Ergonomics Research Techniques

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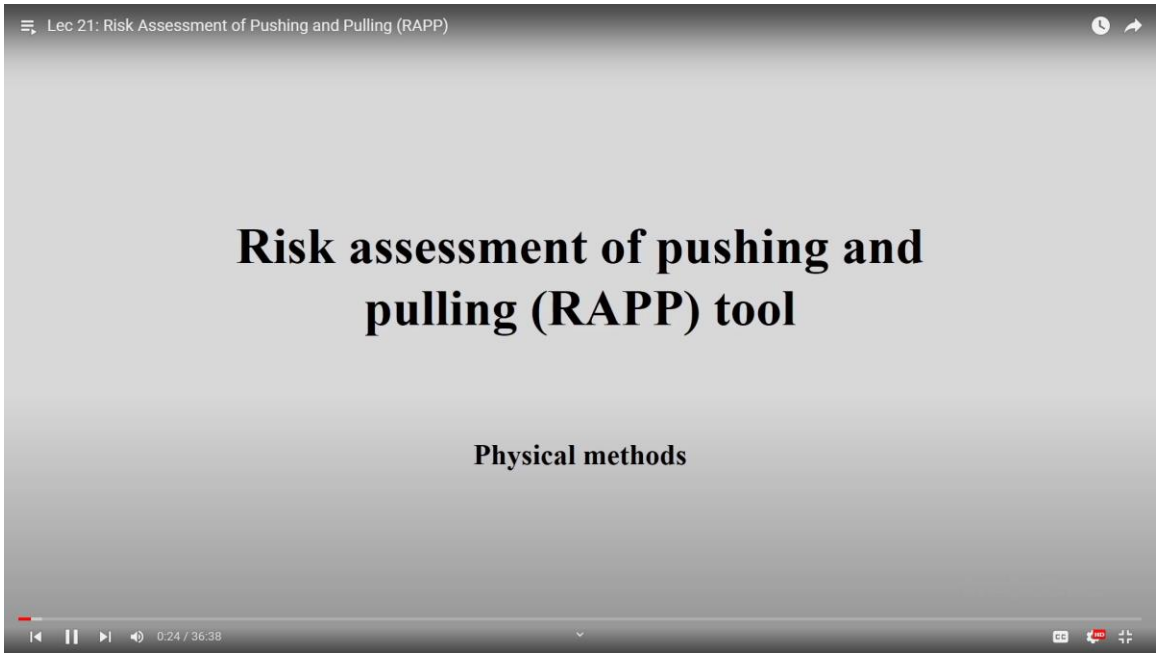
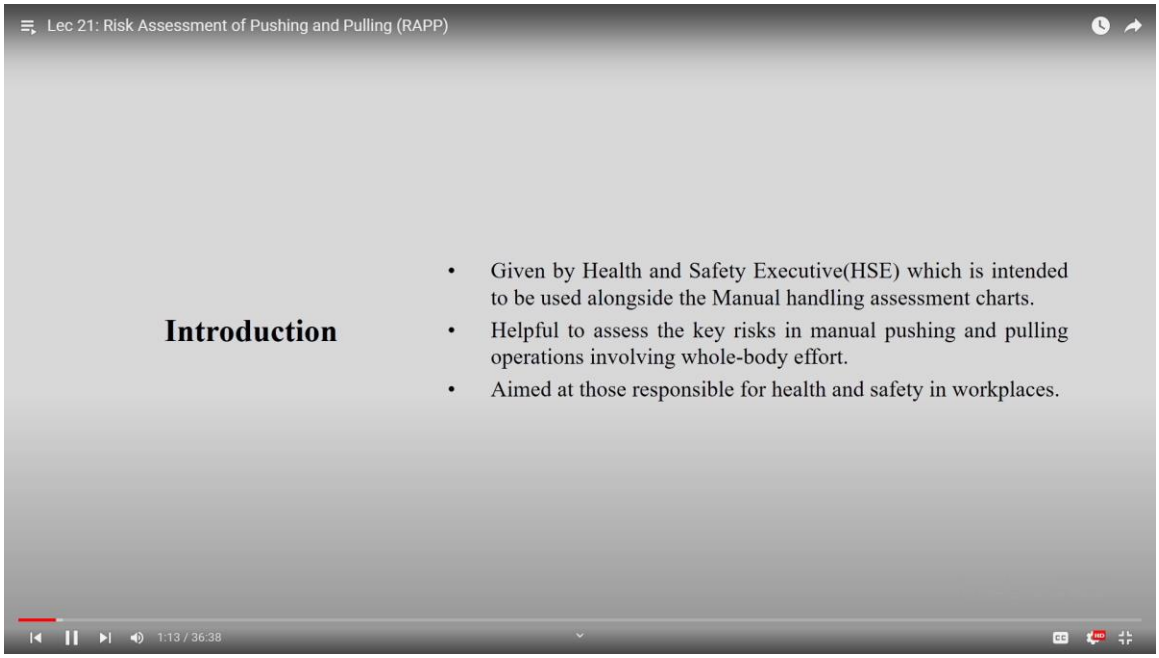
Week – 06

Lecture - 21

Lec 21: Risk Assessment of Pushing and Pulling (RAPP)

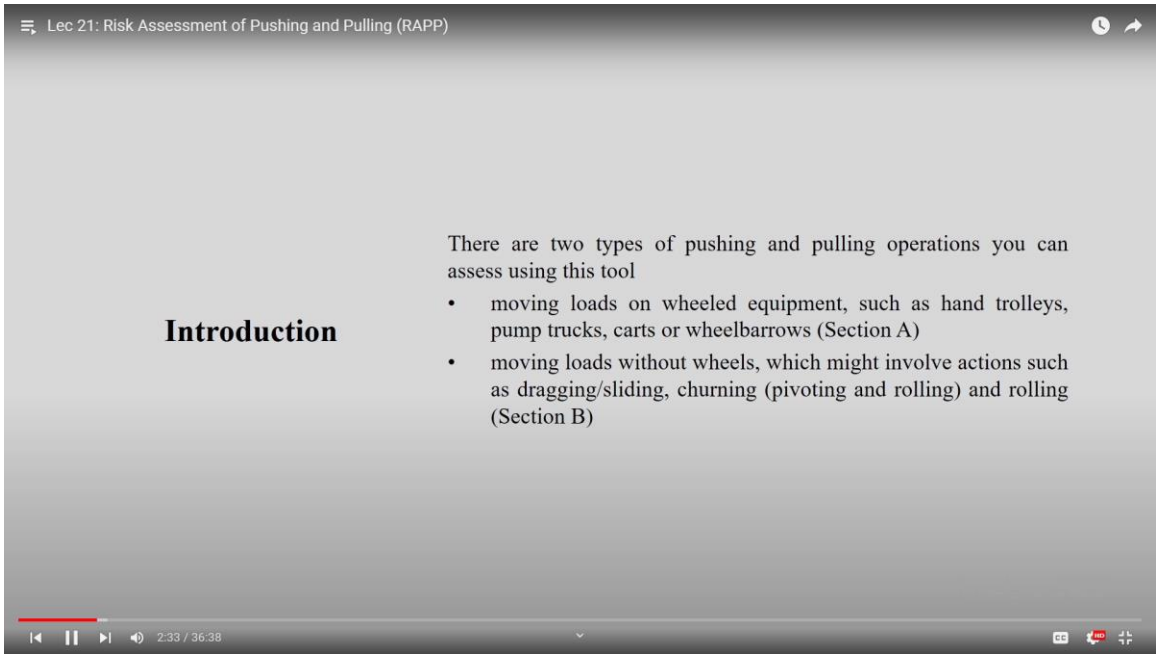


Welcome back. Today we will talk about one more physical method that we are going to use to assess the physical risk in any workplace or workstation. The name of the tool is risk assessment for pushing and pulling. So we talked about snook stable, we talked about other HSE tool. So this is a very specific tool only which takes care of your pulling work and pushing work. This tool is also introduced by health and safety executive that is the HSE.



So this tool help is very much helpful to assess the key risk in manual pushing and pulling. So when we are talking about pulling, pushing, lifting, lowering, shifting something, carrying for all these type of activities it all comes under manual material handling. So this particular tool is very similar as we did for other tools introduced by HSE for pushing then lifting, lowering, carrying etc. So this is very specific to pull and push.

This tool aim to those responsible for health and safety in the particular workplace. So if somebody is doing such work so what is the impact on them in terms of back pain, neck pain, maybe sometimes shoulder pain or any disorder or difficulties which is get which they are developing due to exposure such kind of load while doing pulling or pushing activities. So there are two types of pushing and pulling operation that we are going to assess through this tool. First one is moving loads on wheeled equipment. So we are transferring some amount of load using some kind of wheel such as hand trolleys, pump trucks, cars, wheel barrows etc.



