o'clock position and approximately 140° flexion in the elbow • **Head:** Maintains position and balance, keeping the body completely still • **General Quality Note:** gets into balanced 1 handed wheelie in less the 3 seconds	☐ ☐ ☐ ☐ ☐
3. Forward 10m in a wheelie	• **SP:** Hands placed on the wheels in approximately the 10 o'clock position • **Hands** are in the 2 o'clock position, **Elbow**: approximately 140° flexion to maintain the wheelie position • **Trunk and Head:** brings a little bit forward simultaneously to the pushing forward • **Hands:** brings immediately back to 10 o'clock position (short recovery time) • **General Quality Note:** maintain the same speed and the same front wheels height throughout the task	☐ ☐ ☐ ☐ ☐
4. Backward 10m in a wheelie	• **SP:** Hands placed on the wheels in approximately the 10 o'clock position • **Upper body**: stays still when the **hands** are pushed forward into wheelie position • **Arms** push backward; simultaneously bring the **upper body** a little bit backward as well, while keeping the **head** bent forward to avoid falling back. • Brings **hands** immediately back to 2 o'clock position **without rolling forward** • **General Quality Note:** maintain the same speed and the nearly the same front wheels height throughout the task	☐ ☐ ☐ ☐ ☐
5. Circle forward in a wheelie	• **SP:** Hands placed on the wheels in approximately the 10 o'clock position**,** **Upper body**: stays still when the **hands** are pushed forward into wheelie position • **Hands when turning,** hold the inner wheel and push the outer wheel forward, when both hands are pushing, the **outer elbow** is flexed more and pushing harder • **Upper body**: Bend laterally to the side of the turn • **General Quality Note:** maintain the same speed and make the turn as close as possible to the cone • **Finishing:** control the final movement and brings the front wheels down in controlled way	☐ ☐ ☐ ☐ ☐

6. Uneven surface in a wheelie	• **SP:** Hands placed on the wheels in approximately the 10 o'clock position**, Upper body**: stays still when the **hands** are pushed forward into wheelie position • **Hands:** Push forward, maintain balance by alternately performing flexion and extension in the elbows, while keeping the rest of the body still • **Head and upper body:** while pushing forward, bring the upper body and head a little bit forward simultaneously, keeping the lower trunk pushed against the backrest • Brings **hands** immediately back to 2 o'clock position after crossing each obstacle • **General quality Note:** maintain the same speed throughout the task	☐ ☐ ☐ ☐ ☐
7. Accelerate and stop in wheelie	• **SP:** Accelerate as fast as possible • **Head and trunk:** when crossing the line, goes at once into wheelie by extending the head and the trunk and jerkily generate a last 1 push • **Arms:** Braking as fast as possible (minimal distance behind the line) by keeping the arms flexed • **Hip:** Tilting the chair to the maximum (to brake maximally) by extreme hip flexion • **Finishing:** as soon as the chair reaches standstill, hips go back in neutral wheelie position	☐ ☐ ☐ ☐ ☐
8. Backward over 5cm curb/stop in a wheelie	• **SP:** Go into wheelie, oriented backward to the step, drives slowly backwards in wheelie until both wheels touch the step • **Hands** are moved forward on the hand rims until the elbows are almost in full extension • **Trunk** is flexed • **Hands**: inclining backwards 'en-bloc' (pulling force brings wheelchair on the step), while the trunk **remains** flexed forward • **Finishing:** on top of the step, trunk returns into wheelie neutral position	☐ ☐ ☐ ☐ ☐

Total score	TOWM	Wheelie Test
Total quality score		

***SP = starting position**

*** 10 o'clock position / 2 o'clock position = evaluator facing the right wheel**