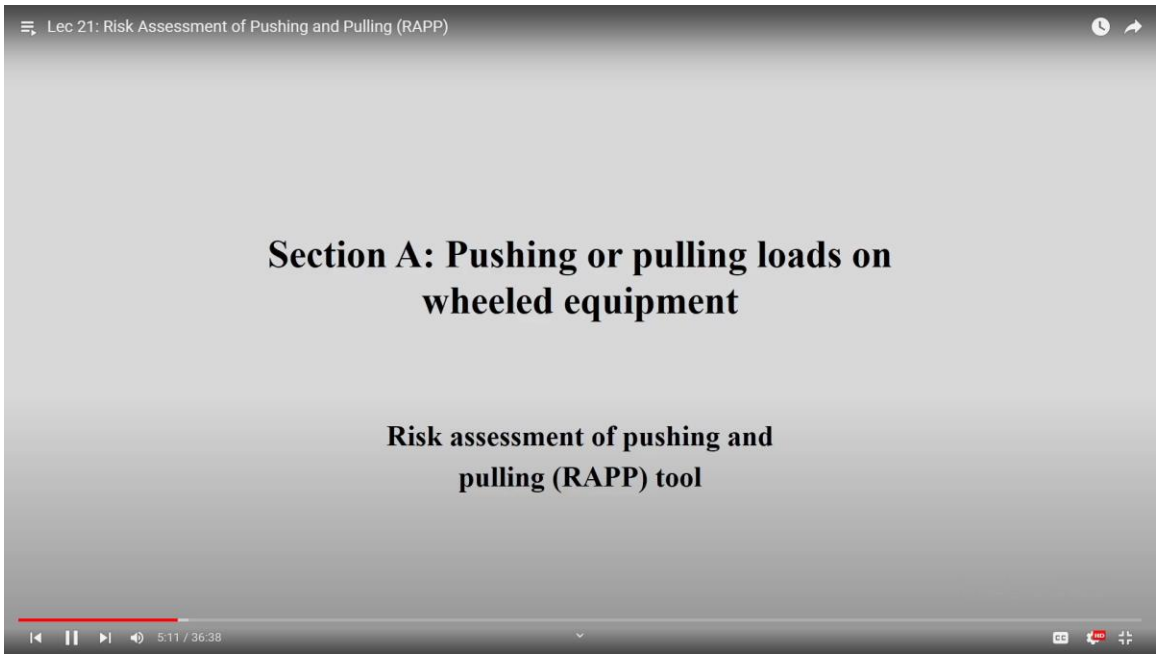
So that we will be calling it as section A. We will be discussing this particular part in section A. The second is moving loads without wheel. So one is with wheel another is without wheel. So depending on what is your context you should choose which section to be used for the analysis.

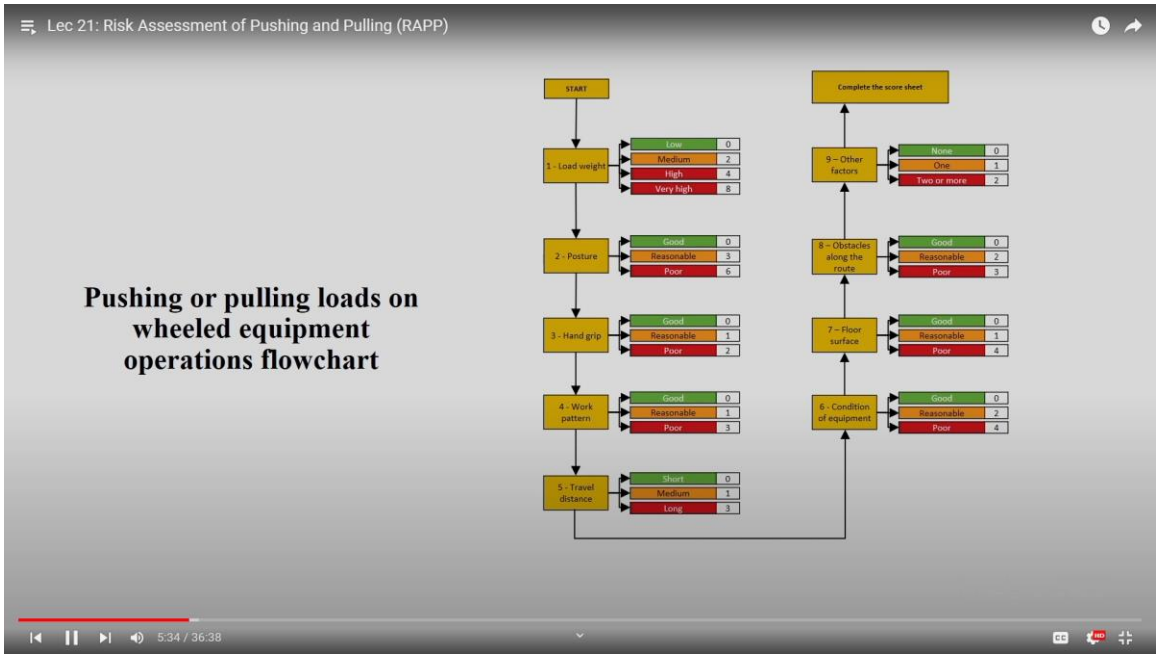
So without wheel it may be dragging, sliding, churning, rolling all these activities you are going to consider for this particular section B. The risk level that is exactly similar that we discussed for the carrying, load lifting, load lowering and all those activities. So G denotes green that is the low level of risk. Although the risk is low consider the effect on vulnerable groups such as may be pregnant women or very young workers and

whatever is appropriate you should consider that. A is equal to amber that is the medium level of risk and you can examine that particular task closely.

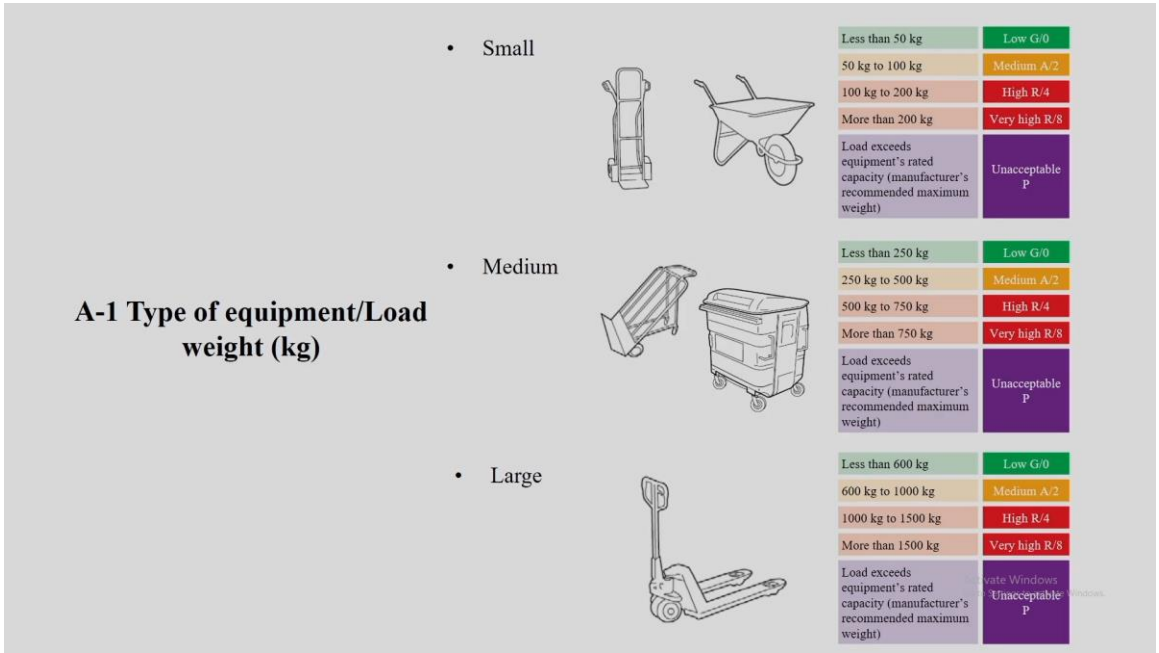
If you find any difficulties you can go for the modification. R is going to denote the rate that is the high or very high level of risk that is the prompt action you need to take. This may expose a significant proportion of working population to a risk factor or risk of injury. Then the final one is P or purple which we will be terminating as unacceptable. So if such scenario is there you are not going to continue the work at all.

So such operation may represent a serious risk of injury and must be improved immediately. You need to stop that particular job immediately. So that is the kind of categorization we will have. So let us go one by one section A and section B and how do the scores comes. So first is the pushing work that will be for the wheeled equipment.





Pushing or pulling that is the with wheeled equipment like wheeled barrow then may be some trolley etc. So this is the general flow we will be discussing each flow in the next slides individually. So let us start. So when we are talking about so A, B, C, D like that we have components. So first the component is A1 that is the type of equipment or load weight.



So we can have three major category small, medium and large. So here you can see that the categorization. What it says? If it is less than 50 kg in case of it is small then it has a categorization of L or green right G0. So color is G, value is 0. 50 kg to 100 kg then A2 or we can say A for amber that is the color is amber and value is 2.

100 to 200 kg then color is red and value is 4 and more than 200 kg that is very high. So here red has two numbers. One is high that is number is 4, the score is 4. If it is very high then color is same that is the red. However the number has increased it is 8.

So here you have two specific category that you have to remember and then the rest is the unacceptable. So what is the definition of unacceptable load? It says that is the color is P of course. So load exceeds equipment's rated capacity. So every equipment is having their specific rated capacity. If that is exceeding that the actual load which is being carried by that particular equipment if it is exceeding that that means you are not going to continue the job with that particular equipment.

So that is the unacceptable or you can say the color is P. This is only for small equipment, small wheeled barrow or small trolley or whatever pulling or pushing equipment you are using with kind of having some kind of wheel. The next category is medium. So here you can see the kind of instrument you can assume that they can be used as medium. So here we had last amount as 200 kg.

Here it is green if it is less than 250 kg. So that is the medium size then it is G. Then 250 to 500 it is A. 500 to 750 it is red. Then again only high if it is 4 and if it is more than 750 kg then the value is 8.

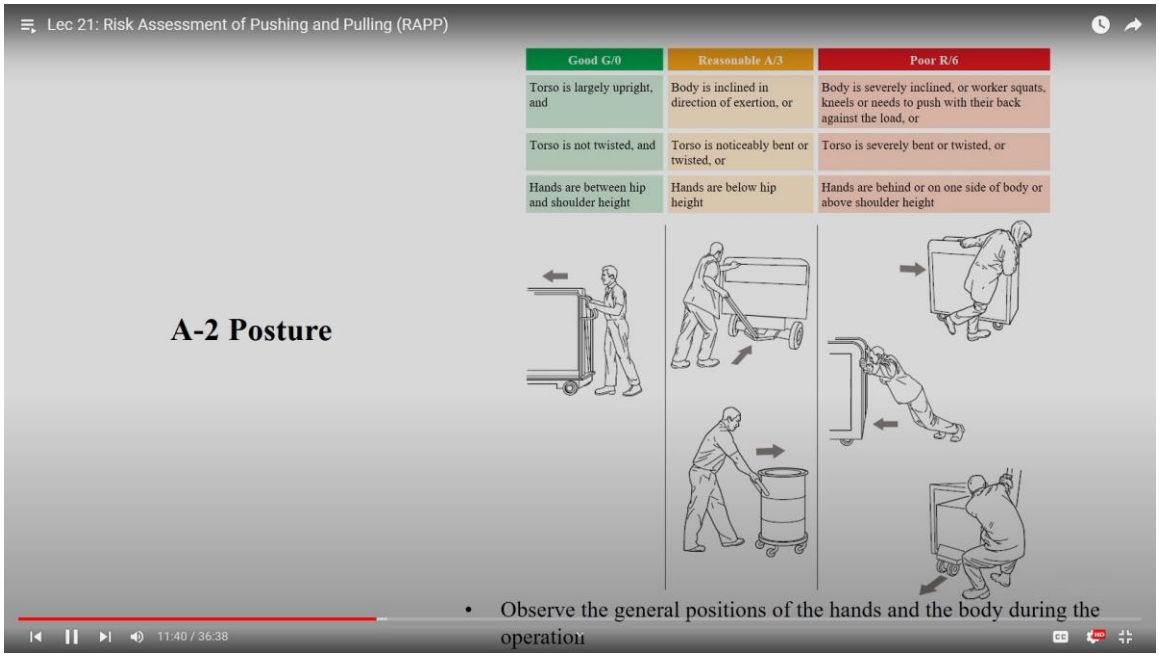
So here you also in red zone we have two specific division. And of course the purple where it is exceeding the equipment's capacity. And the third one is the large. So it starts with less than 600 kg.

So G or value is 0. 600 to 1000 kg medium or amber and the value is 2. Here again the similar consideration that is 1000 to 1500 kg is high risk, level is color is red but number is 4 whereas if it is more than 1500 kg then it is value is 8. So here is 2 red. So similar like as we have two reds in medium section, large section as well as in small section. And everywhere if the capacity the total load is exceeding the equipment's capacity then it is purple.

So you are not going to conduct any kind of pulling or pushing using that kind that particular situation. Suppose here in this particular case medium you are talking about you are using this type of instrument for shifting, pulling or pushing and you are exceeding the 750 kg of weight. So that is the capacity of this particular fill barrel. Then

you should not use this type of instrument rather you should use this type of instrument. So you can change the equipment to come from you know go into the safe version of pulling pushing activity.

So here also suppose you are exceeding 200 kg using this type of trolley. So if it is 300 kg or something like that you should not use this, you should use any one of this. So then it will be within the safe zone. That is how the equipment size also matters. Based on the equipment size the amount of load that you are going to pull or push will change.



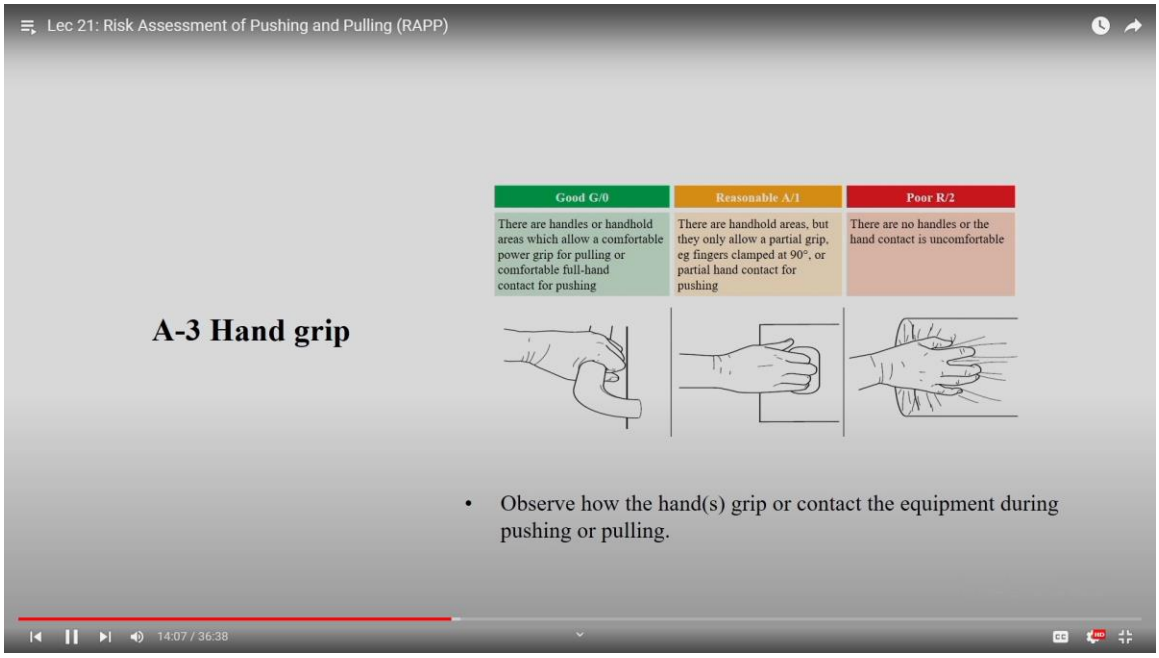
So this is very important understanding and you should consider when you are designing the pulling pushing activity at the workplace. Now coming to the posture. So what happens here, here we do not have anything in purple color. Either it is green that is the very less amount of postural load, then amber and then red So values are 0, 3 and 6. These all numbers are pre-computed you need not to worry about these numbers.

Whatever the situations are there based on that checklist you can assign the number. So G is green or we can call it good. So torso is largely upright you are looking straight. Then torso is not twisted at all. Hands are between the hip and shoulder height.

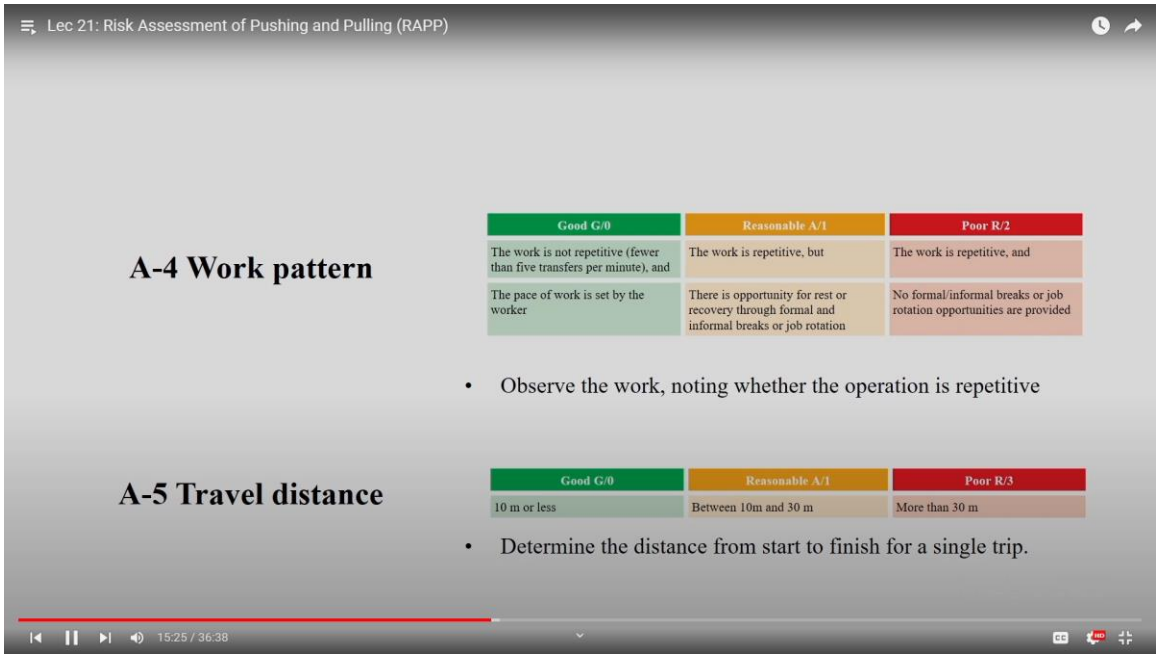
So actually your posture is in good shape then you can consider it as good. Then reasonable or A3 body is inclined in direction of exertion. Torso is noticeably bent or twisted anything. Twisting means moving like this, bend mean either forward flexion or extension. Extension is hardly possible mostly forward bending.

Hands are below the hip height. So similar kind of situation may be observed. The last one that is the poor or red or value is 6 in that case something like this type of postures may appear or if we go for the verbal description it appears the body is severely inclined or you are working in a squat position or kneeled position or need to push with their back against the load. You are keeping your back on the load and you are pushing it back okay. So that type of scenario. Torso is severely bent or twisted or hands are behind or one side of your body above the shoulder height.

So if you are raising your hand that means definitely you are giving lot of impact on your whole body posture. So that that is way it is red. That is all about posture. Coming to hand grip that we will denote is as A3. So you can see the picture is very very clear.



So G that is green there are handles or hand holds where you can hold it very comfortably there is very easy way to pull it or push it so you are holding your grip is very correct Whereas in the second case that is the reasonable or we can call it as 1 the value is 1 or color is amber there are hand hold areas but that only allow a partial grip. Here the grip is complete here grip is partial then it is amber. Whereas in our last case where it is red you do not have any proper available grip. So this is the scenario. So observe how the hands you are gripping or you are in contact with that particular equipment with during the pulling or pushing job then you can categorize the hand grip fine.



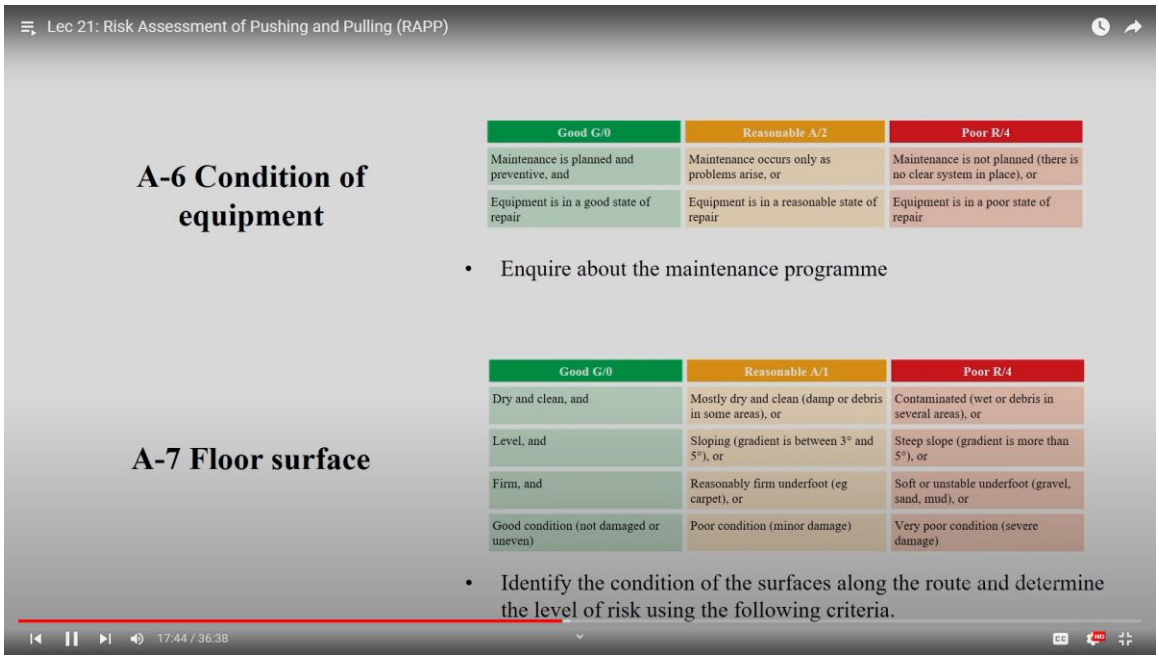
Then A4 that is the work pattern again 3 division no purple area. Green says that the work is not repetitive and the pace of work is set by the worker. So if I am the person I am doing my job at my own pace. There is no one or no such surrounding or environment which is forcing me to do some kind of job. So I am taking my own time to complete that particular job.

So in that case work pattern is peaceful. The pace is maintained so then it is G. Whereas if it is amber then what is the condition? The work is repetitive in nature. The first case it is not repetitive. The second case it is repetitive in nature and there is some opportunity for rest on recovery through formal and informal breaks and the job rotation. So you have a pace to do the job however there is some kind of formal gap in between two works.

So it is like you know they are not rushed. So in that case it is A1 or value is 1, color is amber. If it is poor then it says the work is repetitive definitely and there is no proper break. So that is the kind of pattern they have and then you will assign them as color red. Now we are talking about pulling and pushing. So definitely the whole amount of load we are transferring from one place to another place.

So if it is 10 meter or less then it is green, 10 to 30 meters it is amber or value 1 and more than 30 meter it is red. So this way you can give an understanding how long the person is continuously pulling or pushing the whole load. So that will give you an understanding from the travel distance this particular parameter. Then we are doing the

job, we are using the equipment. Now what is the condition of the equipment? If the condition of the equipment is good then definitely you will feel more comfortable to do the job.



However, if the instrument itself is having some kind of trouble then definitely it will create more load on your whole body, on the whole activities. So condition of the equipment is also very important. Here based on the condition of the equipment you have three categories. So first one is green that is maintenance is planned and preventive. So you are doing it properly, equipment is in good state of repair.

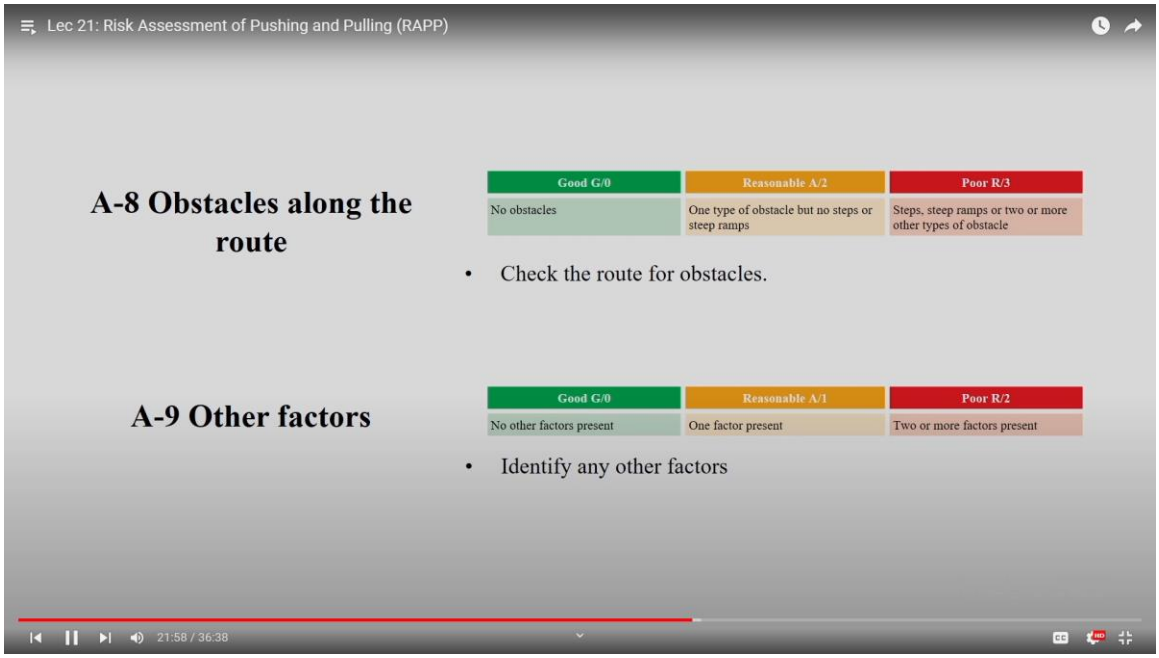
If it is amber then maintenance occur only as problem arises. If there is problem then only maintenance happens otherwise you keep on working. So equipment is in reasonable state of repair. It is not that it is completely okay but it can work and if something some breakdown happens it can be repaired. So that is the case then it is the you can call it amber zone or value is 2.

Poor maintenance is not planned there is no clear system in place. So if something goes wrong then the equipment will not work. So you are very cautious, you are very concerned. If it breaks then what will happen? So it creates lot of stress. So if that situation is there then it is poor or equipment is like you know broken, there is some difficulties, it is not functioning properly in that case also it is rate or poor is the condition.

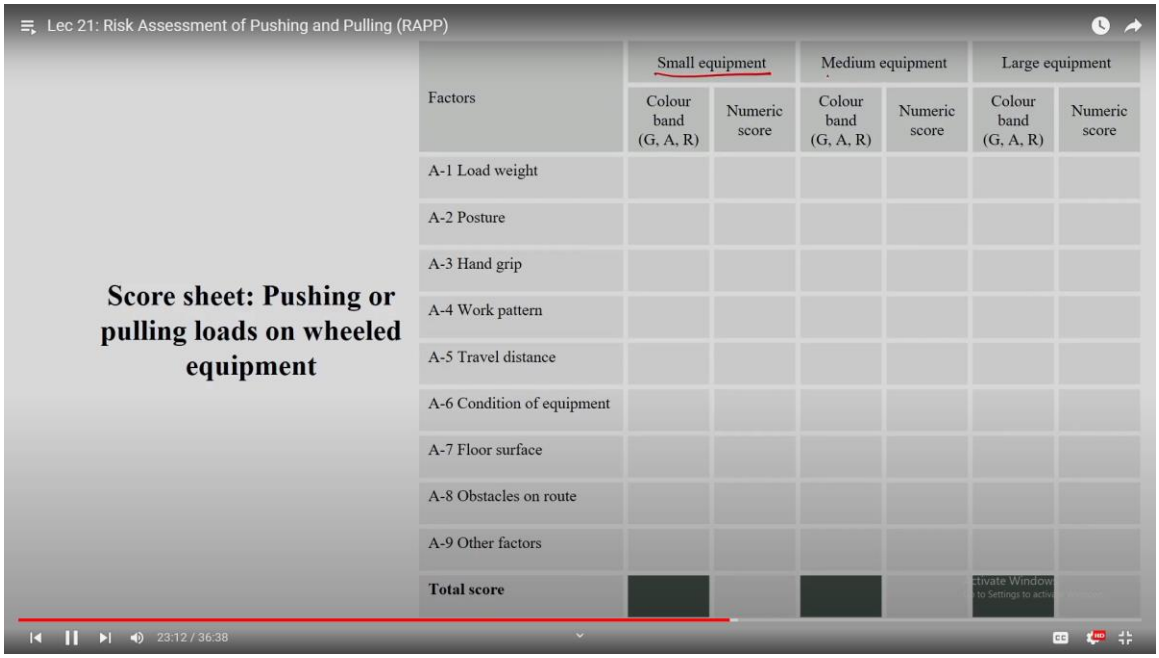
Of course, once we are doing pulling and pushing floor surface is going to affect the whole job. So you have again categorization for floor surface. Same dry and clean if it is level, if it is firm and good condition then it is green. If mostly dry and clean however maybe some kind of debris are here and there Little bit of sloping, sloping is there however it is not completely flat, some kind of gradient is there but it is not very very steep gradient.

It is only 3 degree to 5 degree okay. Reasonably firm, it is not completely firm and there are some minor damages are there then it is A or and value is 1. Amber is color, 1 is value. Contaminates like lot of debris, lot of you know other things are you know here and there on the floor. So it is very difficult for you to move that whole trolley. So in that case it is poor, very steep, soft and unstable you know underfoot because there are some difficulties in stepping also and very poor condition.

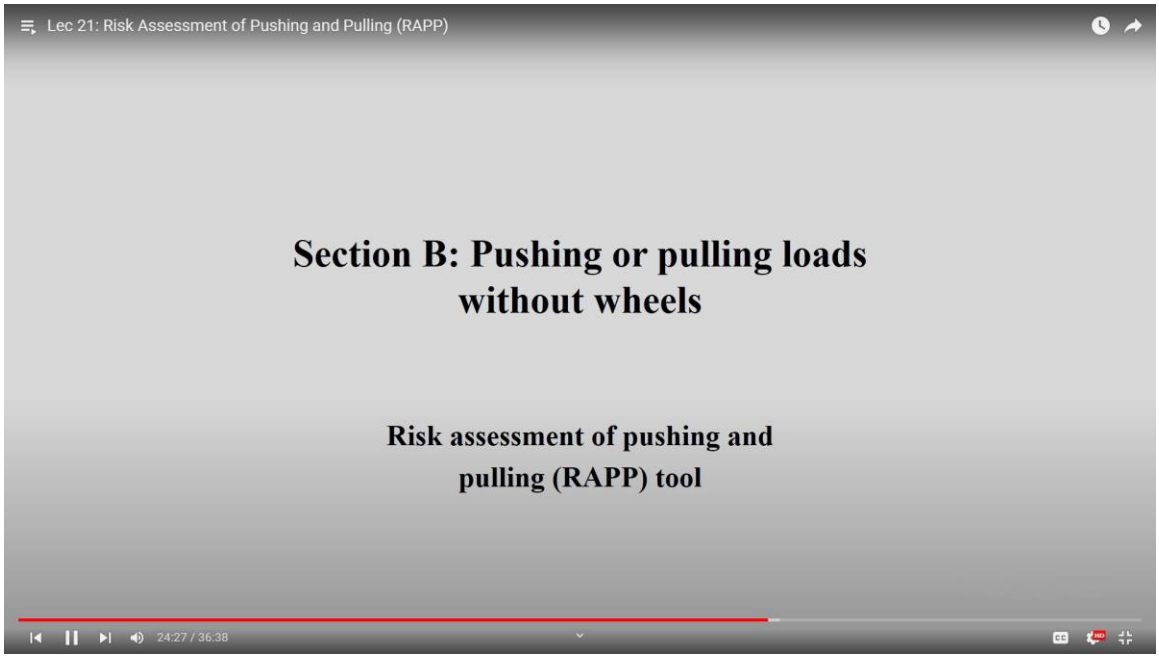
So in those cases it will be red or value will be 4. So here you can understand slowly we are taking care of all small small condition which is going to affect your pulling and pushing activity. First we took care of the equipment that you are going to use. Then we have talked about how you are holding the equipment. Then we talked about how the floor surface is, how the equipment condition is, how you are gripping it. So all small small elements that is going to affect your pulling and pushing job we are giving the categorization and we are going to give the numbering of it and we are trying to score them and add them for your final value.



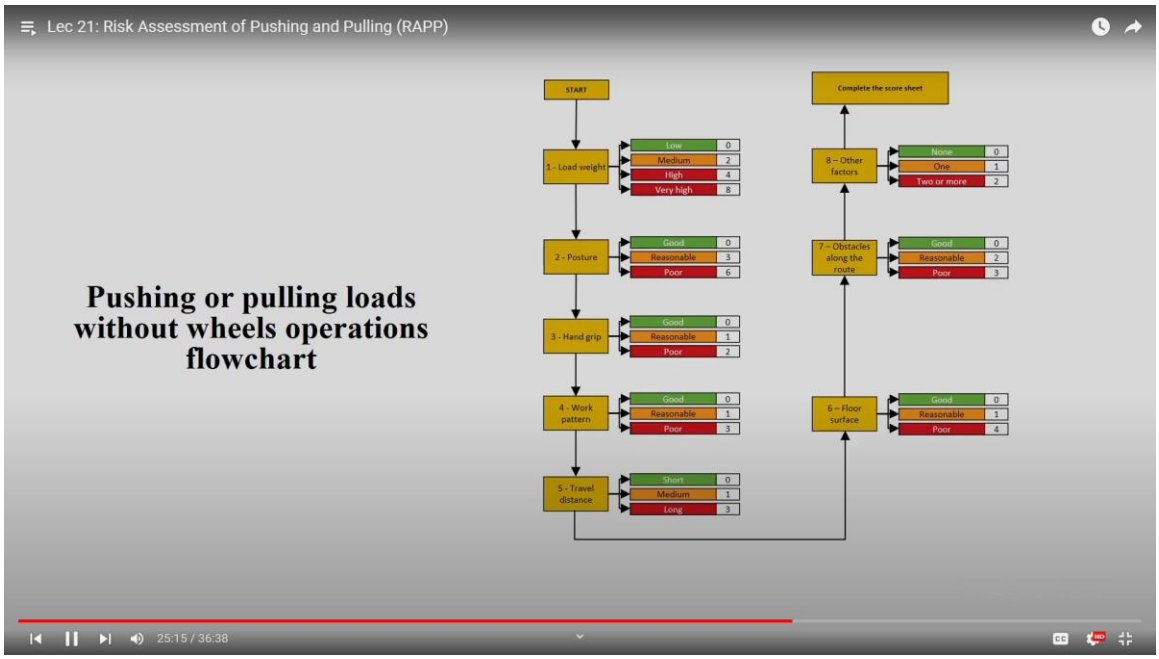
The few other thing that is the obstacles around the route. So if there is no obstacle then green, one type of obstacle 2 and steps, steep ramp and many other obstacle then it is red or value is 3. And any other extra factor that you feel in while doing the data collection that this is going to affect your whole pulling pushing activity then you can categorize them if only one factor is there then it is 1, if 2 if there is no factor then it is 1 or 0 sorry green and 0 and if it is one factor then A1 that means amber and 1 and last one if it is more than any one factor. So 2, 3, 4, 5 whatever is coming then it is red or we can call give the score as 2. So these are all the 9 factors that we are going to collect the information and give the score in the final score sheet. So we will give the scoring for small equipment separately, medium equipment separately and large equipment separately because we cannot compare small with medium, medium with large or large with small that is not possible.



So you have to first categorize the equipment based on the equipment you have to give the scoring of all these 9 factors. So here you can see the color so if the number of red in these boxes are more definitely you can understand the work is very hazardous. Also from the score you can compare your before intervention activity and after intervention activity and then you can claim that how it has been improved. So this is how you are going to use this particular part that is the pulling and pushing activity with some wheeled equipment that is for the section A. Now next one is the section B that is without wheel because it is not always that we do the pulling and pushing only with wheeled thing.

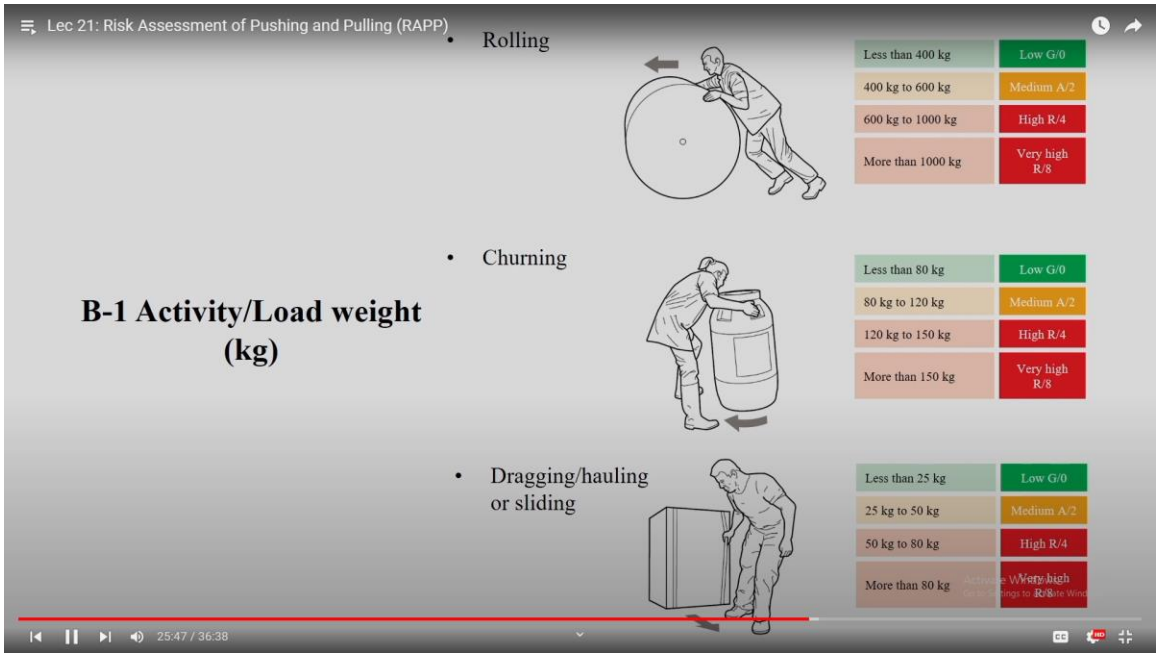


We do lot of activities which is without wheel in industrial scenario. Sometimes we roll it, sometimes we drag it. So those activities also need to be those are also pulling and pushing so we need to understand what are the risk factors or how do we assess those risk factors for those conditions. So let us begin with the section B. This was section A was for wheeled equipment and section B is without any wheeled equipment.



Similarly here you also have category and you have components earlier we had 9 components here we have mainly 8 components. So let us understand about these 8 components in how it is going to assess and how you are going to get the final score.

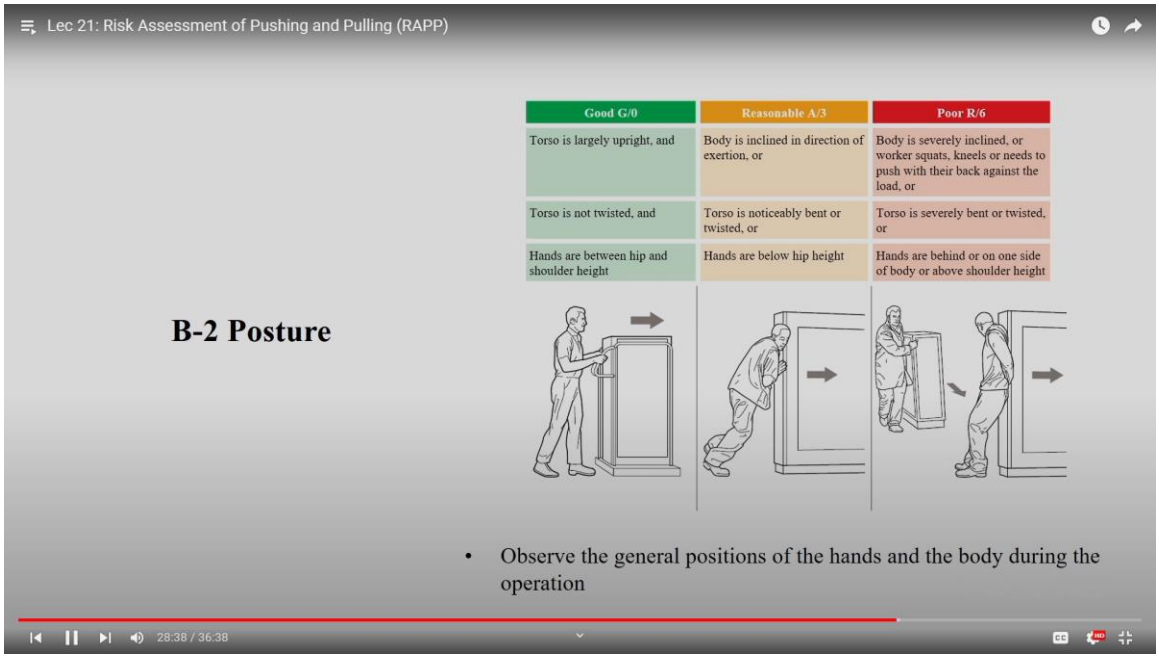
Now first one that is every numbering has been done in earlier case with the A because that is the section A. Here everything will be done with the B because it is the section B.



So B1 first factor is activity or the load weight. Here also you have 3 major category earlier we had 3 major equipment that is small scale equipment, medium scale equipment and large scale equipment. Here you have 3 major activity one is rolling then is churning and third is dragging or hauling or sliding. Here you can see we do not have anything as purple either it is green or amber or red. Similar we did for the earlier case section B A has 2 component one is high another is very high.

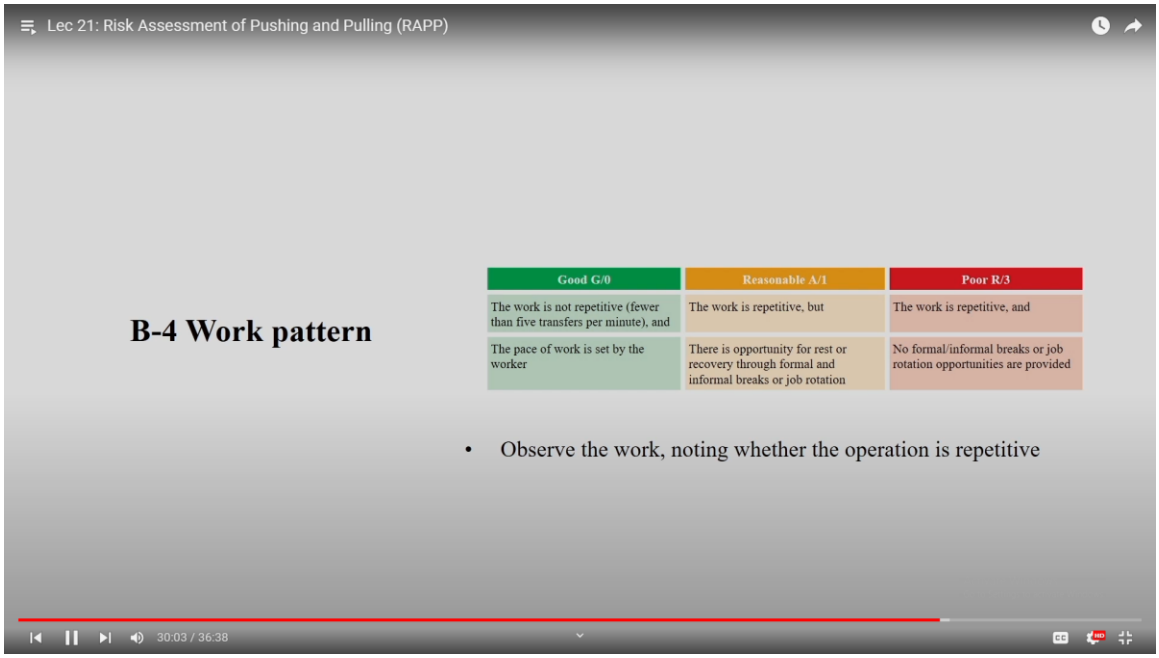
So let us understand the values. So if it is in case of rolling if it is less than 400 kg then green 400 to 600 kg it is amber 600 to 1000 kg it is red and more than 1000 kg it is red but the value is 8 earlier it was 4 now value is 8. Now in case of churning so you are now half rolling like this. So you can see you can refer this particular picture that how this particular activity can be done. Here you have the categorization less than 80 kg then it is green 80 to 120 kg medium or amber 120 to 150 kg that is high but value is 4 if it is more than 150 very high and the value is 8. And now the last one last category is the dragging you are holding something and you are dragging it.

So pulling pushing mostly pulling towards you so dragging. So such cases less than 25 kg green 25 to 50 kg medium 50 to 80 kg red high and value is 4 or more than 80 kg very high red and the value is 8. So this is how we are going to categorize the activity or the load weight that we are going to do during our pulling and pushing activity.

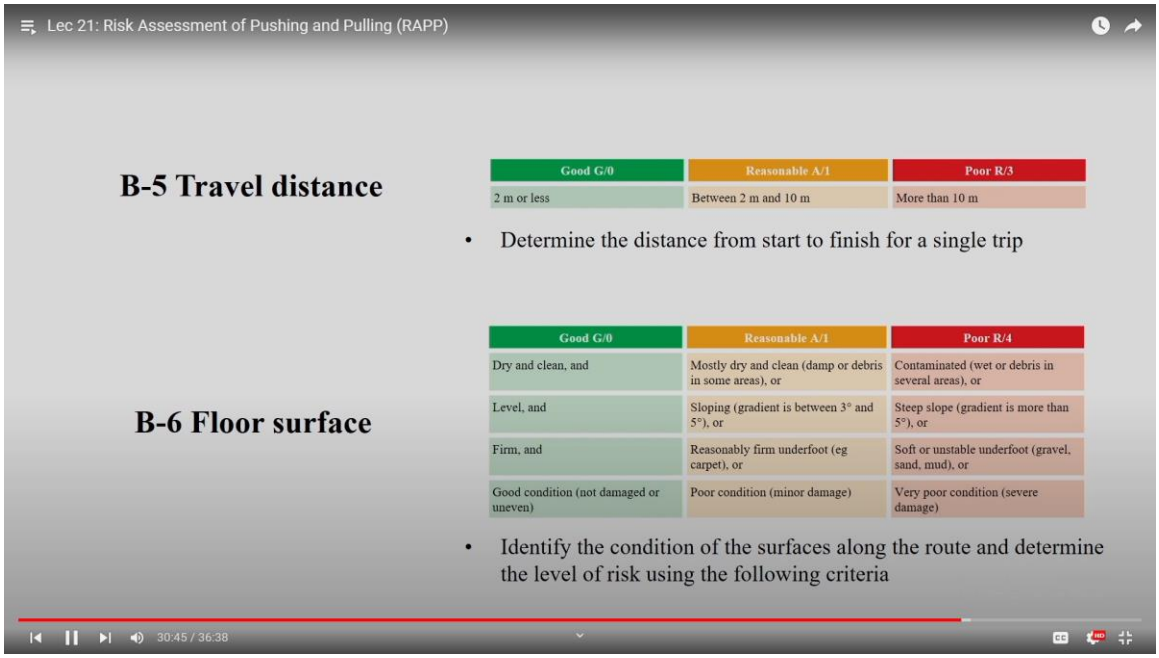


Again the posture, posture is quite similar as we did for our earlier case with field equipment but still I will give an explanation. So torso is upright mainly in upright condition it is not twisted not bended and hands are between the hip and shoulder in that case it is green. Body is inclined in a particular direction or maybe in exertion mostly it is like forward bending torso is noticeably bent or twisted and hands are below hip height in those cases probably it is amber or reasonable or value is 3.

In case of red we will be describing it as body is severely inclined or worked in squat or kneeled or needs to push with their back against the load. So you can refer this particular picture. So this way if somebody is handling the load in while doing the pushing and pulling you can categorize their posture. Hand grip exactly similar that we discussed in our earlier activity with field equipment Work pattern is also quite similar some little bit of changes but mostly it is similar.

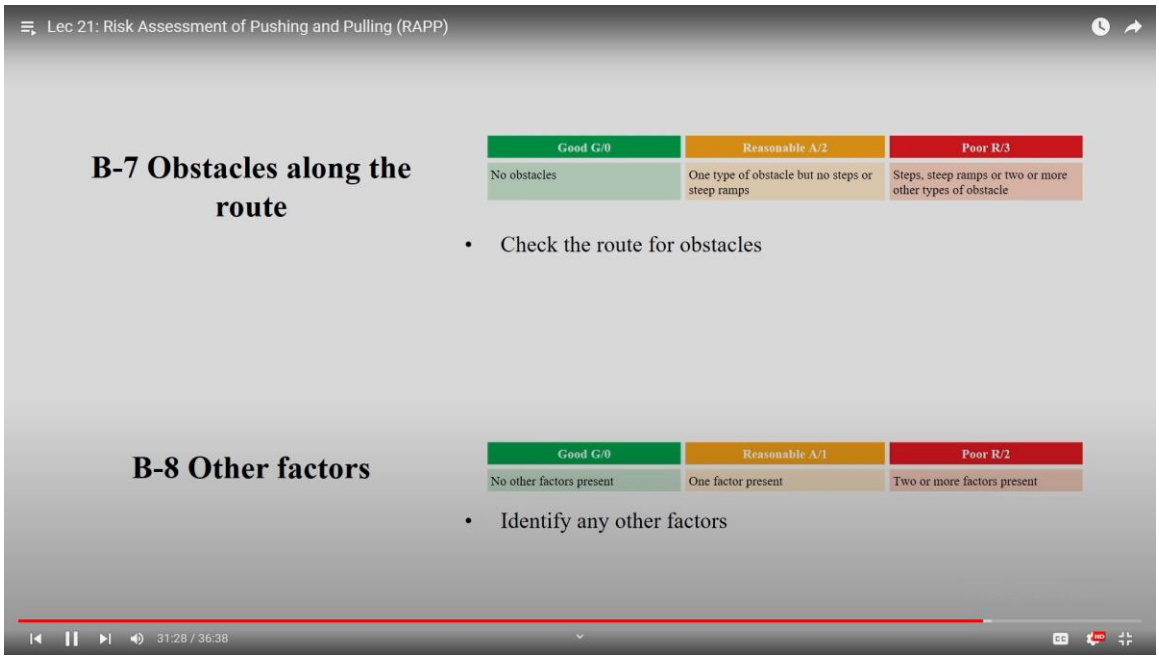


So you can see that when you have a pace to work definitely it is green. You have a pace to work it is know there is a typical pace that you need to follow however there is a small small break then it is amber or value is 1 and if there is no break at all you have to keep on working on this and it is quite repetitive in nature in that case it becomes red or the value is 3. So that way you can use the it is exactly same as we discussed in the earlier section.

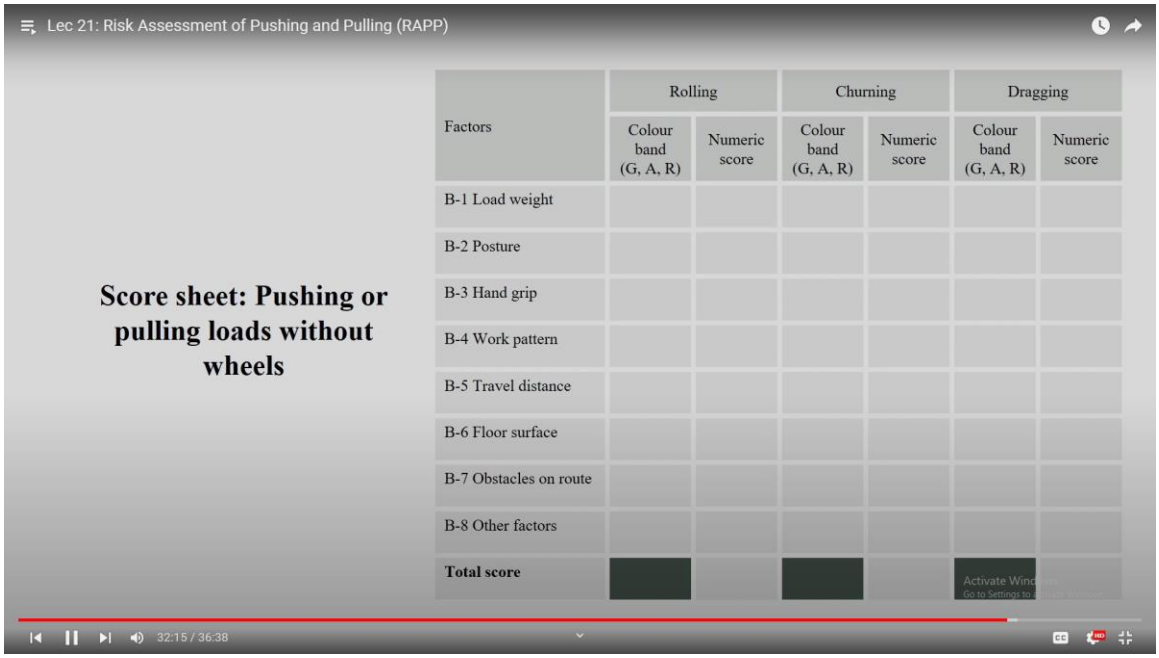


Here also you have travel distance values are little different to 2 meter or less it is green between 2 to 10 meter it is amber and more than 10 meter it is 3 earlier it was 30. So the limits are little different.

Floor surface exactly similar that we discussed with the wheeled equipment. So you can refer already I explained it so this is exactly similar as we have in the earlier one that is the activity with the wheeled equipment or section A.

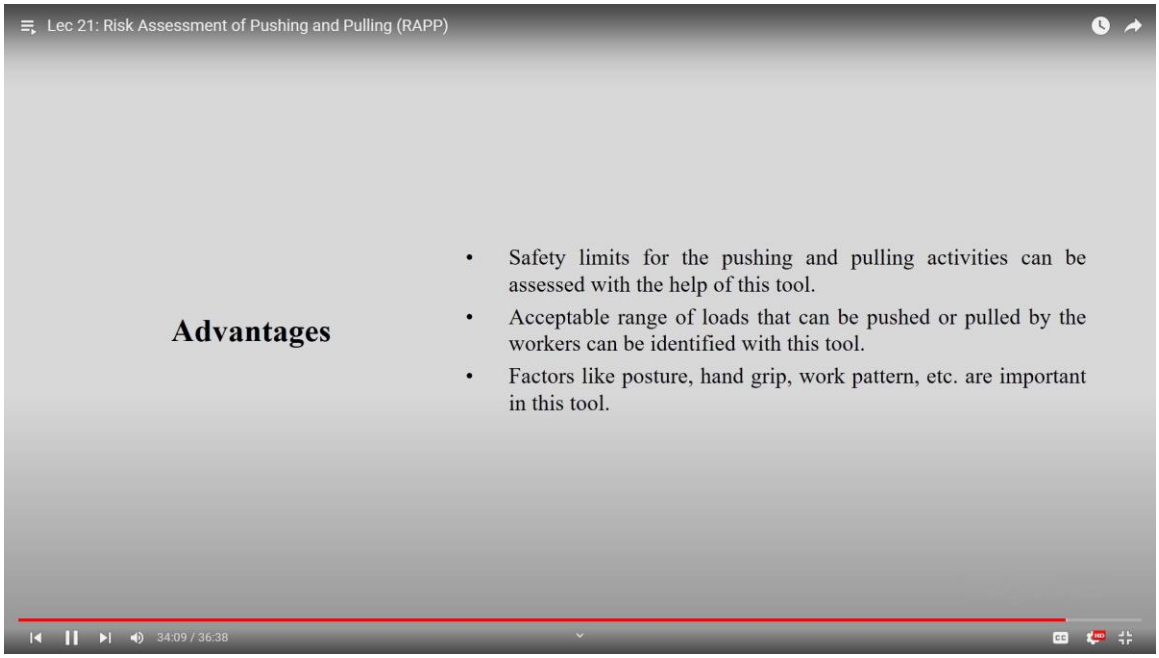


Obstacles same type of pattern that is if there is no obstacle then it is green one type of obstacle but no steps or any steep ramp then it is A2 and if it is poor then step steps are there you have a steep ramp or two or more other varieties of obstacle then it is red or value is 3. Other factors considerations are also exactly similar as we discussed in the section A. So section A and B few cases it is similar few cases it is not similar.

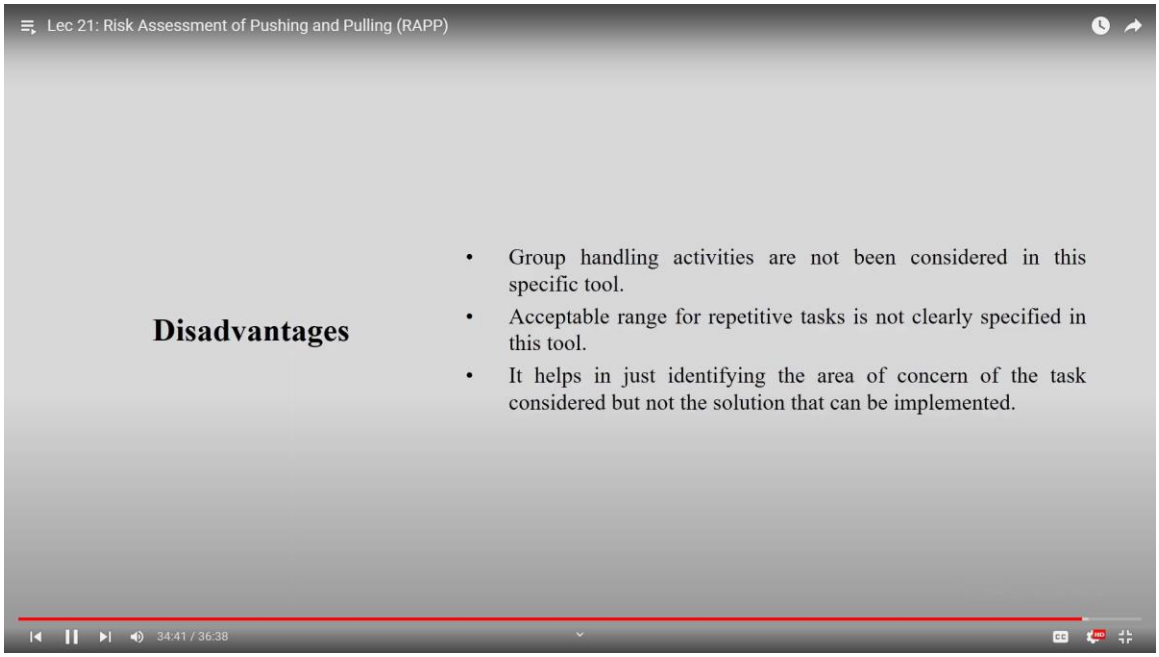


Now let us understand these factors. So earlier one we had based on the size of the equipment or size of the wheeled equipment we have categorization. Here how do we pull or push the type of the activity based on that we have rolling, you have churning and you have dragging and you have the similar values over here but we have only 8 factors and from there you can get the color coding in this particular sections with the color coding and here you can get the scores. So that the similar way you can analyze the data. So you can see before experiment after experiment before experiment when you have the data you have clear indication that which are the area is going to be taken care in your design process. Suppose you found everything is here it is green here it is green here it is green here it is amber maybe here it is also amber but only here it is red here maybe green and here also it is green.

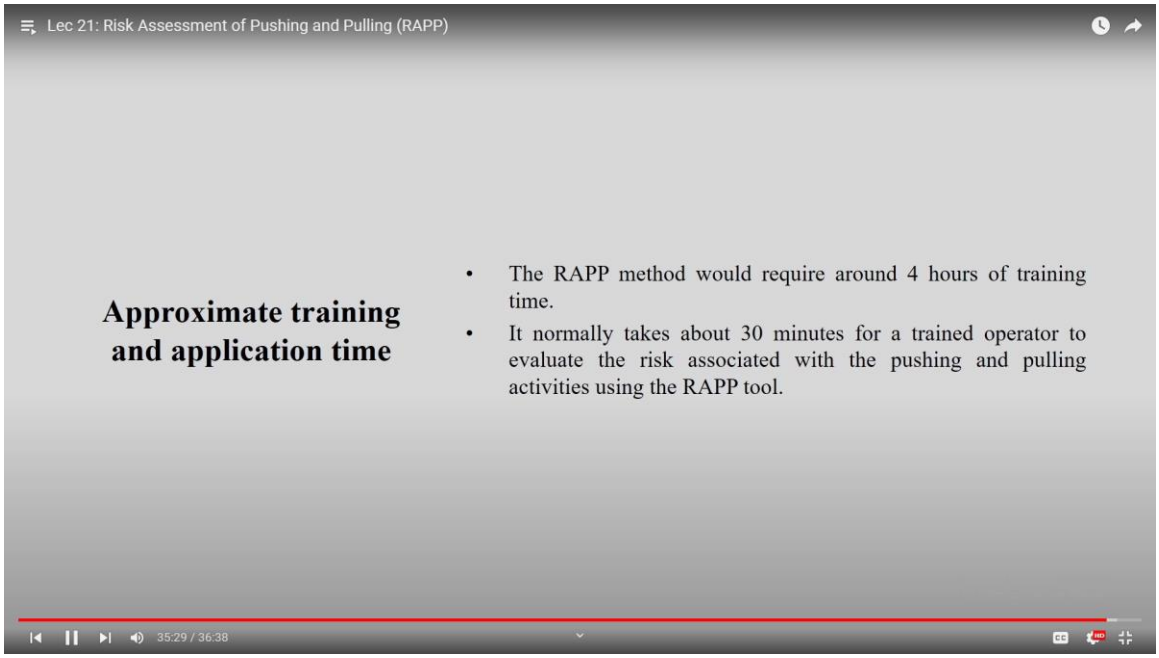
So here this particular part gives you a clear indication that you should start designing the particular aspect right how to improve the floor surface while doing that particular job. So this way you can take the intervention direction and once you do that intervention then similarly you can check these values for the before and after. So very easy to use tool very effective tool to initiate any kind of design intervention for pulling and pushing activity. So let us understand the advantages. Safety limits for the pushing and pulling activities can be assessed with the help of this particular tool.



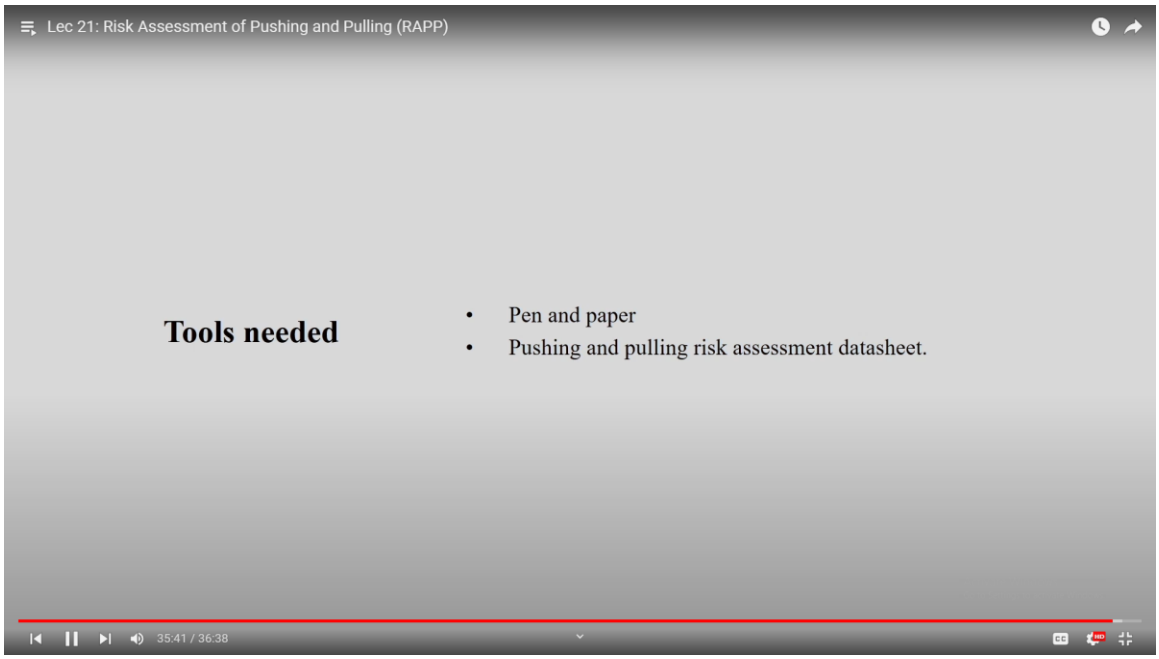
Acceptable range of loads that can be pushed or pulled by the workers and can be identified with this particular tool and factors like posture, hand grip, work pattern these are the important component that you can actually identify and there is lot of chance that using these values you can start your design intervention.



However, there are some kind of disadvantages. So group handling activities you cannot estimate or assess with this particular tool. So acceptable range for repetitive task is also not clearly specified here. So it helps in just identifying the area of concern of that particular task that considered but not the solution that you are going to implement.



So these are the disadvantages for this particular tool. In case I am talking about the approximate timing it is very easy to understand method. So you can learn this method within you know 3 to 4 hours of training and for implementation when you start data collection it may hardly take 30 minutes of time to do a data collection and it needs only pen and paper to do the assess.



However, you can have a video recording of the existing task to further analysis at your laboratory. So this is very simple method you should try and you collect your own data try to analyze and finally do the interpretation and process it for before and after

comparison. That is all for today. We will meet with another tool in the next class. Thank you.